

Measuring the Social Impact of Digital Services: A Case of St. Petersburg, Russia

Radomir Bolgov ^{a,b*}, Olga Filatova ^b, Daniil Volkovskii ^c

^a Saint Petersburg State University, Russia, rbolgov@yandex.ru

^b ITMO University, Russia.

^c Université Paris 1 Panthéon-Sorbonne, Paris, France.

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Abstract. The paper presents the results of using automated tools to study the dissemination of information in media, social networks and instant messengers, as well as the comments to mobile applications, allowing to search for information by keywords. The cases analysed are the Unified Ecosystem of Urban Services "Digital Petersburg" and its flagship application "I Live Here", as well as the mobile application "Unified Card of St. Petersburg Resident" as part of a study on the social impact of digital services. The data obtained indicate on low awareness of citizens about digital public services. At the same time, we can talk about the high demand among citizens for the "Unified Card of St. