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# Application of an Interdisciplinary Approach to the Implementation of Projects to Create a Comfortable Environment for Human Life

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## Abstract

In modern conditions of globalization and urbanization, the development of territories is reaching a qualitatively new level associated with the mainstreaming of digital technologies in the human environment. Nowadays, we understand the development of the territory as comprehensive improvement of systems and infrastructures in order to increase the comfort, quality and safety of life of the population. An interdisciplinary approach plays a key role in the development of territories, since the successful implementation of such projects requires the involvement of specialists from different fields to develop an integrated solution that meets the needs of the population to the possible extent. The article explains the relevance of applying an interdisciplinary approach to the development of territories, analyzes the world experience of interdisciplinary interaction in solving problems of creating a comfortable environment for human life. It considers the existing approaches of interdisciplinary interaction in the development of territories within the framework of concepts such as "smart city" and "programmable city", and also reveals the problems of the development of territories that can be solved through the application of an interdisciplinary approach. As a result of work the principles of interdisciplinary interaction in the implementation of projects for the development of territories were developed. The ways to solve existing problems in the field of the development of territories within the framework of applying an interdisciplinary approach were proposed.

**Keywords:** Territorial development, Interdisciplinary approach, "Smart city", Digital technologies, Urbanization

## 1 Introduction

Currently, territorial development processes, including urbanization, are integral to the gradual spread of digital technologies that transform the human environment. According to experts, in 1950, 30% of the world population lived in cities, in 2018 - already 55%, and by 2050 this indicator is projected to grow to 70% [1]. Right now 27 largest megacities consume 9% of all world electricity, while creating 13% of household waste in the world [2]. Accordingly, such a concentration of the population and the flows of goods and services within the cities will lead to the transformation of the human environment, and even more advanced technologies will constantly be required to maintain the sustainability of the city's life support systems. Currently, such a concept as a "smart city" is being increasingly discussed, which generally means the development of territories through the use of digital technologies in order to improve the quality of life of the population and ensure sustainable economic growth. The concept of "smart city" implies changes in all spheres of life - from education to utilities and public administration [3]. However, the territory should be an integral structure, therefore it is critical to integrate all the information collected to further comprehensive analysis. It is the application of an interdisciplinary approach that allows the interaction of various urban structures to be established, which leads to the most justified and effective development of the territory in the context of urbanization and the global growth of information flows.

## 2 Literature review

The scientific community recognizes that the analysis of the process of development of territories in the context of urbanization and digital transformation of the human environment requires a comprehensive approach based primarily on interdisciplinary interaction. In the most global sense, solutions in the field of the development of the human environment are understood as one of the directions of spatially oriented modeling [4]. It is also believed that in the coming decades it will be necessary to study more deeply the mutual influence of societies and energy consumption systems on each other, which is associated with an increase in both production volumes and direct energy consumption by the population [5, 6]. Moreover, scientists analyzed the types of urban processes in terms of their rate of change under the influence of digital technologies [7, 8]: the slowest transformation occurs in the processes of transport and

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communal infrastructures, which is associated with the need to replace obsolete physical objects with more advanced ones; slightly faster changes are possible in the processes of creating housing and non-residential buildings, since the cycle of design and construction of facilities is long; relatively rapid changes in employment are possible, and even more rapid transformations in mobility flows of goods and population. It should be noted that information is not always distinguished as a separate category of urban processes, since this concept is already implied in the composition of modern information and communication technologies [9, 10].

Since the end of the 20th century, considerable attention has been paid to such a concept as a “smart city”, through the creation of which the development of the human environment is supposed, and so far this approach has become one of the main directions of urban development [11], which is expressed in the ideas of transnational dissemination of the concept “Smart city” [12, 13]. On the one hand, it is said that all megacities and cities will gradually come to the concept of “smart cities”, which will lead not only to technical updating of systems, but also to profound socio-political transformations associated with the widespread adoption of technologies and the subsequent data collection [14, 15]. One of the main elements of the “smart city” is digital platforms, through which the interaction of subjects of socio-economic relations is ensured. That contributes to the development of territories by attracting financial and labor resources, tangible and intangible assets [16]. On the other hand, the importance of a critical attitude to this concept and the possibility of choosing alternative solutions is noted [17].

The development of an interdisciplinary approach is one of the sources for harmonization of comfortable living environment. As it mentioned previously, the development of territories is considered in conjunction with social changes, which cannot be realized without the interaction of specialists from various fields of knowledge. Early studies substantiated the importance of an interdisciplinary approach to the food supply of urban populations in developing countries, which highlighted such traditional approaches as historical, demographic, economic, sociological, geographical, urban planning, logistics and legal [18]. The application of an interdisciplinary approach to the development of territories is usually considered from the point of combining such areas of knowledge as urban planning, mathematical modeling, the philosophy of pragmatism [19], data coding, etc. It also allows deeper consideration of various aspects of the interaction of previously isolated areas, which is reflected in the framework of territorial development projects based on the introduction of digital technologies.

## 3 Methods

Currently, territorial development processes are considered from various points of view basing on the application of an interdisciplinary approach. So, there are already studies integrating social sciences, neurobiology and psychiatry in order to study the urban problems of the modern world. Scientists concluded that, compared to the residents of suburban areas, urban residents have an anxiety rate of 21% higher, the level of disturbances in their emotional state is 39% higher, and schizophrenia is 2 times more common [20]. Such an application of an interdisciplinary approach will make it possible to more effectively solve public health problems by developing approaches to the management of urbanization processes at the state level. Another area of interdisciplinary interaction is an attempt to apply the results of archaeological research to solve the problems of territorial development. The systematization of the theory of urbanism is inextricably linked with ancient civilizations and cities. Modern archeology pays increasing attention to the territorial growth of ancient cities, the reasons for the emergence of "informal housing" not controlled by the ruling elites (as, for example, in the Mexican city of Teotihuacan, in which the so-called "right to the city" existed) [21]. Such a combination of archeology and urbanism allows not only a better understanding of history, but also creates the basis for the most complete understanding of the processes of territorial development in the modern world. If you look at the problems closer to people's lives, then an interdisciplinary approach is also crucial for developing solutions to address them. Forest fires in Australia cause irreparable environmental damage, lead to the death of residents, the natural world, animals, so scientists conducted a study to assess the risk of fires in Victoria in Australia. As a result, it was determined that the application of an interdisciplinary approach is critical to reducing fire losses, since the occurrence and spread of fire is affected by physical, meteorological factors, human behavior, and construction technology, and urban planning can play a key role in maintaining housing [22]. It is important that modern experts in risk assessment, land use planning, environmentalists, firefighters, etc. should understand the importance of an interdisciplinary approach and be able to work in the conditions of its application.

As a result of another research, it was found that the development of territories implies the improvement of relations between such categories as population, localities, traditions and cultural values, which is expressed in an interdisciplinary examination by specialists of buildings, the environment and landscape of the territory [23]. Using the example of Fujian Region in China the ways of transforming the city of XibinZhen were proposed and optimally integrated into the landscape of the riverine territory, taking into account the existing agricultural approaches in the area [23]. In this project, it was proved that it is an interdisciplinary approach that allows developing territories taking into account many factors, including architecture, socio-cultural traditions and customs, territorial zoning and environmental conservation tasks. Also one of the innovations in territorial development based on interdisciplinary interaction is the emergence of dashboards - platforms on which citizens, organizations and government officials can see key performance indicators of the city in real time and analyze these evidence to make their own decisions. In Dublin, as part of the Programmable City project, a similar initiative was implemented - the Dublin Dashboard portal, which graphically combines information from city authorities, statistical agencies, including the European Union, and other organizations [24]. In the UK, there is also a similar platform, launched in London in 2012, which visually combines data on weather, air quality, transport communication and traffic, local news, data from cameras and sensors installed in the city, and also shows the “happiness index” and “influence analysis ”based on information from social networks [24]. Thus, the interdisciplinary approach has established itself as an effective method of interaction between specialists in various fields of knowledge in the implementation of territorial development complex projects. Currently, the scientific community more and more pays

attention to correlation between the capabilities of digital technologies and the effects of their implementation in the human environment, which determines the need for further interdisciplinary study of the processes of territorial development.

## 4 Results

Territory development is a process of multidimensional improvement of the living environment, which includes tasks from various fields of knowledge. In general, the territory can be represented as a system of integrated elements, consisting of a set of activities, needs and restrictions, flows and stocks of goods and services, as well as impact factors (Figure. 1).

The flows and stocks of goods and services can be quantified, such as, for example, energy (kW), road traffic (cars/h), water consumption (l/day), assets (rubles, dollars, etc.), materials (tons). They may be less prone to measurement (intangible assets such as information and human capital). By stocks is meant a quantity at a certain point in time, and by flows is a quantity arriving or, conversely, coming from stocks per unit of time. So, the number of cars in the population is the stock, and the flow is the number of cars on the way from point A to point B for a certain hour, taking into account the capacity of the road network. Electricity is an exceptional case and, as a rule, it is initially a stream, since the reserves of resources in the form of liquid or solid fuel are not stored for a long period of time or are purchased in small volumes for private consumption. Also, some flows and stocks are extremely volatile (information), while land resources in terms of permitted use categories and housing stock require a long period of time to change them. The flows and stocks of goods and services exist in conjunction with the types of activities implemented on the territory. Activities can be economic (including education and employment), political, social (food, cleaning, childcare), etc. The mobility of the population, tangible and intangible benefits can act as a separate type of activity, as well as a stage preceding the above types of activity. Activities are usually assigned to a specific space and time. Needs and restrictions are the causes of a particular activity, and they can be both individual and dictated by society. An example is the initial desire of people to have a personal vehicle as a status element, which has become a necessity over the time, as some territories are planned so that transportation becomes uncomfortable and takes a lot of time than going by personal car [25].

The last element of concerned system is the factors that influence all of the above, including socio-cultural (norms and values), economic (phases of the economic cycle), political, demographic, environmental (climate change and resource reserves), etc. Note that one of the factors influencing the development of territories is urbanization. Currently, urbanization is no longer considered by scientists separately, since the processes of territorial development have gone beyond the traditional concepts of urban growth and the influx of population from rural areas. Now, with the development of territories, the main goals are the harmonization of flows within and outside the city and the improvement of comfort, quality and safety of life, which cannot be realized without an interdisciplinary approach. Scientific and technical progress does not stand still, and increasingly complex tasks for the development of territories can no longer be solved solely on the basis of the interaction of specialists in local disparate projects. Now, the scope of the consideration of the territory development process should not be limited to the city, as the mobility of the population is growing, the flows of tangible and intangible benefits are becoming more complicated, new ways of interacting the population with government bodies on the basis of electronic portals appear, tools for managing systems in the field of communal infrastructure are developing, etc. In recent years, the scientific community has been paying close attention to software as such, its essence and content, in particular codes - the core of all digital technologies [26, 27, 28]. The result of combining the achievements of scientific and technological progress and the process of territorial development is the concept of a “programmable city”, the key idea of which is to study the relationship of digital technologies (software) and city systems (the city) using codes (Figure 2).

It was found that, on the one hand, the processes taking place in the city are translated into a code representation. Information about residents and the environment is collected through digital systems and sensors, brought to the most optimal way of storage and presentation, aggregated in data centers to further analysis. Therefore, the developers of software related to the solution of economic, political, social problems form the basis on which managers will rely when making decisions at the city level, therefore, interdisciplinary interaction is critically important. Moreover, the territories themselves largely determine the processes of software development and become growth promoting factors of the frequency of applying the interdisciplinary approach. Silicon Valley in the USA, Boston, New York, Toronto, Singapore, London, Berlin and some others are the world centers where digital technologies specialists are concentrated. The features of these territories are the availability of venture capital, tax remissions, as well as the high degree of digitalization of these cities, which the authorities are trying to only increase. On the other hand, software codes change the city operation. Collecting big data allows you to analyze a huge amount of information previously scattered across various systems. Now, with the help of digital technologies, it has become possible to automatically combine information from many sources, and hence the development of new, previously unobvious solutions at an interdisciplinary level. Even today, territorial management is based on information systematically collected for various categories of economic entities, which has largely changed the life processes of cities. Moreover, digital technologies have changed the way they work: it is already impossible to imagine a workplace that is not equipped with one or another software. Currently, territorial development models suggest the possibility of unification of technological solutions in order to transfer them to other situations. Separate agglomerations create their own strategies for the development of territories, “road maps” in certain areas, such as energy conservation and environmental conservation [30]. As a rule, capitals become the standard of digital transformation, their practice is transferred to other cities of the country. Moreover, the possibility of transnational exchange of experience in the development of territories is not denied.

