

SYSTEM OF SYSTEMS APPROACH FOR INVESTIGATING PUBLIC SERVICE SYSTEM

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Abstract: Public services and demands for increasing efficiency of the public administration have been in public spotlight and on the political agenda for at least last twenty years in Latvia. In Europe and the USA this trend has been going even longer. Nevertheless, the public services and their systems are still object of the research.

The aim of this study is to test the suitability of the system of systems (SoS) approach for describing and researching public service system and to identify new dimensions in the understanding of the public services. The SoS approach means that the object under study is defined not as the single system, which should be managed from a single point, but as an association of several systems, where each element of the system is independent and has its own goals, tasks and interests.

In order to investigate the suitability of the method, it is tested for one service, describing this service from point of view of different actors involved.

The result of the study shows that investigating the public service with SoS method can reveal new dimensions of this service and gain in-depth understanding of the impact of the service process on the parties involved and society as whole.

Keywords: System of systems, public service system, system thinking, ecosystem.

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Introduction

Public services and ways for providing them within a system, the operation of public service system, management models, innovations and introduction of the new methods and technical solutions have been in the focus of governments and societies of many countries. Over the last 50 years, public administration has seen several models for improving its performance, but public services and systems for their provision still is a target for improvement.

New public management (NPM) approach, which includes the implementation of the private sector management methods, and service approach in public administration was considered as ineffective and new ways and approaches were sought to improve public services (Osborne, et al., 2012), (Dunleavy, et al., 2006).

New approaches are mostly focused on the introduction of various digital technology solutions in the provision of the public services and focus to the involvement of society in the development of those services (Petrescu, 2019), (Chen, et al., 2020), (Rantanen Minna M., 2019), (Alford, 2016), (Audretsch, et al., 2019).

The aim of this study is to test the suitability of the SoS approach for describing and investigating public service system and to find out what new dimensions this method can provide.

The following tasks will be performed to achieve the goal: (1) the concept of the public service will be clarified taking into account the historical context of its implementation and development directions; (2) a public service system framework for one case study will be defined and scope of problems existing within this system will be described; (3) actors and their type of relationship with the public service will be identified; (4) possible solution of one of problem will be described and its impact to the actors will be identified.

Tasks will be realized by using systems thinking and SoS approach.

Research results and discussion

1. Short history

Since 1970s, public administration was criticized as ineffective and inflexible to new challenges. (Osborne, 2006), (Göçöğlu, 2021). At that time introduction of NPM approach in the public administration (PA) was a remedy against the lack of flexibility and transparency. The main idea of NPM was transferring the management approach from private sector to the PA including entrepreneurial leadership, formation of the service agencies, emphasis on inputs and outputs control, defining public services and disaggregating them to most basic units, contracts for resource allocation and service delivery within public services. (Osborne, 2006), (Göçöğlu, 2021).

The NPM was criticized for its intra-organizational focus and adherence to the application of out-dated private sector techniques to public policy implementation and public services delivery. Later, focus from intra-organisational approach to the public service delivery was moved to inter-organisational relationships and a concept of the New Public Governance (NPG) was proposed as a new tool with potential to assist understanding complexity of the challenges of the provision of the public services (Osborne, 2010).

Development of the information and communication technologies (ICT) provides an impact on methods of interacting with citizens and other service users and public administration. Implementation of ICT solutions and particularly e-services, raised cognitive, behavioural, organizational and cultural changes in public administration. Dunleavy et al. denominate this new constellation of ideas and reform changes as "digital era government" (Dunleavy, et al., 2006). However, despite a comprehensive study of public service delivery models, there is no common definition of public service system. It always depends on context and research problem.

2. Public sector and ecosystems

In the recent studies, *M.Petrescu* (Petrescu, 2019), *M.Rantanen et al.* (Rantanen Minna M., 2019), *J.Chen et al* (Chen, et al., 2020) and *Audretsch et al.* (Audretsch, et al., 2019) point to the need for a comprehensive approach for investigating public services and their systems and offer to look at them from an ecosystem perspective.

M.Petrescu (Petrescu, 2019) offers to use concept of ecosystems, centred on integrating actors and resources through systems and institutions for drawing new conceptual avenues for coproduction and value co-creation in public services. Public service ecosystems incorporate a comprehensive view of all the individuals, technologies, and institutions involved in the creation and delivery of value generated through the public system and adjacent private stakeholders.

M.Rantanen at al. (Rantanen Minna M., 2019) defines e-government ecosystem as a socio-technical system that is orchestrated by the government, but which also includes citizens and other user groups such as companies and their representatives. These social systems (citizens, other users, governmental officials and vendors) and technical system (interconnected e-government systems) should be inseparable from each other. Together they form the ecosystem, that is (or at least should be) self-organising in a sense, that the needs of citizens should guide the development of technical systems. It is noteworthy that also governmental officials and software vendors often are also citizens

The describing term of "ecosystem" for explaining non-biological systems can be tracked back to the work by *James F.Moore*, who used the metaphor of an ecosystem to explain the complex and interrelated relationships between different actors in business world (Rantanen Minna M., 2019). *James F.Moore* defined

business ecosystem as "an economic community supported by a foundation of interacting organizations and individuals – the organisms of the business world" (Kaiya, 2018).

James F. Moore (Moore, 2006) emphasizes that the business ecosystem is driven by four interrelated ideas: (1) the concept of business ecosystem itself: collaboration to create a system of complementary capabilities and companies; (2) concept of a "space" for business opportunity as a future domain of business activity that may not exist today, or that exists only in nascent form; (3) the concept of a specific business ecosystem naturally follows from the concept of a space where there will be a number of critical contributions that need to be linked in order for solutions to be produced; (4) the concept of a company as principally defined by its innovation trajectory rather than by its current products, services, and tangible assets. He accentuates that every occupant of a niche is under constant challenge to keep up with others in the ecosystem.

By simply combining public service organizations and business structures involved in their preparation, as well as employees (who are also citizens in the same time), it is not possible to define the requirements for high quality, modern and efficient public services in a single ecosystem because of the following reasons: (1) each party involved in public service production and consuming has its own understanding what the quality and effectiveness of the public service is and those understandings may be diametrically opposed; (2) the parties involved in public service processes are evolving on their own right and are influenced by external factors as well.

Therefore, a more complex approach, which shows the different nature and objectives of the actors in public service system is needed to discover the best ways for improvement of the public services. For this reason, systems thinking and SoS approach could be useful for public service system research.

3. Public service system and its elements

SoS engineering methodologies only recently have been applied to policy analysis and design, even though policy analysis has its roots in systems thinking (Chmieliauskas, et al., 2012). Systems thinking consists of three kinds of things: elements, interconnections and function or purpose (Ross & Wade, 2015). First, let us look at the public service system from the point of view of systems thinking and try to find its elements, interconnections and purpose. According to *M. Rantanen et al.*, citizens, organisations, companies and governmental agencies are key elements of the public service system. Electronic platforms are included into public service system as well thus defining it as socio-technic system (Rantanen Minna M., 2019).

There are two possible approaches to define a system – analytical and real. Studying an analytical system, the observer or researcher determines the boundaries of the system, while in case of a particular system it is assumed that these boundaries objectively exist and it is possible to study the system as it is (2013). If we would like to study the interaction between people, public service organizations and electronic platforms, then platforms can be included in the analytical system as elements of the system. However, it should be borne in mind that the objectives for setting up electronic platforms are determined by organisations that set up and maintain them. Therefore, in this study we will look only at those elements of the system that themselves participate in defining the objectives of the system.

In order to characterize the interaction of elements in the public service system, it is necessary to determine what the public service is. The British use plural concept "public services" which refers to the various services provided to citizens by central government and local authorities like education, health care etc. (CEEP, 2010). To determine the minimum amount of public intervention in the provision of services, *W. Wright* (Wright, 2000) defined four conventional justifications for distinction public and private spheres in service provision: (1) public goods (goods for which it is impossible to deter consumption once they are

produced, for example , defence, clear air etc.); (2) externalities (if the total social costs of creating the product are not included in its price, as with industries that produce significant levels of pollution, then government must intervene to regulate that production or to force the producer to internalize those costs); (3) natural monopolies (like large scale infrastructure objects); (4) inequalities (if market produces significant inequalities among individuals or regions and level of inequality is deemed unacceptable, the public sector must intervene). Those limitations cover a wide range of public services.

Analysing the public and private benefits arising from the state intervention, *A. Laing* has described the spectrum of public services.

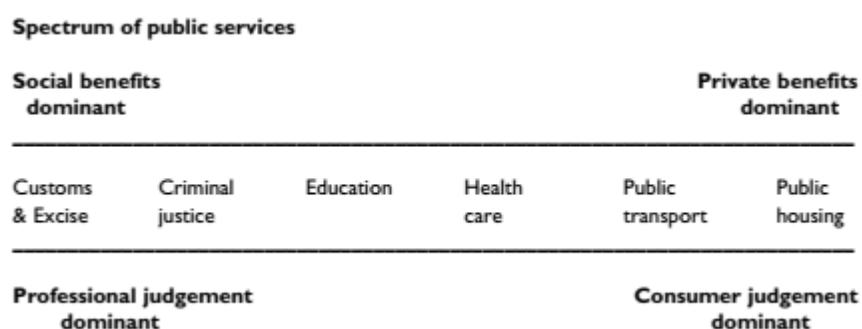


Fig. 1. **Spectrum of public services by A. Laing (2003)**

The logic and the process of public services differ significantly from private sector services. This approach shows that virtually any public function can be translated into service. Despite the similarities in the service delivery, it is possible to point out four main differences between public and private services: (1) for private service firms the retention of customers and their repeat business is the essence of the profitability, but for public services existence of such "repeat business" is like to be a service failure (e.g. repeat visits to the doctor with the same condition or repeated and on-going social work relationships); (2) the reality of unwilling or coerced customers is unfamiliar to the for-profit sector, whilst it is a marked element of public services (e.g. in the prison service or child protection services); (3) for-profit firms are (usually) confident who their (sole) customer is. Public services, however, can often have multiple end-users (and stakeholders), some or all of whom may have different (and often controversial) definitions of a successful outcome of a service; (4) public service users also inhabit the dual role of being both the users of public services and citizens who may have a broader, societal interest, in the outcomes of public services (Osborne, 2018)

In case of a public service, the concept of customer is ambiguous. For example, a prison service for a criminal is a security service to the public. Shifting the focus from outputs to outcomes is denoted by terms such as outcomes management or public value management (Alford & Hughes, 2008) Being citizens and customers in the same time, people become co-producers of the value of the public service. Private value is consumed individually by users, while public value is received collectively by the citizenry, including aspects such as care for the environment, help for the weak and vulnerable, as well as justice (Alford & Hughes, 2008), (Petrescu, 2019), (Rantanen Minna M., 2019).

Application of such service dominant logic (SDL) shifts the focus away from the "performance" as the key metric of public services, and instead articulates "value" and indeed purpose of such services. Besides that, it shifts the locus of public service delivery from linear production processes instigated by the public service provider, which ideally should involve the service user (co-production), and to the way that service users create value by their interactions with the public service organisation and within the wider service system (co-creation) (Osborne, 2018).

From the above, we see that public service is a process in which public administration, public service provider, customer and public participate. However, it is not enough to describe and study the public service system. According to the SDL and then the public service dominant logic, the user is a co-creator of services, and his or her experiences represent the basis of analysis (Osborne, 2018), (Petrescu, 2019).

From the view point of systems thinking, public service is the form of interaction between system elements – people, government, public service organisations and business structures (Rantanen Minna M., 2019).

The question of the purpose of the public service system is more complex than it seems from the first sight. More available public services, better service quality, more effective government are just few of goals mentioned in policy planning documents in all levels of governance and scientific publications. But despite numerous changes within the system, public service system still is considered too expensive and ineffective. *Jan Kooiman* concludes that problem definitions are too simple, policies too static, and audiences too generalized: this might be one of the primary reasons why so many governments do not satisfy governance criteria as stated (Kooiman, 2010), (Overman, 2016), (Dunleavy, et al., 2006).

Without abandoning better public services as a goal of the system, it must be understood that each element of the system (which may be the system itself) has its own goals, the achievement of which affects the perception of efficiency.

It means that we cannot think of the public service system as a whole. Its elements must be considered as independent systems with their own elements and objectives, forming public service system as a SoS.

DiMario notes that the uniform agreement in literature is that a SoS is comprised of cooperative constituent systems, which can be planned and developed intentionally or just occurred naturally (DiMario, 2010).

Another working definition of SoS is "a set or arrangement of systems that results when independent and useful systems are integrated into a larger system that delivers unique capabilities". Both individual systems and SoS are regarded as systems because each consists of parts, relationships, and a "whole" that is greater than the sum of the parts (MITRE, 2014).

4. SoS approach

SoS approach is a set of the tools that allow us to grasp the complexity and experience the extent of policy decisions. *DeLaurentis&Sindi* recommended a three phase SoS engineering approach where SoS problem is defined, abstracted and simulated. The definition phase consists of identifying and characterizing the SoS problem as it currently exists and seeing the problem in its context. The abstraction phase allows us to identify actors, things and relations and gives inputs for the implementation phase. The implementation phase is meant for replicating and simulating the working of the SoS. (Chmieliauskas, et al., 2012).

We can look at the public service system as an ecosystem in which public services are formed as a result of certain processes. However, looking deeper, we see that various actors are involved in the service processes, who belong to the different systems and who already perform the necessary processes for realisation of their goals, and the public service may not be the main goal for them. Public service as a process is the result of the interaction of different actors and systems. This result is something more than a single actor could achieve in solving a specific problem.

To illustrate the application of SoS in public service research, let's choose very common example and follow the above mentioned three phase SoS engineering and systems thinking approach to investigate the process.

The following steps were done to investigate the case and discover the content of the public service system: (1) identify an issue (problem) of general interest that service solves and describe the context, including all stakeholders; (2) describe stakeholders (actors) as separate systems that have objectives in the face of service process and identify nature of interconnection between service process and actor; (3) discover the result get from this interconnection by each actor.

Considering that the aim of this study is to test the suitability of the SoS approach for describing and investigating public service system and to find out what new dimensions this method can provide, let's limit ourselves to qualitative research. In order to provide modelling and quantify the impact of different changes on public service and its stakeholders, it would be necessary to define variables and their indicators. The development of such models can be a subject of separate study. However, the systems thinking method and SoS approach can also give good results in a qualitative study.

5. Case-study

For the case study, let's choose a service that is encountered by every motorist who enters in the city. The case study will be based on the analysis of the regulations governing paid parking in Riga city in the period from 2000 until the present day. In addition, Riga City Development plan and information from the participation platform www.manabalss.lv will be used for the analysis.

Paid parking is a service that clearly demonstrates the public and private benefits of the public service. The private beneficiaries of this service are motorists, while the public beneficiaries are all those who enjoy an organized urban environment that is convenient for living and attractive for business.

Latvian Law portal www.likumi.lv offers the regulation from 2000 as the oldest car parking legislation in Riga city, which provided that: parking could be paid for with coins or payment cards; the municipality authorizes a manager who is responsible for the management of the car parks (Riga Municipality Capital Company "*Rīgas satiksme*" was appointed manager as it was stated in the later versions of the regulation); the payment was confirmed by a ticket issued by the payment machine, in which the car number was not fixed; for non-payment, the car was fitted with a wheel lock, which was removed only after payment; residents whose place of residence was on the street directly to the parking lot received a permanent parking permit free of charge (Rīgas dome, 2000). Paid parking and corresponding legal framework in Riga existed before 2000, but a period of more than 20 years is enough to observe the evolution of this public service with the development of ICT.

Next version of the regulation for parking in Riga city was adopted in 2005, stipulated that payments can be made not only in coins and with payment cards, but also by sending SMS indicating the car's registration number. The use of SMS service meant "debiting funds from the user's electronic money account". From this moment we see that not only the parking lot manager and the payment card operator, but also the SMS service operator are involved in the public service process. In addition, these regulations show a tendency to pay more attention to traffic problems, and residents living closer to the city centre have to pay for a permanent parking permit (Rīgas dome, 2005). The regulation shows the efforts of the Riga municipality to balance the interests of the residents, business and drivers, because regulations are often updated by setting different fees for parking in different parts of the city and changing regulations for residents parking permits.

In 2014, the parking payment service reached a qualitatively new level, because at that time legal regulation for mobile application usage for the parking fee payment was introduced (Rīgas dome, 2013). All these changes required a technological and a legal basis. This meant both the development of web services and applications and the conclusion of appropriate agreements between the actors involved.

In turn, the medium-term planning documents of Riga city show that the local government's interests include: an increase in the number of cars (not desirable), the creation of the safe urban environment (including pedestrians and cyclists) and combating air pollution (Rīgas dome, 2005).

In turn, the interests of the residents of the city change dynamically depending on the decisions made by the municipality. The wishes of the residents include preservation of parking lots (Egle, 2020), protection of the interests of residents living right next to the parking lot, creation or, on the contrary, elimination of cycle lines (Pilsēta cilvēkiem, 2017) etc.

The evolution of the public service over the time shows the attraction of new partners to the municipality, the introduction of ICT solutions to improve the service and the formation of new business ecosystems.

The business structure that will be entrusted with the administration of the fees can be expected to create a business ecosystem together with ICT and financial service providers. Such business ecosystem will consider the customer to be a part of their ecosystem. Business ecosystem will include actors around parking place and fee management, but other societal needs will be beyond its sphere of interest.

The type of interaction in this particular service is easy to classify: if a decision is made on behalf of a public authority (for example, to issue parking permissions for residents), an administrative relationship is established; if an agreement is reached between parties involved in the service process, a contractual relationship is established (payment for parking is also considered as a contract), but society as a whole is connected with the service by belonging to a certain territory through institution of citizenship or other type of registration which shows the connection of the society with specific territory.

The introduction of paid parking will change the relationship between the elements of this public service system. Depending on the decisions made by municipality, parking spaces will be more accessible to either motorists or residents and business owners. It can determine the future development trends of area as well as policies related to urban traffic.

