MULTIDISZCIPLINÁRIS KIHÍVÁSOK
SOKSZÍNŰ VÁLASZOK

GAZDÁLKODÁS- ÉS SZERVEZÉSTUDOMÁNYI FOLYÓIRAT

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INSTABILITY, AS A CHARACTERISTIC OF ORGANIZATIONS IN THE 21ST CENTURY – AT THE INTERSECTION OF CHANGES AND CHAOS

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GÁL Zsuzsa

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ABSTRACT

Change has become permanent in organizations in the 21st century, therefore adaptation is essential for survival. Change management deals primarily with controlled changes and puts less focus on spontaneous changes. The question arises as to whether organizations operating in constant instability can be characterized by chaos. The purpose of the study is to explore the relation between chaos theory and change management based on domestic and international literature. The question to be answered is whether it is possible to characterize organizations based on variables, dynamics, structure, movement, or predictability of change among the characteristics of chaos. This raises the question of whether it is chaos, or some of its characteristics, which affects the functioning of an organization. In the study, I point out that not each of the characteristics of chaos theory is adequate for describing the functioning of an organization, however, instability plays a significant role in survival in uncertain environmental conditions.

ABSZTRAKT

A 21. századi szervezetekben a változás állandóvá vált, ezért az alkalmazkodás elengedhetetlen a túléléshez. A változásmenedzsment elsősorban az ellenőrzött változásokkal foglalkozik, és kevesebb hangsúlyt fektet a spontán változásokra. Felmerül a kérdés, hogy az állandó instabilitásban működő szervezeteket jellemezheti-e a káosz. A tanulmány célja, hogy a hazai és nemzetközi szakirodalom alapján feltárja a káoszelmélet és a változásmenedzsment kapcsolatát. A megválaszolandó kérdés, hogy a káosz jellemzői közül a változók, a dinamika, a struktúra, a mozgás, illetve a változás kiszámíthatósága alapján lehet-e jellemezni a szervezeteket. Ez felveti azt a kérdést, hogy a káosz, vagy annak egyes jellemzői befolyásolják-e a szervezet működését. A tanulmányban rámutatok, hogy a káoszelmélet nem minden egyes jellemzője alkalmas egy

szervezet működésének leírására, azonban az instabilitás jelentős szerepet játszik a bizonytalan környezeti feltételek közötti túlélésben.

INTRODUCTION

The acceleration of development processes, globalization, technological innovations, and constant online life due to the digital era require continuous adaptation from both individuals and organizations. As a result of the dynamic and heterogeneous social and economic environment, constant change of the 21st century is now an accepted phenomenon that permeates each field of life. As a result, it is not stability, everything is constantly changing, and it becomes necessary to adapt to new, changed circumstances that have developed day by day, whether it is legal environment, consumer habits, market phenomena, or changes caused by global processes. At the individual level, it is now necessary to undergo changes that requires a completely novel approach to react to the situation.

Organizations must face and experience these changes, even as a kind of development opportunity, because in their case, adapting to the environment is a function of survival. Organizations are dynamic by nature, as they are constantly interacting with their environment, reacting to changes in environmental conditions by changing themselves in the process. In this case, for organizations, stability can be interpreted as a desirable state, which they strive for, but cannot achieve - or only for a brief time. Consequently, stability can be studied at a given moment and interpreted for a given time, since organizational processes are dynamic, characterized by a state of continuous change and transformation.

In this interpretation, change means adapting to the environment, which is the natural state of organizations and one of their most permanent characteristics, since most systems and organizations strive to achieve stability by their nature. The question also arises whether instability associated with change is a natural state for organizations.

This adaptation process appears in the hope of survival by its nature, but in the life of organizations it can be controlled and made conscious to a certain extent. This conscious, controlled adaptation are warranted in change management: the organization strives to reach a stable state through this area.

The phenomena outlined above, unpredictability and continuous change affecting organizations tend to suggest that it is worth examining the unstable stage during the change, which is between unfreezing and the possible refreezing. Instability in science appears in chaos theory, which is interpreted differently in fields of science. The purpose of the study is to explore different interpretations of chaos theory and instability based on domestic and international literature, and to draft the main relations of the permanent change that characterizes organizations in the 21st century. I examine interpretations of change, chaos, and instability. I raise the question whether organizations operate in permanent instability during permanent change, or within a chaotic framework. In other words, is every single condition included in the interpretation of chaos turn into reality during their daily operations, or are these organizations partially characterized by the concept of chaos?

LITERATURE REVIEW

Change and changing

The three-phase theoretical model of change by Lewin (1951) and force field analysis (*Figure 1*) date back several decades, it still helps to understand the foundations of change and serves as an aid to change the behaviour pattern (Spector, 2013).

