Models of Social Research in the Development of Digital Infrastructure

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Abstract

This study provides a literature review of research on social research models and describes their role in transforming digital processes, analyzing the features of the current stage of development of digital platforms and platform tools. The authors focus on digital platforms for research and development. Based on the literature review, the paper identifies the elements of the digital social research infrastructure, types of models of the digital social research infrastructure, and the main tools of these models. The development of the digital infrastructure for social research is a hot topic today as digitalization simplifies many social research management processes. As a result, the following types of models of the digital infrastructure of social research were identified: integrated system, application programming interface, virtual research environment, metadata, and lack of infrastructure.

Keywords. Digitalization, Digital Technologies, Social Research Model, Digital Platform
JEL codes: O32, M29

1 Introduction

Today, the global digital space is influenced by major technological innovations and the accumulated data sets they have created (integrated social networks) that companies like Apple, Google, Facebook, Amazon have at their disposal. On the one hand, LIFO (last in - first out) data structure or stack technologies offer scientists great empirical and analytical opportunities. On the other hand, such technologies reduce the amount of research using traditional social studies. This, in turn, leads to an inevitable process where standard social research is replaced with new social media methods.

It is useful to understand the concepts of technological innovation used in the digital space. For example, technological innovations in digital communications embodied in the shift from the information web (Web 1.0) to the interactive web (Web 2.0) present new opportunities and challenges for

social research. The development of Web 2.0 and the high accessibility of the World Wide Web through portable and widespread devices are contributing to the generation of new forms of data, new methods for analyzing this type of data, and new services (Edwards et al., 2013). The difference between Web 1.0 and Web 2.0 is that the second one contains more interactivity and content for users, being a modern version of the Internet. Users actively use Web 2.0 to exchange information on the network. Active participation in the network by Internet users is the main difference compared to the previous version, since in the past users could only consume information. According to researcher Allan (Allan, 2009) there should be web portals with web services to provide a whole infrastructure for researchers that includes all academic disciplines. This virtual research environment in the form of portals should use Web 2.0 technology (O'Reilly, 2005), social media solutions (Wang, Carley, Zeng & Mao, 2007) and provide a virtual research environment for searching big data, indexing and posting papers. The appearance of this term dates back to 1999, with the transition of the Internet to the creation of content and interaction with Internet users. Websites for publishing information, social networks, web applications such as Instagram, Vkontakte, Facebook, Twitter and others began to appear. According to research by scientists, the scientific environment is becoming a networked, global environment, which has been confirmed by research on patterns of scientific collaboration and science (Smith et al., 2011). This trend has called for a research environment where scientists can share their research, have access to software and access to data, access to resources through the use of a web browser. There are the following types of different environments: science gateways (Wilkins-Diehr, 2007), virtual research environments (Carusi & Reimer, 2010), collaborative labs (Wulf, 1993), inhabited information spaces (Snowdon, Churchill, & Frécon, 2004) and digital libraries (Candela et al., 2011). Cyberinfrastructures (Cyberinfrastructure Council, 2007) and e-Infrastructures (e-Infrastructure Reflection Group, 2010) implement these environments. These frameworks implement services ranging from access to portals with resources in repositories, to access to management systems with more advanced services provided. Also, the use of these resources, the availability of access on demand, and the economy are in line with cloud computing (Foster et al., 2008) and grid computing (Foster & Kesselman, 1998).

Digital social research focuses on the application of digital technologies to social science research. They encompass quantitative and qualitative approaches, including new data sources, automatic information mining techniques, social network analysis, digital collaboration tools, etc. (Spiro, 2014; Zhuravleva, 2015; Morana et al., 2014).

In this context, each of these models of social research is valuable at the national and international levels: access to data allows for comparative

research and improving the quality of scientific work in general. Therefore, it is very important to explore tools, approaches, and models of social research and service activities in the context of the digitalization of the economy. In order to facilitate it, digital social research platforms have been created in many countries of the world, which help researchers in finding and working with the necessary information. In some cases, data and information can be found on these digital resources, and sometimes information from government sources.

The adaptation of digital infrastructure, virtual research tools, and cyber tools in social research is one of the directions of e-social science (Morana et al., 2014). It encompasses not only the informatization of various research activities, the digitalization of libraries and archives but also the creation of unified research infrastructures existing only in the virtual space of the Internet (Aschauer, 1989). There exist the following standard methods and text services as Canonical (Blackwell & Smith, 2019), EpiDoc (Cayless et al., 2009)

These services are used to solve epigraphic and textual problems. Researchers are also creating digital workflows covering different functional categories, e.g. Perseus (Crane, 2022).

Today, digital platforms are of great importance in digital transformation (Gössling and Michael Hall, 2019; Idowu and Elbanna, 2020; Kiesling, 2020). Digital platforms have changed interactions on the Internet, communication on the network (Instagram, Whatsapp, Twitter, Facebook), including making online food purchases (Glovo, Volt, Alibaba, Amazon, eBay) online taxi calling (Uber, Yandex), mobile banking, resource use and online entry to medicine (Damumed, polyclinic sites, Airbnb), purchase of goods and services (Apple pay, Alipay, Paypal), research and development activities (ResearchGate, Google Academy, Sci-Hub, Scopus, Web of Science, EPIC) and so on. The development of digital platforms has an impact on innovation and innovation activities. For example, the authors Myrick and Jeppesen (Myrick & Jeppesen, 2020) found that property rights affect major innovations in digital platforms. Also, researchers (Hein et al., 2019) confirmed this phenomenon in their study of Internet of Things B2B platforms.

Facebook has been assessed as an entity that considers the interests of society in the digital space by researchers (Nooren et al., 2018). Facebook's revenue is delivered by advertising as one of its revenue models. Facebook has potential network effects, with over 1.9 billion users, influencing the platform's innovation activities.

The impact of digital platforms on students and researchers in education is also significant, affecting aspects such as access to information and knowledge, socialisation, collaboration, career plans. Basically, the

application of digital platforms in education and research affects the dynamics of socialisation, access to information and learning. Thus, the transmission of knowledge and information in educational institutions has undergone great changes (Miño et al., 2019). However, the implementation of these changes does not consider the possible risks to the mental and physical health of students and researchers. There are also cybersecurity risks that need to be investigated.

Digital platforms make it possible to effectively solve problems in various subject areas, be useful both for business and civil society and for the scientific community, primarily for the formation of research competencies. Therefore, it is very important to understand the concept of digital infrastructure for social research, investigate modern models, and develop recommendations for adapting their experience to the conditions of Kazakhstan.

2 Literature review

Since the late 1980s, the issue of the impact of infrastructure assets and infrastructure on economic systems began to be vigorously discussed in the scientific community.

So, in 1989, David Aschauer's work was published on the relationship between the volume of state expenditure for the period 1945-1985 and the total productivity of the United States economy. According to Aschauer's research, it was concluded that a unit of social capital pays off through productivity growth in about a year. The author analyzed the slowdown in productivity growth due to the slowdown in infrastructure investment (Aschauer, 1989).

However, A. Munnell believes that there are no specifically substantiated cause-and-effect relationships that have been established in Aschauer's work. Investments made in public infrastructure have a positive impact on growth and output, Munnell believes (Munnell, 1992).

The use of information and communication technologies, servers, local networks, and the spread of broadband Internet are digital infrastructure assets. How broadband Internet affects economic growth has been discussed in the works of Waverman and Roller, Agarwal and Datta, Gillet, Crandall, Jamison and Holt and others. The works of scientists such as Castaldo, Nipo, Bagchi, Pradhan, Mallik, Niebel paid attention to the influence of information and communication technologies on the improvement of economic systems.

With the increasing availability of data and the growth of interdisciplinary research on a global scale, a digital social research infrastructure based on advanced GRID technologies which provide access to large-scale, complex, heterogeneous, and widely distributed data repositories, as well as the means for their high-speed computation and scientific

collaboration-is developing. However, technically powerful GRID technologies do not always offer appropriate solutions to the needs of researchers and can sometimes be difficult to implement in practice. In most cases, therefore, social sciences use Web 2.0 technology-based solutions for their research purposes. They provide user-friendly services through simple protocols and web-based user interfaces. Web 2.0 provides flexible solutions for researchers to provide advanced computational tools and services, increasing public participation in the development of research resources (Popova, 2015).

Conducting social research involves the formation of specialized research infrastructure and software associated with the emergence of new methods, approaches, information technologies, models, and others. The peculiarity of social sciences in the digital environment is the close relationship with the humanities, as there are common techniques, services, tools, projects, and electronic cooperation (Wessels & Craglia, 2007). There are five models of the digital infrastructure of social research: 1) virtual research environment; 2) integrated system; 3) metadata; 4) application programming interface; 5) lack of infrastructure (Zhuravleva, 2015).

Models define the interfaces, roles, communities, and relationships present. Based on the identification of commonalities between the models, it is possible to form cross-sectoral collaboration and implement interfaces of data, information, and knowledge (Kemman, 2018). The Virtual Research Environment model does not target a few scientists, but rather a large group of scientists. This model is appropriate for large infrastructure projects. This model includes procedures for providing access to certain resources, research management, data analysis and use, publication of scientists' research, intellectual property protection (Priddy et al., 2016). The TTO is the system for transmitting the technical and scientific results and deals with licensing and patenting (Ulanin, 2017). A virtual research environment is a digital environment, which is created at the request of the community and provides data according to the requirements of the community with the protection of intellectual property rights, in particular copyrights (Kireyeva et al., 2020). The advantage of the model is that it is user-friendly, and scientists are given the ability to search for information. The disadvantage is that it is expensive, as not all information is available, it has to be purchased.

The "integrated system" model implies an infrastructure with a set of data, tools, and analysis. This model includes architecture, using database and application servers; aimed at working in computing networks (Candela et al., 2013). The "interface" model is becoming the most popular among scholars conducting social research, as today the use of digital technology and web portals can provide surveys and questionnaires. This model is a set of functions, structures, procedures in a form understandable to the IT

professionals (Boikov et al., 2010). The metadata model is based on describing publications, objects, or assets, contributing to the usefulness of the data. There is an application programming interface (API), which is a set of ready-made functions, procedures, constants, classes and structures to facilitate the creation of user program modules in the solution and execution of production tasks. For example, there are social research metadata schemes such as ISO 19115, ISAD, DC, and others (Kamnev, 2016). The next model is to research without a defined infrastructure, only with a set of data and tools.

This approach is not expensive because it does not need funding. It is basically up to the developers to decide on the specifics of what tools and data to create. The disadvantage of this approach is that it is not always possible to quickly discover the tools. Essentially, these tools may not be understood by scientists, which makes it difficult for them to position themselves, as different tools may be needed for different research problems (Gomez et al., 2016).

Based on the literature review, the digital infrastructure of social research is understood as a set of conglomerates of researchers, diverse in composition and structure, and the necessary tools, approaches, and data that are based in the Internet space and are actively used for conducting social research.

3 Methodology

The methodological basis of the study was based on the results of scientific publications, achievements of global economic science on the formation and development of social research models in the digital infrastructure. To identify models of social research in digital infrastructure, it is important to analyze the literature review of this area of knowledge.

In this study, system-structural and functional approaches were used in working with the literature review. The methods of systematization and synthesis of information were also used.

In Figure 1, the visualization of the main elements of the digital social research infrastructure was suggested.
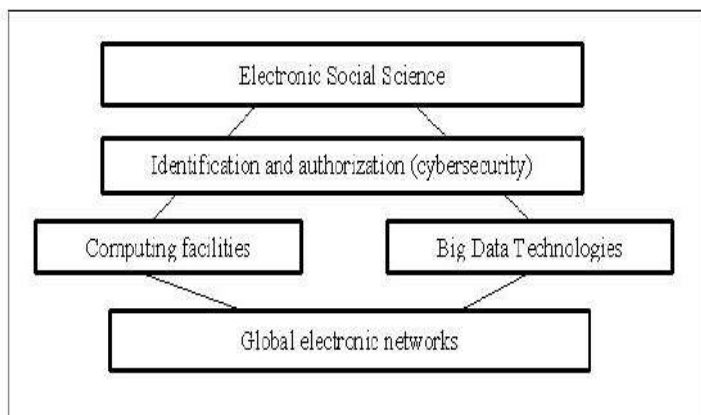
Figure 1. Elements of a digital infrastructure
of social research

The social research model is a self-developing network of technological systems, technical devices, intelligent models, software, communication practices, databases for the efficient production, distribution, and exchange of scientific data and new knowledge in a distributed digital environment.