The technical performance of the service can range from staffing, which charges for parking, to modern mobile application solutions. It should be borne in mind that the use of ICT will in addition create a flow of data that can be stored in companies involved in the provision of services and further possibly used to improve the service.

This service has several quality metrics depending on the point of view select for evaluation. In the sense of private services, price, availability of parking places and convenient payment options can be the criteria. Administrative and maintenance costs are also relatively easy to estimate and evaluate. Other criteria relating to environmental accessibility, air quality, impact to the business activity or real estate value will depend on the objectives set by each actor.

To move to the simulation phase, all elements of the public service ecosystem need to be identified and their interests understood. Following the system thinking algorithm, let's identify actors, goals, relations. Regulatory framework, city planning documents and information from participatory platform allow us to define the actors of the public service system, describe their goals and the way they interact.

Table 1

Actors, their goals, results and nature of the interaction within of the public service

Actor/system	Needs/goals	Nature of interconnection with the service process	Result
Residents	Affordable parking places, good traffic, clear and secure environment, accessible infrastructure	Permanent parking permission (administrative relation or contract)	Service (possibly restricted), data shared
Business owners	Good accessibility to the business premises	Permanent parking permission (administrative relation or contract)	Service for the business clients, data shared
Car drivers	Good traffic, available, affordable parking	Contract	Service, data shared
Municipality	Tax incomes, lower administrative costs, secure environment, satisfied citizens. Achieving planned goals regarding climate, clear air, accessible environment etc.	Administrative relations with residents and business, contract with service provider	Managed and controlled process
Society	Secure environment, clear air, good traffic, accessible services	Citizenship or other belonging mechanism	Managed and predictable environment
Service providers	Profit, service development, dominance in market	Contract	Business and data

The definition of a public service system will be different for each party involved. For the municipality, it will be both specific administrative procedure for the creation of parking lots (legally and in nature) and their exploitation, as well as long term policy and spatial planning documents for the realization of wide spectrum interests of the whole society. In the first case, the purpose of the public service system will be aimed at creating of the private value, in the second – on public value.

For the direct service providers, it will be a set of ICT solutions, staff, agreements and procedures which can be understood as socio-technical system according to *M.Rantanen et al.* (Rantanen Minna M., 2019).

The most challenging task will be the assessment of the public interest, which might be controversial. For example, drivers need a place for traffic and parking places, which is not possible in the same place and time. Cyclists compete with drivers for this place. Pedestrians often share the place with cyclists etc. In such cases, discussions and communication between individuals, interest groups and government are essential to find most acceptable solution that is unlikely to be ideal for everyone.

Conclusions

The aim of this study was to test the suitability of the SoS approach for describing and investigating public service system and to find out what new dimensions this method can provide.

The results of the study show that a comprehensive approach to the analysis of public service using the SoS approach and system thinking allows us to gain a new perspective to this service. The case study shows that there is more than one private beneficiary in the case of public service. The private beneficiary is both the driver who has a parking space and the entrepreneur (in fact, the business ecosystem, as financial and ICT service providers, if used, must also be taken into account) who participates in the provision of the service and makes profit. The case study shows the potential of the SoS approach for investigating public services or even groups of services.

- 1) The basis of the public service is the process that derives from the functions of the public authority and provides both individual and public value and, taking in to account public value, cannot be managed from single centre.
- 2) Public service framework (system) can be explained as a set of elements (systems) aimed at acting in the interests of the society and the individual at the same time. In the case of the conflict between the interests of society and the individual, there is a strong possibility that some of the parties involved in the system will be more satisfied than others.
- 3) The identification of all actors involved in the public service process provides in-depth understanding of the diversity of interests that determine an actor's assessment of public administration's work. It means that in order to express an opinion on the efficiency (or inefficiency) of the system, the position of the party on whose behalf that opinion is expressed must always be considered. The public administration must be able to strike a balance between the service process, the public good and the interests of the parties involved.
- 4) Changes in the service process may mean the creation of new roles (for example, an entrepreneur becomes a partner of the municipality), and it means new actor with specific interests and connections in the public service system framework. The specific links that emerge between public administrations, their partners from the private sector and the recipient of the service provide additional added value – data that can be used for in-depth analysis of the service and for improving certain aspects of it.
- 5) Possible further research directions may relate to the combined application of SoS and organizational theory methods, which would help describe the elements of the system and reveal their interactions. The question is whether the public service system will always be an ecosystem (or simply a system), which in the case of public service system may differ depending on the actor on whose behalf the system is analysed.

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