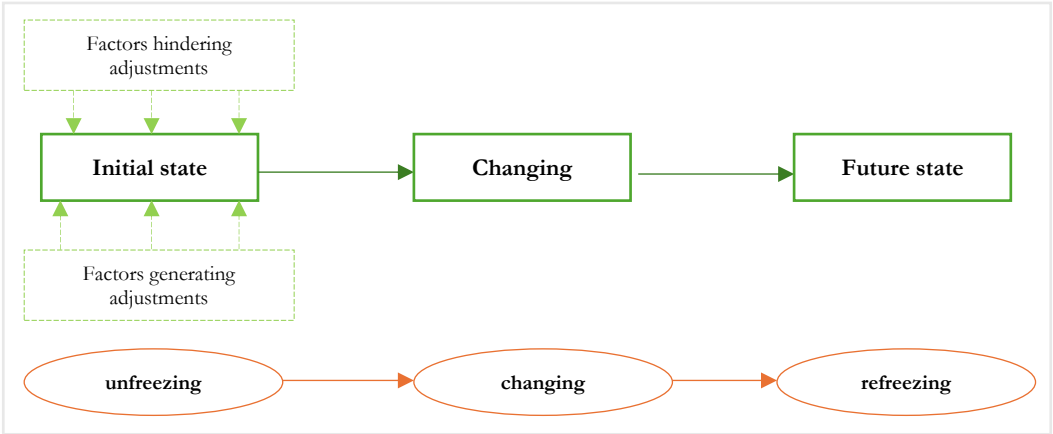

Figure 1. Lewin's force field analysis and three-phase change theory model
Source: *based on Lewin (1951) own edition (2024)*

Judson (1991) described a five-step model of change that is similar to Lewin's model to a considerable extent, including the fact that the process begins with analysing and planning the change. Another prominent figure in the theoretical modelling of change is Kotter (1995), who considers the avoidance of errors a priority in his eight-step model. The common point of change theory models is the unstable process that occurs during change. For organizations, the management of change is a condition for survival.

In any case, organizational changes should be interpreted as managed changes, because the term organizational change itself refers to the active participation and direction of the management (Berde et al., 2009). Based on controllability Molnár (2015) distinguishes change from changing. We cannot control change; therefore, the key step is to respond to it properly. On the other hand, during the change, we are in control of what is happening, and we are aware of what and how to change and, what results to achieve.

An organization can respond to challenges from the environment reactively (reflexively) or even proactively (Nickols, 2000). No matter how change is approached, it is nothing more than continuous adaptation to environmental

conditions. Changes under environmental conditions are effects and pressures that encourage organizations to behave and produce differently. However, quick response is no longer necessarily a competitive advantage, but rather a key to survive (Bácsné, 2014). The response of organizations to the changing environment - as a result of which changes in structure, behaviour and attitude come into effect - is nothing but the change itself (Berde et al., 2009).

Reactions to environmental changes, i.e. changing, can be distinguished from several aspects. Literature contains groupings that are formed based on, for example, the pace, extent, and manner of the change, and the extent of the changes it causes. Regardless of the approach, according to Molnár (2015), change is the result of external influences, and the internal environment only reacts to it. Research results prove that factors that most often trigger changes come from the external environment, such as changes in market demand and the strengthening of market competition (Ujhelyi - Kun, 2016), but we can also classify technological development as an external factor, as a result of which workforce demand can also change significantly (Keczer, 2019).

One of the most widely used methods for mapping environmental conditions is Porter's five-factor model for microenvironmental factors, and PESTEL analysis for macroenvironmental factors. According to Porter's five-factor model, the external root cause can derive from political, economic, socio-cultural, or technological environment. Accordingly, the organization's bargaining position with its suppliers might change, a new player or substitute product/service might appear on the market, and the nature of the competition between competitors might also change. In the PESTEL analysis, the development of political, legal, economic, social, and technological processes is considered. Changes in both environments can have a significant impact on the operation of the business and can make it react (Huang, 2020).

Micro- and macro-environmental factors affect the functioning of the organisation in a way that the organization cannot influence, they arise

spontaneously and require a dynamic reaction. Changes over which we have no influence can result in chaotic processes, which can be related to chaos theory. In the next subsection, I review the literature related to the interpretation of chaos.

The interpretation of chaos

Chaos was one of the new concepts of the last decades of the twentieth century. It entered the scientific public consciousness at the beginning of the 1970s, with Yorke-Li's (1975) publication titled 'Triple period results in chaos'. In the 1980s, a Russian chemist, Prigogine, pointed out that systems were non-linear and dynamic (Öztürk – Kızılkaya, 2017). Afterwards, chaos theory progressed step by step in scientific fields: it was interpreted in biology, meteorology, physics, and even astronomy. Within a short time, it also appeared in the social sciences and presented a new challenge to management science: it shed new light on the perception of management, predictability, future uncertainties, the question of stability and instability, and the possible outcomes of changes (Berde, 2009).

