

THE APPLICATION OF COMPLEXITY THEORY IN THE CONTEXT OF PUBLIC GOVERNANCE CHALLENGES

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Annotation. *Traditional public governance is based on rationality, clear causal links, and the assumption of stability of social systems. However, contemporary public governance systems have different levels of operation, they adapt, can organise themselves, have different levels of sensitivity, evolve and change unpredictably according to their internal logic of operation or under the influence of other external systems. Thus, traditional models of public governance become insufficient to explain and address the challenges that arise in this context. The provisions of complexity theory and methodology become especially important for understanding the contexts and processes of modern society, applying governance methodologies and increasing their efficiency, implementing systemic changes, and forming prediction models. While it may not be possible to provide concrete technical solutions that are useful in the short term, this theory can offer certain models and principles to better meet the challenges ahead. This article aims to define the essential features of complexity theory and to discuss the possibilities of its application in the context of public governance. The methods of scientific literature analysis, synthesis, historic analysis, and document analysis are used in this paper. The possibilities of applying complexity theory differ depending on the stage of development of public governance and its methodological assumptions. In the context of complexity theory, when shaping public governance change strategies for effective solutions, it becomes important to understand the limitations of idealised future perspectives and to assess the current functioning of systems and forces acting on them, identifying natural system development trends due to the influence of self-organisation forces.*

Keywords: *complexity theory, governance methodologies, public governance, public governance systems change*

Reikšminiai žodžiai: *kompleksiškumo teorija, valdymo metodikos, viešasis valdymas, viešojo valdymo sistemų kaita*

JEL classification: H83, O3

Introduction

When public governance researchers and practitioners face increasingly complex problems in the formation and implementation of public policy, it is important to properly understand the ongoing institutional and inter-institutional processes, the dynamics of their changes, and the measures that determine the respective results. Stable, rational, predictable, and control-based functioning of social systems in postmodern society is often quite limited. Modern social systems have different levels of functioning – they adapt, change, can organise themselves, have different levels of sensitivity, and can evolve and change unpredictably according to their internal logic of functioning or when affected by other systems. Significant changes can be caused by even the smallest fluctuations in social systems. This applies to contemporary public governance systems.

Currently, public governance systems around the world are facing unforeseen events and changes that have not been taken seriously so far. It is therefore necessary to seek new methodological approaches for the formation and implementation of effective and efficient policy decisions (Eppel and Rhodes 2018; Cairney and Geyer 2017; Gerrits and Marks 2015; Tenbenschel 2013; Eppel 2012; Room 2011, 2015; Westhorp 2012; Cairney 2012). With significant changes in the functioning of systems to create or change institutional synergies and ensure effective and efficient results in public policy-making and implementation, scientific discourse increasingly focuses on complexity theory, which may help to explain why certain political interventions do not produce the desired results in different contexts (Eppel and Rhodes 2018; Cairney 2012; Dawkins and Barker 2018; Fish and Hardy 2015).

Complexity theory is focused on the dynamics of the analysed social phenomenon. Policy formation and implementation, decision-making, and institutional activity improvement take place under the influence of different, complex, dynamically interacting factors. These processes can be linear if the systems are affected by a strong central force, but they are usually non-linear, if influenced by many different forces and interests when the final result of this operation is difficult to predict. These processes are strongly affected by different feedback mechanisms and contexts, which are often multidimensional and dynamic, with an emphasis on their potential functions of promoting or inhibiting change (Teisman and Klijn 2008; Westhorp 2012).

Complexity theory applied to the analysis of public governance processes emphasises that the decisions and implementation of policies by public governance institutions are difficult to predict and control, and the rational intentions of public sector policymakers and implementers do not produce the desired results. On the other hand, although there is a growing interest of the scientific community in complexity theory, it is still not widely applied in public governance science and practice (Eppel 2017). The authors of the article put forward a position that complexity theory became especially important for public governance systems in the face of the global COVID-19 pandemic when seeking to manage it and minimise its negative consequences for society. Thus, this article aims to define the essential features of complexity theory and to discuss the possibilities of its application in the context of public governance. The methods of scientific literature analysis, synthesis, historic analysis, and document analysis are used in this paper.