In doing so, it encompasses a variety of entities, from individual initiatives to global communities. Models of social research in the digital infrastructure were considered and their basic specifics were given. The paper presents tables with the elements of the digital infrastructure of social research and with the models of the digital infrastructure of social research, compiled according to the above-mentioned sources. The elements of social research digital infrastructure include global electronic networks, computing tools, big data technologies, identification and authorization, electronic social science.

4 Results and Discussion

The specific nature of social research determines the complexity of creating specialized software and research infrastructure. This is due to the accelerated emergence of new mathematical methods, models, approaches, as well as new information technologies, which in turn affect social research methods. The peculiarity of social sciences development in the networked digital environment is determined by close interconnection with digital humanities at the level of common tools, techniques, services, as well as e-collaboration and common projects.

Table 1 shows the models and tools of the digital social research infrastructure.

Table 1 - Models of digital social research infrastructure

Type	Data	Tools	Benefits	Restriction
Integrated system	Centralized	Centralized	Specificity	Rare stability
Virtual research environment	Distributed	Centralized	User-friendliness, search capability	High cost, generality
Application programming interface	Centralized	Distributed	Specificity, stability	Inconvenience for the user
Metadata	Distributed	Distributed	Cheapness, specificity	Lateness
Lack of infrastructure	Distributed	Distributed	Cheapness, specificity	Lack of search capability
Note - compiled from the source [18]				

The social research model represents an integrated system approach in which infrastructure is created that contains both a data set or several consistent data sets, as well as related tools for their study and analysis. Five models of social research in the development of digital infrastructure are identified.

Similar models for researchers in finding and working with the necessary information are being developed not only in Europe but also in the USA, China, South Korea, Japan, etc. Generally, researchers are interested in the patterns generated by the aggregate interactions of online users, which allows for a deeper use of social network analysis to support management decisions.

Digital platforms were classified according to various parameters in the form of five blocks. These categories were identified where we conducted a thorough analysis and detailed description. Thus, the main models of social research in the context of the development of digital infrastructure were considered. Each model consists of a minimal set of unifying concepts and relations in the field of social research. At the same time, there is no single model of the digital infrastructure of social research. The models discussed above are not unified, some of them integrate with the existing physical infrastructure. The choice of a particular model is determined by various factors: the tasks to be solved, efficiency, cost, ease of use, personal preferences of the scientist, etc.

5 Conclusion

The rapid development of digital technologies is an integral part of the social environment, becoming a new means of communication. In turn, the development of social research models, the emergence of new information processing methods and tools, leads to the need to optimize information and knowledge management to prevent information loss, as well as to support geographically dispersed research teams and the possibility of remote working.

Based on the literature review, the digital social research infrastructure is understood as a set of conglomerates of researchers, diverse in composition and structure, who are based in the Internet space and actively used for social research. The study considers various research studies dedicated to the analysis of models of social platforms and related events based on big data arrays. They reflect research methods, techniques, and algorithms, enabling researchers to implement them to solve problems.

So, we can distinguish the following types of social research digital infrastructure models as an integrated system, application programming interface, virtual research environment, metadata, and lack of infrastructure. In addition, as can be seen from the above, digital platforms are divided based on different measurements. This highlights the multidimensional nature of digital platforms and the need to take this diversity into account when studying digital platforms of social research. Therefore, future research on digital social platforms should consider the nuances of different types of platforms when classifying, analyzing, and summarizing the results of their research.

The development of social research digital infrastructure models is not only taking place in Europe but also in Asian countries, the USA, and others. Social research methods can now be conducted online using social media. In accordance with the experience of using digital social research, digital research should be complemented with traditional research. The application of digital infrastructure in social research greatly expands the opportunities for scholars in education, experience, and so on. Through the emergence of virtual activities that are linked to research projects and the functioning of various schools of thought, networks of researchers are formed in which contemporary information is exchanged between researchers, efforts and resources are pooled.

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