In management science, change management deals with the examination of change processes in organizations including processes that are generated by the conscious initiative of the organization's management. Change management therefore does not take those processes into account that arise spontaneously and are created as a result of the interplay of unpredictable events, although it recognizes that such spontaneous changes do exist. According to Dobák (1999), due to the internal and external complexity and dynamism of organizations, changes take place in organizations that are not planned and independent of the intentions and goals of the organization's management.

These spontaneously generated processes affect processes operating within the framework of the organization, thereby forcing the organization to behave randomly and irregularly. This approach is quite close to the mathematical interpretation of chaos. According to Gáspár (2002), chaos is irregular or random behaviour that is entirely governed by rules. Randomness manifests itself in the

fact that, despite known deterministic rules, we cannot predict the behaviour of a chaotic system in the long term, because chaotic motion is an aperiodic motion that never repeats itself.

According to Wernecke et al. (2017), one of the most fundamental starting points of chaos is the sensitivity of dynamics to initial conditions. It is this sensitivity that causes the loss of predictability. They distinguished partially predictable chaos and strong chaos, studying them as a function of time. Tél's (2002) finding is in line with that, according to which the time development of any quantity can be considered as movement in a general sense, so chaos in modern usage refers to the nature of movement and dynamics.

These chaotic and random processes raise the question whether spontaneous changes in organizations can also be characterized by the concept of chaos.

Chaos can be defined in several ways based on facts above. According to the mathematical approach, stochastic behaviour occurs in deterministic systems. According to Tél (1996), chaos is a steady movement that does not repeat itself, the temporal behaviour of nonlinear systems, steady instability. According to Kemény (1993), chaos is a non-periodic behaviour caused by the nonlinear nature of the given system. Accordingly, it can be concluded that chaotic processes can also be interpreted in organizations, as a permanent unstable state can be created. However, organizations can only be considered as non-linear, dynamic, and complex systems with few variables or few characteristics, in which spontaneous, unpredictable changes take place, only **at the cost of significant** narrowing and simplification. The processes called chaos by natural science definitions can therefore also be interpreted in economic and social organizations.

Organizations are exposed to complex processes, and the maintenance of their operation depends on adapting to them. As a result of these complex processes (complexity), decision-making processes within the organizations change, planning is not a long-term concept, communication has an increasingly significant role (Kisa et al. 2018). In chaotic conditions, unsuccessful

communication can result in huge problems (Latif - Elmas, 2017). Leadership based on chaos theory is a new paradigm for social science, where the leader has a prominent role, as he must be able to accept unpredictability and show sufficient flexibility to allow the organization to adapt (Calacgac - Singh, 2016). Becoming an agile organization is a general phenomenon today, which helps organizations through processes facing changes. A key factor in this process is the transformation of the organizational culture, the structure and evaluation of human resource management, which results in complex processes in the life of organizations (Székely et al., 2023).

Instability these days

COVID-19 that appeared at the end of 2019, first appeared in the Chinese city of Wuhan, has thrown organizations around the world from their normal operations. The epidemiological situation worsened significantly over the course of a few weeks (Cuccinotta - Vanelli, 2020).

The epidemic had impact in each field globally. Economic processes split. In some cases, they slowed down or stopped: in most areas there was a significant decline, but there were also areas where work stopped completely overnight. At the same time, there were areas whose growth rate was extremely high. Without claiming to be exhaustive, for example, the sales revenue of service companies dealing with cloud services and software development achieved an average increase of over 50% between 2019 and 2022 (healce.com, 2023). This kind of difference put certain organizations on a forced path, while the development potential of other organizations suddenly rose. Responding to changes in an information-deficient and uncertain environment presented the managers with an extremely intense situation.

Based on few available data, this proved to be an extremely challenging task, as the forecast of the epidemic was based on uncertain parameters (Mangiarotti et al., 2020).

The epidemic infected millions of people and recalled the fears related to economic crisis. Educational institutions were closed, market demand and supply were upset: demand for health care increased, for other products and services decreased, and panic buying showed increased demand for products from the food industry (Nicola et al., 2020). COVID-19 threatened individual livelihoods, businesses, various sectors, and the entire economy (Laing, 2020). The change appeared fast, it was large-scale and required an immediate response from the organizations. As a result of the new coronavirus, several countries closed their borders, restricted travel, the possibility of crossing the border, and slowed down social relations. These measures affected the service sector, retail trade, hospitality, entertainment industry and the transport sector negatively in North America and Europe, among others. Decrease in consumer needs reduced imports from developing countries, which have dealt a severe blow to these areas. In addition, large electronics manufacturers suspended their activities. Significant problems also arose in supply chains due to the closure of borders and the restriction of logistics routes (Akbualev et al. 2020). The associated labour market problems further aggravated the situation, generating a further decrease in disposable income. Due to the coronavirus, it became necessary to reach a compromise between public health and economies (Atkeson, 2020). One of the most affected sectors was tourism, the UN tourism agency predicted a drop of around 20-30% in international tourism revenues compared to 2019 (Folinas - Metaxas, 2020). The foundations of chaos theory were also used for strategic purposes, crisis management and decision support in certain areas of tourism during the pandemic, which helped the affected organizations to recover (Iirmdu - Donaldson, 2024).