Complexity theory and analysis of its essential operating principles

Until the middle of the 20th century, the development of theories of social sciences was significantly influenced by the mechanical approach to research objects established in the natural

sciences, which is characterised by the following essential provisions: i) the relationships between the individual elements of the system can be understood by isolating the interacting parts; ii) there are links among these parts of the system, which are predictable; iii) the results of the interaction of all system elements can be predicted by analysing and summing the interactions of individual parts.

J. Sapir (2020) compares system (mechanical) and complexity approaches (Table 1).

Table 1. System thinking versus complexity thinking

Factor	Systems Thinking	Complexity Thinking
Ideal future vs. evolutionary potential of the present.	Systems thinking seeks to define an ideal future (e.g. culture) and then define strategies to “close the gap”.	Complexity works with the evolutionary potential of the present, i.e. it seeks to understand the “now”, find out what can be changed (in a measurable way), and then take small evolutionary steps in a more positive direction without any assumption of the end destination.
Complex systems are modulated, not driven.	Change one thing, and the other components of the system remain unchanged.	Change one thing, and the other components in the system change as well – in ways that do not repeat.
Complex systems are dispositional, not causal.	One can accurately predict the behaviour of the system (can see cause and effect).	One can observe a tendency or propensity for the system to move in a general direction. As we move in any given direction by making choices, there will always be a certain fluidity, not a direct path as in a causal system.

Source: Sapir (2020)

In the 21st century, simplistic understanding of systems is criticised by natural and social sciences, with increasing emphasis on the dynamism and unpredictability of systems, structures, and processes, seeking to distance from reductionism. One such approach is complexity, which is currently applied in many fields of science (Eppel and Rhodes 2018; Pirson and Turnbull 2016; Wagenaar 2007).

Complexity is defined as the scientific study of systems consisting of several interacting parts or agents, the behaviour of which cannot be explained based on individual system elements, agents, or interactions among individual system elements (Thietart and Forgues 2011). Greater complexity is a characteristic of those systems which are composed of more qualitatively different dynamically interacting elements. Social systems are always more complex than chemical, physical, and natural systems.

Social phenomena we face in the field of public governance differ from the objects of scientific research of the precise sciences primarily by the fact that they often arise and form not only as a consequence of some isolated cause – as we can see, for example, by analysing chemical reactions or mechanical interactions between objects, when a particular stimulus produces a very clearly and unambiguously predicted response or outcome. Social contexts and circumstances are much more complex, as we encounter many new, higher system-level variables, such as inter-sub-

jectivity, differences in system elements, individual attitudes, values, and top-down causation (reciprocal causation), when higher system-level phenomena influence the elements of the system, which in turn are influenced by the elements and the ability of the elements-agents operating in the system to realise and assess the processes taking place in the system. Social phenomena are very complex, and currently the complexity of such phenomena is gaining momentum because of globalisation. It becomes quite difficult to predict what policies, solutions, or interventions can deliver the results which are necessary, effective and efficient in the context of public governance (Fish and Hardy 2015).

Although the concept of complexity theory is often used, it must be acknowledged that it is a set of different theories. The basic idea of complexity is that the analysis of various phenomena should be concentrated not on individual elements of the system, but on the system itself as a whole, a network of various elements which interact with each other and cause a specific system operation which cannot be mechanically separated into the behaviour or actions of its constituent parts. On the other hand, the development of the system is inseparable from the interaction of the elements. Complexity theory is dominated by the view that systems develop in a non-linear way because they are affected by various feedback mechanisms, the principle of self-organisation, and development together with other systems (co-evolving) (Cairney 2012; Haynes 2008; Klijn 2008).

Self-organisation is the principle by which social systems can organise themselves (Morçöl and Wachhaus 2009). Wagenaar (2007) claims that the concept of complexity includes an evolving theoretical perspective. Complex systems cannot be fully understood and controlled, but some ways or approaches of dealing with them may be more useful and productive than others, such as those based on positivism or rationalistic cognitive methodology. Thus, it can be stated that complexity theory may be useful to identify and explain systems or processes that lack stability and order (Cairney 2012).

Classical public governance is based on positivistic and rationalistic assumptions that the stable functioning of systems must be ensured by centralised hierarchical governance and focused on the implementation of various procedures and legal acts. However, the postmodern society of the 21st century is complex, and constant change and uncertainty lead to the limitations of this classical approach. In the face of a global pandemic, good governance practices based on rational arguments, stability, and predictability may not produce the desired results (Eppel 2017).

The perspective of complexity provides an opportunity to explain how independent elements interact to increase their resilience and ability to survive over time when they are influenced by historical contexts, institutional forms, values, and other factors. It promotes an understanding of the interaction models and trends that emerge in systems, not relying solely on isolated, context-independent cause-effect relationships (Eppel and Rhodes, 2018). When assessing the performance of complex systems, it should be noted that due to the many different interrelationships in the complex system, small effects under specific conditions can affect the entire system in unforeseen ways, creating unpredictable results (Wagenaar 2007).

The scholars analysing and applying complexity theory claim that fundamental changes in the system occur at certain critical points, where different bifurcations of the system emerge. It is a process in which the system fluctuates between two possibilities and further developmental trajectories. This is manifested by system instability and increased sensitivity to environmental factors (Westhorp 2012, Dawkins and Barker 2018).

A very important idea of complexity theory is that social phenomena develop not only due to the action of external forces. Various social systems do not always obey the rules, laws,

and principles – they are also characterised by self-organisation features. Due to self-organisation, such systems can develop along a difficult-to-predict trajectory and at an unknown speed (Teisman and Klijn 2008). Dawkins and Barker (2018), based on the research of various authors, distinguished six essential periods of operation of complex system changes: (a) turbulence, when the system is brought out of balance due to external and internal influences and fluctuations; (b) sensitivity, when the system becomes particularly sensitive to various internal or environmental conditions and circumstances; (c) the critical bifurcation point, when, in the unstable state of the system, the structure of the system fluctuates among possible new alternative structural variants; (d) forces which form a new structure; (e) forces which break system symmetry and balance and encourage the transition to a new state; and (f) a new state of equipoise, in which a qualitatively new system is created that adapts to the changing forces and influences in the wider context.

The complicated possibilities of predicting complex systems are the main challenge. According to Fish and Hardy (2015), predictions in the case of complex systems are a major problem because such systems are adaptive and adjustable – they interact with the environment through the loops of positive and negative feedback. This presupposes the idea that even very intense factors acting on the system may not have a significant effect, and sufficiently weak factors may have a disproportionate effect and substantially transform the system (the best example here is E. Lorenz's "butterfly effect"). Thus, the impact on the system from the centre of the system (for example, from the municipal administration) may be less significant and effective compared to the impact which can be caused by the interaction of individual elements of the system (for example, the impact of the community or any other social group unexpectedly formed on social networks), which is generally less known and to which less attention is paid when analysing the system. This is supported by other scientists (Morçöl and Wachhaus 2009), who argue that systems do not seek to be in balance; on the contrary, they move away from balance and become less stable and more sensitive to external influences. In such states, systems begin to behave only in a partially predictable way when cause-and-effect relationships become non-linear. In such system states, systems can break down or become even more differentiated, complex, and achieve higher-level organisational principles and orders. The principles of a system self-organisation create preconditions for the emergence of adaptive elements of the system, strengthen certain approaches in the systems, and weaken others, which disturbs the new emerging order and enables harmonious operation without greater external coordination (Dawkins and Barker 2018).

Self-organisation in social systems arises from the freedom of choice and the actions of people and organisations when they belong to one system. Even when the system is exposed to some strong external force, the elements of the system retain freedom of choice and action, which can be used for even greater adaptation (Teisman and Edelenbos 2011). If a system is considered self-organising and self-renewing, it obeys its internal dynamics and reacts to the environment in a peculiar, specific way. Thus, the principles of operation of the system become difficult to understand from an external perspective, and the system itself becomes resistant to external pressure, or at least the response of the system to such pressure is unique (Klijn 2008).

In summary, the provisions and methodology of complexity theory become extremely important for understanding the contexts and processes of modern society, applying governance methodologies and increasing their efficiency, implementing systemic changes, and forming prediction models.

Complexity theory in the context of public governance

Complexity theory provides new insights into different areas of public governance in policy processes, the implementation of decisions, and institutional interaction. While it may not help to make concrete, technical, short-term solutions, it can offer some principles for public governance systems, their operation and interaction (Eppel 2017).

The possibilities of applying complexity theory differ depending on the stage of development of public governance and its methodological assumptions. Traditional public governance is based on linear functioning, predictability, clear causal links and system stability. In the context of traditional public governance, actors are agents involved in the operation of systems – they are, or at least seek to be, rational. It is considered that they can set clear goals, choose their implementation means and achieve the desired results. However, the rational existence and functioning of an actor in the context of complexity is considered an inappropriate provision, as it limits the understanding of what can influence changes in the analysed public governance system and how (Eppel 2017).

The rational actor and rational choice in complexity theory are treated as simplifications of complex reality, reductionism, or simple complexity, which is unreasonable but very understandable and acceptable to a citizen or agent of a public governance system who is burdened with complex information (Cilliers 2011.). Such attitudes do not provide a better understanding of social reality itself but provide a version of reality that is useful to some stakeholders.

The same is true of the public interest. Complexity theory, like post-structuralism theory, states that there is no objective or neutral position from which it would be possible to observe and describe complex social systems such as organisations or society (Cilliers 2011.). Thus, to assess what is happening in social systems, we must always admit that we will never be able to fully understand complex systems and changes that take place in them, while realising that other starting points, other positions, and other ways and methods of understanding and interpreting social systems are also possible.

One of the main conceptual tools of complexity theory for understanding structural-process transformations is non-linearity. In mathematics, where this concept originated and formed, non-linearity refers to a disproportionate relationship between variables, where a small change can have a large effect and, conversely, a large impact can have almost no effect. This is completely inconsistent with the thinking models which are commonly applied to public policy and administration or public governance, where any policies and solutions are proposed in the hope that they will generate a result proportionate to the resources invested in them, ideally a measurable result (Morçöl and Wachhaus 2009). Otherwise, such decisions would be difficult to publicly justify and explain. A good example here could be from the practice of ensuring traffic safety in Lithuania – the abolition of green right-turn indicators, hoping that this will increase road safety. This decision was based on a variety of scientific research results and legal regulations. However, its effect (an increase in traffic jams) was quite different from that expected by its initiators, who when proposing such a solution followed isolated cause-and-effect relationships in the field of public security.

In essence, such an understanding of the non-linear relationships of individual social variables calls into question many of the traditional science-based generalised laws about social systems that rely on isolated linear cause-and-effect relationships between individual variables. In this case, the prognostic possibilities of such laws when dealing with broader complex systems are very limited (Fish and Hardy 2015). In reality, any public policy or decision falls into a complex field of forces that are difficult to predict, and the impact of that policy or decision inevitably transforms. Even when impacts from other natural systems (geological or biological) affect social

systems, it is very difficult to predict the consequences of such impacts. Examples of this include the impact of the earthquake and tsunami in Japan on the Japanese economy in 2011, or the impact of the COVID-19 pandemic on the Lithuanian and global economy in 2020–2021.

Thus, it can be assumed that, under traditional hierarchical-linear governance conditions, every leader or public sector manager, when managing and controlling the situation and initiating change from their central position, cannot avoid complexity and various difficult-to-predict or fundamentally unpredictable influences that arise in the process of policy-making and implementation (Teisman and Edelenbos 2011). The new public management approach sought to reduce complexity by proposing clear responsibilities for politicians and civil servants and by separating public policy-making from its implementation. The focus is on output criteria and the organisation of the operation field (e.g. market mechanisms, privatisation, etc.). On the other hand, modern complex governance theories, such as the theories based on principles of networking, seek to assess the complexity and the existing fragmentation of systems by delineating complex systems and developing designs and strategies for governance mechanisms that are purposeful and focused on specific situations and process characteristics.

It is also noticeable that in public governance there is an institutional complexity when different institutions operating in the public space are guided by completely different values or operational logic, and have different expectations regarding the results of their activity (Greenwood et al. 2011; Raynard 2016). For example, it is suggested that foreign taxi drivers in Lithuania, which considers itself a part of the global world, are obliged to learn the Lithuanian language when communication between the service provider and the client is not necessary through the application of modern technologies.

The attempt is made to overcome institutional complexity by trying to bring together different stakeholders and ideas in the system to achieve the situations of temporary stability needed to achieve the results of policy-making and implementation. On the other hand, in the context of networking, the information processes in systems will be incomplete and complex due to the different values and perspectives represented by the stakeholders (Klijn 2008; Eppel 2017). In assessing the fragmentation of these interacting stakeholders, it should be noted that the negative effects of fragmentation will be reduced if the efforts of self-organising systems, such as communities, are combined with the efforts of controlling and supervising government institutions.

Integrated policy-making and implementation in complex systems should be based, on one hand, on the search for and implementation of new hierarchical control mechanisms and, on the other, on horizontal integration based on self-organisation when mutual adaptation is sought. Such integration is only possible if the results of mutual adaptation and interactive governance and the decisions made in this context are supported by citizens, and if they receive support from the higher levels of the formal government bureaucracy system (Teisman and Edelenbos 2011).

One can agree with the provision of Haynes (2008) on public policy: that the application of the complexity methodology to assess any social system or policy towards it emphasises the importance of a holistic overall approach to that system and the interaction of the elements of that system in the process of change. To identify the appropriate direction of development, it is necessary to understand the whole system and its individual elements, as well as the external factors of the system. Eppel (2012), summarising the works of various authors, offers such an analytical approach to the assessment of public governance processes that focuses on the cases analysed by the author, but can also be applied to a broader context when analysing and interpreting complexity in the context of public governance. This approach emphasises the following key principles: (i)

the system is a whole; (ii) an interconnected, interacting, and interdependent system; (iii) many interacting systems providing mutual feedback mechanisms within and among the systems; (iv) adaptation and development together with other systems; (v) changes due to self-organisation and emergence processes; (vi) open systems and socially constructed boundaries of the systems; and (vii) the history of the system influences the starting position of its changes.

Thus, to implement change in any sphere of the public sector, based on the complexity theory, it is necessary to abandon large long-term visions of the ideal future. It is much more promising to observe what is happening in the system we want to change, to understand the forces operating within the system and beyond our perceived (constructed) boundaries of the system, and to try to identify natural tendencies of system development that arise in the system due to the influence of self-organisation forces, than to artificially cling to any pre-determined, pre-known, and highly desirable or citizen-friendly results.

Only this way, by experimenting, is it possible to change the development trends of the system in the desired direction, to push the system towards the result we would like and which would meet the public interests, but not to stubbornly pursue any ideal vision of the future. Thus, in this case, we must at least partially abandon or limit the purely rational-mechanical approach to the governance and transformation of social systems in the public sector that has followed us since the Enlightenment. It is crucial that this approach, based on complexity theory, is well understood not only by state politicians but also by citizens. However, in the current social context, which is dominated by deterministic interpretive models of the social world based on strict cause-effect relationships, this is a rather difficult perspective to imagine.