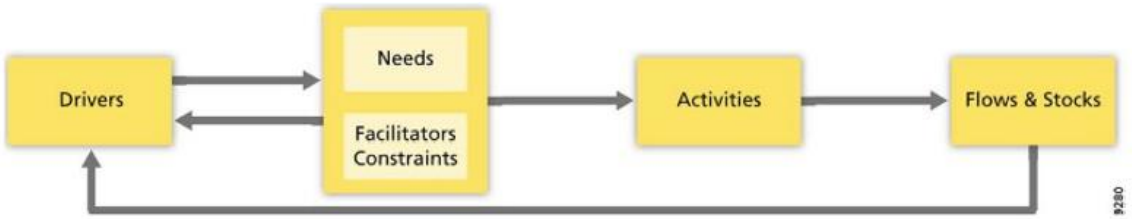


Figure. 1: Typical scheme of the territory general mechanisms [25]

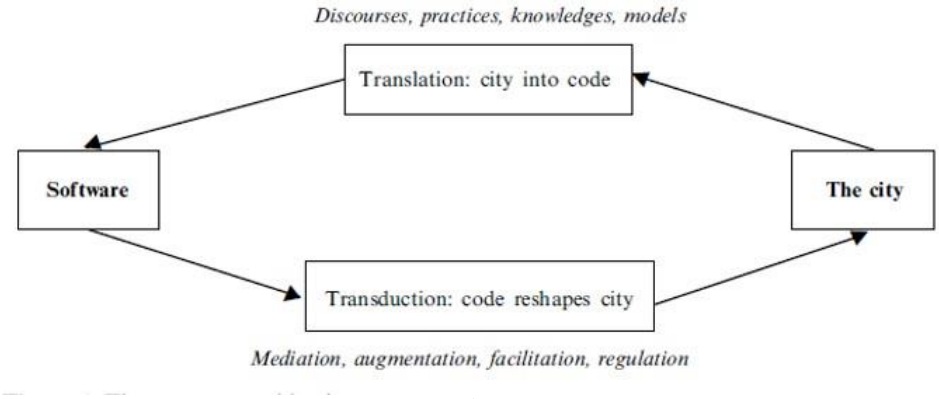


Figure. 2: The concept of "programmable city" [29]

Therefore, the development of general principles for the implementation of such projects on the basis of an interdisciplinary approach is becoming an important area of activity in the field of territorial development. Among the basic principles of interdisciplinary interaction in the implementation of projects for the development of territories, one can single out:

1. Standardization of the conceptual apparatus, which allows to increase the degree of interdisciplinary interaction between different participants due to a better understanding of the project by all specialists.
2. Unification of data management processes taking into account information security requirements, since in modern conditions information can be stolen and used for criminal purposes, which is especially important in the development of territories affecting the population and infrastructure.
3. Interdisciplinarity of the involved specialists. To work on interdisciplinary projects, it is necessary to have working skills not only in your professional field, but also to have an idea of related fields of knowledge and work on multi-level processes.
4. Openness and mutually beneficial cooperation of the state with private institutions is highly important because, as a rule, it is commercial organizations that generate new technologies.
5. The principle of taking into account the historical context of the territory allows selecting the most effective measures for the development of a specific territory within the framework of the usual way of life of the population.
6. The principle of maximum awareness that consists in collecting the best world practices for the development of territories and choosing the most suitable for a particular situation.
7. Social involvement of citizens in the implementation of territorial development projects, based on the involvement of the population through public hearings and voting.
8. The multidimensional nature of the consideration of the territory implies the development of several strategies for the development of the territory, taking into account as many factors as possible influencing the project, and choosing the one that most closely corresponds to the opinion of all participants in interdisciplinary interaction.
9. Focus on the search for hidden, unobvious development opportunities, as well as on taking into account the interests of all participants in interdisciplinary interaction is important.
10. It is necessary to count the continuous interconnections between different systems in order to anticipate the possible consequences of their influence on each other.
11. A systematic analysis of existing systems and infrastructures is necessary to improve them not only in the sphere in which they are already used, but also for the implementation of more complex tasks of an interdisciplinary nature.
12. Efficiency of interaction. The implementation of interdisciplinary projects is based on many factors, therefore, indicators should be developed for the effectiveness of the development of the territory, interconnected and integrated into the general system of indicators of the project, quickly responding to any changes in the project.

Thus, the development of an interdisciplinary approach to the development of territories in the context of the digital transformation of all spheres of human activity basing on the achievements of scientific and technological progress is becoming one of the key areas for improving a significant set of areas of knowledge - from urban design, mathematical modeling and programming to neurobiology and sociology.