The global spread of the epidemic and difficulties caused boosted the sectors in the direction of development. Although there was extremely little time for the organizations to react, it was necessary to adapt to the changed circumstances to survive. The demand for IT services increased, certain work processes took a

novel approach. Technological developments affected all fields of our lives, but healthcare was also forced to adapt in this area (Clipper, 2020).

Overall, due to IT solutions, processes became faster and more efficient in several areas. However, labour market problems might generate further difficulties in economy, tourism is one of the most endangered sectors worldwide due to the epidemic, therefore additional measures are necessary to prevent economic collapse.

As a summary, every single condition of chaos can prevail in spontaneous processes occurring in organizations. Organizations are dynamic systems, therefore, to be able to follow changes in the environment, they must be in constant interaction with it and respond to changes immediately in operating conditions. This adaptation requires continuous movement and transformation, which results in the organizations themselves carrying the dynamism. Complex, open systems whose behaviour cannot be explained simply by analysing the system's components. The behaviour of these systems is incomprehensible and untraceable, which results from the fact that they include irregular movements in addition to their complexity (Vécsey, 2000). Chaos can be interpreted in the case of organizations, but it is also worth examining how instability, which characterizes everyday life of organizations the most, can be defined.

The interpretation of instability

In general, stable is something that is solid, sure, and fixed. In this environment exposed to permanent change, Lewin's stages of change, unfreezing, changing, and refreezing (Lewin, 1951), well-known from literature, appear too quickly, as a result of which refreezing the new state encounters significant obstacles. As a result, stabilizing the future state of organizations is difficult or almost impossible to achieve. Their daily operations are exposed to constant, ever-present instability, changes are uncertain, unpredictable, and unforeseen consequences.

We can obtain an accurate guidance of the interpretation of instability if we examine other scientific fields, as well. If similarities and differences in different interpretations of the scientific fields can be drafted, we can easily determine to which field constant instability present in organizations is most comparable. This assists us to explore suitable solution alternatives later.

I will describe some approaches from the previously mentioned areas regarding the interpretation of instability in the following sections.

Philosophical formulation of the first theories related to change and instability dates to the 600s BC. Heraclitus' analogy of a 'river' epitomizes the problem of permanent change: everything shows constant change, nothing is permanent, and this dynamism never passes, is not dull, but eternal (Koutsopoulos, 2018). In the 17th century, Fontenelle drafted it as a basic philosophical principle: 'Since the memory of the rose, no gardener has died.' The philosophical metaphor suggests that a relationship can be described between change, passing and permanence: man, as a moral being, always looks for permanence in its own environment, but permanence is always a matter of point of view (Szabó, 2014). According to the author, in certain philosophical approaches, stability means nothing more than the 'temporary suspension of instability.' In this interpretation, it is defined as temporary state, however, there are also views that consider time limit if difference between unstable and stable is considered. In this aspect, stability depends on the time limit in which it is examined: in the short term, things may seem stable, which in the long term are no longer at all (Szoboszlai-Kiss, 2014).

Ever since Heraclitus' metaphor of the river, philosophy focused on the questions of change, permanence and passing away. Based on the theories, it can be concluded that change is always accompanied by the passing of something, and the sense of permanence does not depend on anything other than the period we use as a basis to define it. Instability appears for the first time in the previously detailed mathematical chaos theory published in the 1970s. In the theory that appeared in the 1980s, instability is meant to express the complete loss of

predictability. In the interpretation at that time, chaos does not refer to a momentary situation, arrangement, or state, but to behaviour over time. This reflects the interpretation used in change management and the signs of chaos in the processes taking place in organizations: change is not considered a static, but a dynamic process. Since time evolution of any quantity can be considered movement in a general sense, chaos in modern terminology refers to the nature of movement and dynamics (Tél, 1988).

With respect to organizations, instability means the loss of predictability resulting from the characteristics of chaos in natural science. Accelerated processes and changes that characterize organizations in the 21st century are sensitive to the initial state (from where and what characteristics the change affected), the outcome of which is undeterminable - in many cases, even the most accurate risk assessment and forecasting methods are unable to provide a complete picture and cover the actual outcome of situations influenced by the individual. Since reaching a stable state only happens for a brief time, or not at all, we can say that the body is constantly moving between unstable states. And this wording came close to defining chaos.