Conclusions

Traditional public governance systems are characterised by linear, stable functioning, predictability and clear causal relationships, and the rational behaviour of system elements. However, the formation of clear goals, the accuracy of decision-making, and the achievement of desired outcomes in a postmodern society can be a very complex process, as complexity theory is dominated by the provision that in process transformations there is a non-linear dependence expressing disproportionate relationships between variables when a small change can have a large effect and, conversely, a large change can have almost no effect. This phenomenon becomes a challenge to the methodological assumptions of traditional public governance. New public management is focused on reducing complexity, distinguishing differentiation of responsibilities, and the dichotomisation of public governance.

The application of the methodology of complexity to assess any social system or its functioning emphasises the importance of a holistic approach to that system and the interaction of elements of that system in the process of change. To identify the appropriate direction of development, it is necessary to understand the whole system and its individual elements, as well as the external factors of the system.

Modern network-interaction-based theories of public governance assess the complexity and fragmentation of systems by creating specific designs and strategies for management mechanisms that are purposeful and focused on specific situations and process characteristics.

In the context of complexity theory, in shaping public governance change strategies for effective solutions, it becomes important to understand the limitations of idealised future perspectives and assess the current functioning of systems and forces acting on them, identifying natural system development trends arising due to the influence of self-organisation forces.

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KOMPLEKSIŠKUMO TEORIJOS TAIKYMAS VIEŠOJO VALDYMO IŠŠŪKIŲ KONTEKSTE

Santrauka. Tradicinis viešasis valdymas remiasi stabilumu ir racionalumu, aiškiais priežastiniais ryšiais ir socialinių sistemų pastovumu prielaida. Tačiau šiuolaikinės viešojo valdymo sistemos pasižymi įvairiais veikimo lygmenimis, jos adaptuojasi, keičiasi, geba save organizuoti, joms būdingi skirtingi jautrumo lygmenys, todėl gali evoliucionuoti ir nenusipėjamai keistis pagal savo vidinę funkcionavimo logiką ar būti veikiamos kitų išorinių sistemų. Taigi tradiciniai viešojo valdymo modeliai vertintini kaip nepakankami siekiant paaiškinti ir spręsti šiame kontekste kylančius iššūkius. Kompleksiškumo teorijos ir metodologijos nuostatos – itin reikšmingos norint suprasti šiuolaikinės visuomenės kontekstus ir procesus, taikyti valdymo metodikas ir didinti jų veiksmingumą, įgyvendinti sisteminius pokyčius ir formuoti prognozavimo modelius. Nors ji ir negali padėti priimti konkrečių techninių, trumpalaikėje perspektyvoje naudingų sprendimų, tačiau ji gali pasiūlyti tam tikrus modelius ir principus, padedančius geriau susidoroti su kylančiais iššūkiais. Šiame straipsnyje keliamas tikslas apibrėžti esminius kompleksiškumo teorijos bruožus ir aptarti jos taikymo galimybes viešojo valdymo kontekste. Straipsnyje taikomi mokslinės literatūros analizės, sintezės, istorinės ir dokumentų analizės metodai. Kompleksiškumo teorijos taikymo galimybės skiriasi priklausomai nuo viešojo valdymo raidos etapo ir jam būdingų metodologinių prielaidų. Kompleksiškumo teorijos kontekste, formuojant viešojo valdymo pokyčių strategijas, siekiant veiksmingų sprendimų, tampa svarbu suprasti idealizuotų ateities perspektyvų ribotumą ir vertinti dabartinių sistemų funkcionavimą, jas veikiančias jėgas, identifikuoti natūralias sistemos raidos tendencijas, atsirandančias dėl saviorganizacijos jėgų įtakos.

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