## 5 Discussion

Modern approaches to the development of territories are gradually being transformed from the methods of selective and incomplete analysis of data to the systematic collection and integration of many previously disparate information based on the use of controllers, sensors, cameras, GPS, etc. Now, real-time data are aggregated in centralized control centers, intelligent transport systems, logistics flow management systems, as well as in more local models for building operation, including BIM (Building Information Modeling) [31, 32]. Moreover, the distribution of smartphones and the Internet has made it possible to collect data on the location of users and their activity [33]. For a a total, such an increase in the volume, scope and degree of detail of the collected data on processes occurring in the territory is called datification [34]. Currently, the main sources of information for interdisciplinary interaction in the framework of territorial development are [33]:

- utilities (water, electricity, gas);
- urban transport enterprises collecting information on the intensity of flows and traffic;
- mobile operators and the Internet (Internet traffic, activity and movement);
- social networks (public opinion and personal information posted in the public domain);
- crowdsourcing (OpenStreetMap, Wikipedia, Wunderground);
- government agencies and their digital platforms (surveys, actions, frequently used services);
- information from financial institutions and distribution networks (consumption of goods and services);
- first responders services (crime, accidents);
- “Smart” household appliances and systems (consumption and human behavior).

In Russia, by 2024 it is planned to complete the implementation of the Smart City project, which involves the introduction of a digital platform for engaging citizens in addressing the issues of urban development "Active Citizen". This platform also assumes the development of existing systems in the field of urban development, the introduction of a model of the territorial scheme of waste management, the creation of intelligent centers city administration with a single dispatching service, equipping buildings with automated systems for accounting for communal resources, disseminating energy conservation practices, developing transport control systems (photo and video recording), introducing biometric identification systems to improve public safety [35]. Nevertheless, it must be understood that in the context of digitalization of the life of the population, there is growing collection of information about which we do not even suspect. The interests of residents are now studied on the basis of activity on social networks such as Twitter, Instagram, Facebook, etc., it is even possible to identify criminal actions using profiling. In general, the very essence of the big data concept suggests that the data is not used for the purpose for which it was originally transmitted. One of the solutions to the problem of losing information confidentiality is anonymization, that is, the exclusion of personal information about the user of systems and applications [36]. Moreover, the study of urban development processes based on social networks and mobile applications is not an ideal method for obtaining objective results, since the sample is often unrepresentative. In Europe, attempts have already been made to analyze the well-being of the population using Twitter data, but the main consumers of medical services are people over 65, of which only 4% use this service [37].

Thus, the development of an interdisciplinary approach will make it possible to more comprehensively evaluate the information received from various systems, which will become the basis for the development of territories in the intensity of data flows on the functioning of the infrastructure and on the population of the territory. It is also necessary to take into account that all the information that is aggregated for the purpose of developing the territory is not completely objective, since the format of its presentation to users is set by developers who act under the influence of subjective factors. It is an active interdisciplinary interaction based on the experience and knowledge of various specialists that will allow us to identify errors in the selection of estimated data. Another problem that stands in the way of territorial development is insufficient compliance with ethical aspects when collecting information, as often data is transmitted without anonymization or the user is not notified about the collection of information. The application of an interdisciplinary approach will make it possible to evaluate the processes for the development of territories not only from the point of urban planning and the technical aspects of the technologies being introduced, but to allow taking into account other, including social, factors influencing the development of territories.

## 6 Conclusion

In conclusion, it is worth noting that the scientific community and the public did not come to a consensus on the concepts of territorial development, which are based on the ideas of digital transformation, integration and data analysis. In connection with urbanization, transport, logistics and information flows are becoming more complicated, the demand for resources is growing, which increases the existing environmental problems. In general, to solve the above-mentioned problems, the tasks are set at this stage of scientific and technological progress. However, digital technologies should be organically integrated into the everyday life of the population, which cannot be solved solely as seen by the approaches of technical specialists. The application of an interdisciplinary approach is one of the main directions for improving modern concepts of territorial development. Going beyond the sectoral thinking will allow generating new opportunities for multilateral optimization of urban systems. It is within the framework of an interdisciplinary approach we can determine the interconnection of various systems and infrastructures and identify problem areas of territorial development projects, that are not obvious when considering indicators only from narrowly focused specialists. Currently, the development of territories based on digital technologies is a global practice, therefore it is important to develop a theoretical basis for an integrated and interdisciplinary approach to decision making, which can be applied in various projects with a common goal - improving the quality, comfort and safety of life.

## Competing interests

The authors declare that there is no any conflict of interest that would prejudice the impartiality of this scientific work.

## Ethical issue

Author aware of, and comply with, best practice in publication ethics specifically with regard to authorship (avoidance of guest authorship), dual submission, manipulation of figures, competing interests and compliance with policies on research ethics. Author adhere to publication requirements that submitted work is origin.

## Authors' contribution

All authors of this study have a complete contribution for data collection, data analyses and manuscript writing.

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