According to the traditional definition in natural sciences – i.e. the relationship between the quantity over time and the nature of the movement – the management of organizations operating in an unstable environment could be called chaos management.

However, considering the new, modern wording, this statement becomes questionable. Among the criteria defined in two theories described, the mathematical describability and the exact geometrical structure also face serious doubts in the case of organizations. However, it can be concluded that the intensification of indeterminacy and the increased sensitivity to the initial state cover the concept of instability, since in the sense of natural science, the body moves between unstable states throughout the chaotic movement, and the predictability of the outcomes is questionable. As in the case of organizations

operating in the 21st century and extremely exposed to changes. Consequently, the main characteristic of chaos is nothing more than permanent instability, when the body - or in this case the organism - constantly oscillates between unstable states, and the outcomes are difficult to predict.

The appearance in natural sciences had a rapid impact on various scientific fields. The interpretation of chaos spread and appeared in social sciences as well. Every single condition of chaos theory can apply to spontaneous processes in organizations, if we take nonlinearity, few variables and dynamism as a basis. The functioning of an organization can only be described with mathematical equations at the cost of significant simplifications, which have a significant impact on the results of the estimates. On the other hand, organizational processes can be characterized by irregular movement and predictability is hardly realized or not at all. The question arises, based on these, what influences the operation of the organization more? Each characteristic of chaos, or the constant instability and the compulsion to operate within it?

Chaos or instability?

With respect to theories described above, chaos is based on the mathematical property that even a simple equation can have a complicated solution. Consequently, chaos can be interpreted in all sciences where mathematical description is useful (for example, economics). Chaos science studies the general features of chaotic phenomena, but this approach is not complete. Based on this, we cannot speak of deterministic chaos in connection with phenomena that have complicated laws behind them, or that we cannot put the phenomena into precise mathematical form.

The results of the theory of chaos are also implanted in the theory and methodology by representatives of the social sciences to learn about and identify the aspects of uncertainty, nonlinearity, and unpredictability in social and economic systems (Kiell - Eliott, 1996).

According to Maródi (2002), social sciences incorrectly adapt the chaos theory, since it is difficult or even impossible to approach the social sciences mathematically, which, is essential for talking about chaos.

The general compulsion to adapt to permanent changes in the 21st century forces dynamics and operation in continuous instability. As a result, we believe that, in the case of organizations, chaos has few variables, and its nonlinear characteristics have less influence on the ability to survive in the long term in the face of the pressure to adapt. According to Tél (2002), loss of predictability is nothing but instability, that is, the intensification of indeterminacy.

Not each element of chaos theory has an impact on organizations to a degree that would determine their survival and adaptability. Describing it with a mathematical equation would be extremely difficult and its applicability would be meaningless. Not to mention that the accelerated changes enable organizations to have such a short reaction time that makes mathematical solutions irrelevant. During the examination of the impact of chaos and instability on economic activity, it was pointed out that production, management, and the distribution of resources can be described as a dynamic system in which signs of chaos and instability can be found, however, these factors significantly depend on the parameters of the system (Perevoznikov - Lomteva, 2019). However, the interpretation of chaos loses its significance in case of organizations, in the unstable situation created by the changes. However, the middle stage of Lewin's change model is given even more emphasis, since previously stable organizational processes that have been thrown out of their harmony loosen to such an extent that they can even threaten their survival. It is wrong to evaluate chaos as a chaotic and uncontrollable process, since it is necessary to plan within an organization with the occurrence of changes that result in instability and their controlled management is necessary (Kasianova et al., 2019). Chaos theory helps only in strategic behaviour, decision-making and determining the degree of organizational flexibility in uncertain environmental conditions (Onchieku – Ragui, 2019).

As a result, instead of managing chaos, managing instability is the main direction in the management of organizations in the 21st century. In contrast to the term 'chaos management,' the term 'instability management' is better, since the loss of predictability - which is a component of chaos - can clearly be paralleled with the functioning of organizations.

THE INTERPRETATION OF LITERATURE, CONCLUSIONS

In the light of the foregoing considerations, chaos in organizational management can be defined as permanent instability: the harmony of power relations that ensure the balance of organizations loosens again and again - or does not develop at all - due to the nonlinear nature of the changes that begin in the external and internal environment. And this approach is extremely close to Lewin's change model, where factors that generate change and those that prevent change affect the initial state in different weights, which cause the organization to become unstable when it deviates from its initial harmony, thereby forcing the organization to reach a new state. Consequently, instability is at the center of change management.

Instability is also at the center of chaos. Permanent changes force organizations to operate in this constant instability, make decisions and remain profitable. In terms of management science, the management of organizations operating in constant change cannot be called 'chaos management,' since we cannot and should not define a precise geometric structure and direction of movement in a mathematical sense. However, instability management is a valid term based on the literature approach.

In the previous chapters, the questions arose as to whether the instability associated with change is a natural state for organizations, whether chaotic processes can also be characterized by the concept of chaos regarding organizations, and whether each characteristic of chaos or only instability affects it the functioning of organizations better.

One of the greatest challenges in the 21st century related to instability was the emergence of the coronavirus epidemic and its rapid worldwide spread. It confronted both the economy and the organizations with enormous problems, requiring an immediate response. The epidemic situation affected all industries, putting the hospitality and tourism sectors at risk, although it urged the use of IT solutions, which resulted in rapid development in the economy.

Figure 2 illustrates the literature relationship between chaos and organizational changes. Based on the literature interpretations, it can be concluded that instability is the common point of intersection between the definition of chaos and the examination of organizational changes.

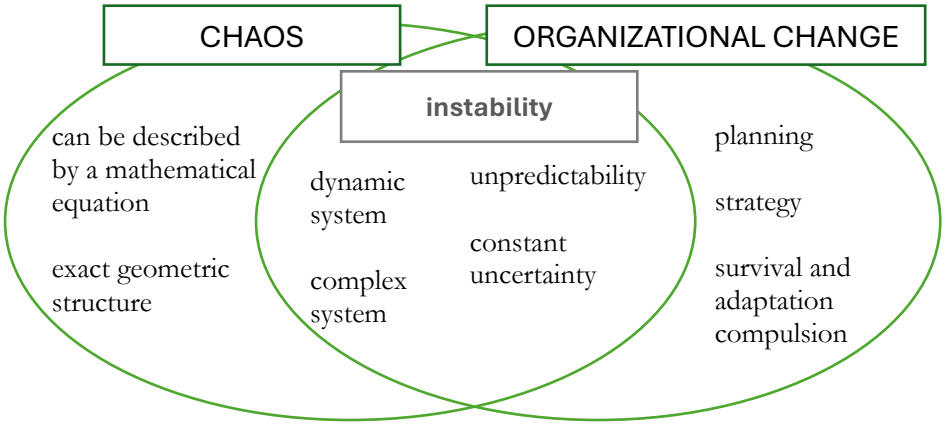

Figure 2. The intersection of chaos and organizational change is instability

Source: *own editing* (2024)

Based on what was described, it can be concluded that the permanent instability of organizations is in a state similar to, or close to, chaos. One of the main obstacles to the development of a stable situation is the rapid succession of changes, which basically results in the fact that the defining characteristic of the functioning of 21st century organizations - instability - cannot be a natural phenomenon, as organizations strive to feel safe, which is achieved by reaching a stable state they can reach. However, a stable state is only a desirable state that

organizations cannot achieve in the age of accelerated changes, instability plays a significant role in the life of organizations.

SUMMARY

In the study, I drafted a question whether organizations operate in permanent instability or within a chaotic framework during permanent change. In other words, are every single condition included in the interpretation of chaos fulfilled during their everyday operations, or can we only partially characterize organizations with the concept of chaos?

Chaos theory began to gain ground in the 1970s. They soon started to deal with it in the social sciences as well, since the spontaneous changes, which the leaders could not control and could not support with facts, caused more problems. It was established that chaos is present in the form of permanent instability in the life of organizations. The difference between various fields of science is found in the form of instability, as well as in the way in which it is defined and how its content is interpreted. Instability, in an organizational sense, also designates further lines of investigation. During successful organizational changes, chaos theory as a strategic guideline is suitable for outlining scenarios and supporting decisions.

REFERENCES

1. Akbulaev, N., – Mammadow, I., – Aliyev V. 2020*: Economic Impact of COVID-19*. Sylwan 164(5):113-126. http://dx.doi.org/10.2139/ssrn.3649813 (2024.02.20)
2. Atkeson, A. 2020*: What Will be the economic impact of COVID-19 in the US? Rough estimates of disease scenarios*. The national bureau of economic research. NBER Working paper No.26867. 2020. pp.1-25. https://www.nber.org/papers/w26867
3. Bácsné Bába, É., 2014: *Szervezeti reakciók a változások tükrében* TAYLOR 6 (3-4), 83-90.
4. Berde, Cs., Berde, Á., 2009: *A káosz értelmezése a szervezetekben* In: Iszályné Tóth J. (szerk): Tartamkísérletek a mezőgazdaságban, DE-AMTC, Kutatási és Innovációs Központ Nyíregyházi Kutató Intézet

5. Calacgac, J., Singh, A. 2016: *Implications of Chaos Theory in Management Science. Chaotic Modeling and Simulation (CMSIM)* 4:515-527. http://www.cmsim.eu/papers_pdf/october_2016_papers/10.Galacgac_Singh_515-527.pdf (2024.02.20)

6. Clipper, B. 2020: *The Influence of the COVID-19 Pandemic on Technology Adoption in Healthcare Nurse Leader*, doi: https://doi.org/10.1016/j.mnl. (2020.06.08).

7. Cucinotta, D., Vanelli, M. 2020: *WHO Declares COVID-19 a Pandemic. Acta Bio Med.* Vol. 91 No. 1. pp.157-60. https://www.mattioli1885journals.com/index.php/actabiomedica/article/view/9397 (2024.02.20)

8. Dobák, M. 1999: *Szervezeti formák és vezetés*, Közgazdasági és Jogi Könyvkiadó, Budapest, p.123-125

9. Farkas, F. 2013: *A változásmenedzsment elmélete és gyakorlata*, Budapest, Akadémia Kiadó, ISBN 978 963 05 9432 5 HU ISSN 2061-6430, p.17- 33.

10. Folinas, S., Metaxas, T. 2020: *Tourism the great patient of coronavirus COVID-19*. International Journal of Advanced Research 8 (4). pp.365-375. https://doi.org/10.21474/IJAR01/10788 (2024.02.20)

11. Gáspár, V. 2002: *Játsszunk káoszt! Káosz: Determinisztikus rendszerek véletlenszerű viselkedése* – Természet Világa, 133. évf.7.sz. pp.299-304.

12. healce.com, 2023. *IT szolgáltatások: magasan szárnyal a felhős technológia* – https://healce.com/mars-hasab/it-szolgaltatasok-magasan-szarnyal-a-felhos-technologia/ (2024.04.20.)

13. Huang, Y. 2020: *Strategic Environment Analysis of Logistics Enterprise based on SWOT-PEST – Michael Porter's Five Forces Model – Taking SF Express an Example.* Advances in Social Science, Education and Humanities Research, vol. 375.pp.183-189.

14. Iirmdu, T. O., Donaldson, R. 2024. Risk Management Strategies: An Empirical Analysis of Strategies Employed by Tourism Business Managers in Plateau State, Nigeria during the COVID-19 Pandemic. *Modern Geográfia, 19*(1), 81–98. https://doi.org/10.15170/MG.2024.19.01.05

15. Jantsch, E. 1980. *The Self-Organising Universe, Pergamon Press*, In: Nováky E.: Jövőkutatás és káosz, Magyar Tudomány, Budapest, 1993. 4. sz., pp.512-517

16. Judson, A. S. 1991.: *Changing Behavior in Organizations: Minimizing Resistance to Change.* Cambridge, MA: Basil, Blackwell.

17. Juhász, Cs. 2016. *Szervezeti tudásmegosztás.* Gradus Vol 3, No 1 pp. 404-409.

18. Kasianova, N. – Tarasova, E. – Kravchuk, N. 2019. *Enterprise development management through managed chaos.* Independent Journal of Management & Production. Vol.10.Nr.5. pp.1626-1644. DOI: 10.14807/ijmp.v10i5.900

19. Keczer, G. 2019. *„Management Challenges Imposed by the Ongoing Economic Changes"*. TAYLOR 11 (2.), pp.24-35.

20. Kemény, Cs. 1993. *Instabilitás és innováció a jövőmodellekben*, Magyar Tudomány, Budapest, 4. szám, pp. 519-527.

21. Kısa N., Özdemir N., Turan S. 2018. *Re-discussing School Management Processes in the Light of Complexity Theory*. In: Erçetin Ş. (eds) Chaos, Complexity and Leadership 2016. ICCLS 2016. Springer Proceedings in Complexity. Springer, Cham

22. Kotter, J. P. 1995. *Leading Change: Why Transformation Efforts Fail*. Harvard Business Review, 73 (2): pp.59–67.

23. Koutsopoulos, G. 2018. *Modeling Organizational Potentials Using the Dynamic Nature of Capabilities.* In Joint Proceedings of the BIR 2018 Short Papers, Workshops and Doctoral Consortium co-located with 17th International Conference Perspectives in Business Informatics Research (BIR 2018) (pp. 387–398). CEUR-WS.org. Retrieved from http://urn.kb.se/resolve?urn=urn:nbn:se:su:diva-164365 (2023.12.20)

24. Laing, T. 2020. *The economic impact of the Coronavirus 2019 (Covid-2019): implications for the minings industry*. The Extractive industries and Society. Vol.7. Issue 2. 2020/4. pp.580-582 https://doi.org/10.1016/j.exis.2020.04.003 (2024.02.21)

25. Latif, H., Elmas, T. 2017. *Strategic communication in Chaos Management and a Case study*. Journal of Social and Administrative Sciences, Vol.4.(2) pp.193-198. DOI: http://dx.doi.org/10.1453/jsas.v4i2.1297 (2024.02.20.)

26. Lewin, K. 1951. *Field Theory in Social Science.* Harper and Row, New York.

27. Mangiarotti, S., Peyre, M., Zhang, Y., Huc, M., Roger, F., Kerr, Y. 2020. *Chaos theory applied to the outbreak of Covid-19: an ancillary approach to decision-making in pandemic context*. 10.1101/2020.04.02.20051441 (2024.02.20)

28. Maródi, M. 2002. *Káosz a társadalomtudományokban? A káoszelmélet (félre)értelmezése a társadalomtudományokban*, in Fokasz N.: Káosz és nemlineáris dinamika a társadalomtudományokban, Typotex Kiadó, Budapest, 2003, pp. 15-28.

29. Molnár, I. 2015. *Változtatásmenedzsment a hazai gyakorlatban* (doktori értekezés), Nyugat-magyarországi Egyetem, Sopron, 9.p.

30. Nicola M. – Alsafi Z. – Sohrabi C. – Kerwan A. – Aj-Jabir A. – Iosifidis C. – Agha M. – Agha R. (2020): The socio-economic implications of the coronavirus

pandemic (COVID-19): A review. International Journal of Surgery, Vol.78. pp.185-193. https://doi.org/10.1016/j.ijsu.2020.04.018

31. Nickols, F., 2000. *Change Management* 101. A Primer.

32. Nováky, E., Orosz M., 2015. *A hazai társadalmi-gazdasági mutatók vizsgálata a káoszelmélet eszközeivel,* Statisztikai szemle, 93.évf, 1.szám,pp 3-42.

33. Onchieku, E. N., Ragui, M., 2019. *Effect of strategic leadership on performance of housing co-operative societies in Nairobi City County, Kenya*. International Academic Journal of Human Resource and Business Administration, 3(5), 411-433 http://www.iajournals.org/articles/iajhrba_v3_i5_411_433.pdf (2024.02.20.)

34. Öztürk, Z., Kızılkaya, S., 2017. *Chaos-complexity theory at management. International Online Journal of Education and Teaching (IOJET), 4*(3), 259-264. http://iojet.org/index.php/IOJET/article/view/162/168 (2023.12.05.)

35. Perevoznikov, E., Lomteva, E., 2019. *Modeling of Eco-nomic Processes, Instability and Chaos*. Journal of Applied Mathematics and Phys-ics, 7, 356-363. https://www.researchgate.net/deref/https%3A%2F%2Fdoi.org%2F10.4236%2Fjamp.2019.72027 (2024.02.20)

36. Robbins, S. R., 1998. *Organizational Behaviour: Concepts, Controversies, Applications*, Eight Edition, Prentice Hall, New Jersey

37. Spector, B., 2013. *Implementing Organizational Change, Theory into Practice,* Third Edition, London: Prentice Hall, Pearson Education International.

38. Szabó, T., 2010. *Globalizáció-elméletek és instabilitás*. Jog- és Politikatudományi folyóirat, 2010.IV.évf.3-4.sz.1-15.p.

39. Székely, B., Naárné, Tóth Zs., Erdeiné Késmárky-Gally, Sz., 2023. *Motiváció az egyén és a szervezet szintjén. Multidiszciplináris kihívások, sokszínű válaszok - Gazdálkodás- és Szervezéstudományi folyóirat* , (2), 200-238. https://doi.org/10.33565/MKSV.2023.04.08

40. Szoboszlai-Kiss, K., 2014. *A görög etikai gondolkodás kezdete* in: Jog-Állam-Politika – Jog- és politikatudományi folyóirat, Szeged 6.évf. 4.sz 91-104 p.

41. Tél, T., 1988. *A káosz természetrajza* in: Természet világa, Budapest,129. évf. 9.sz. p. 386-388.

42. Tél, T., 1996. *Káosz egy csésze kávéban*, Természet Világa, Budapest, 127. évf. 9.sz. p.386

43. Tél, T., Gruiz M., 2002. *Mi a káosz? És mi nem az?* Természet Világa, Budapest, 133. évf. 7. Sz. 2002, p. 296-298

44. Ujhelyi, M., Kun, A. I., 2016. *Szervezeti változásokat kiváltó tényezők empirikus vizsgálata*. Taylor: Gazdálkodás- és Szervezéstudományi folyóirat: A Virtuális Intézet Közép- Európa Kutatására Közleményei VIII. évf.(2) pp. 36-43.

45. Yorke, A.J., Li, T.Y., 1975. *Period Three Implies Chaos*. The American Mathematical Monthly, Vol.82. No.10.pp.985-992. https://www.its.caltech.edu/~matilde/LiYorke.pdf Letöltve: 2024.02.20.

46. Wernecke, H., Bulcsu S., Gros C., 2017. *How to test for partially predictable chaos*. Sci Rep **7,** 1087 (2017). https://doi.org/10.1038/s41598-017-01083-x Letöltve: 2024.02.20.

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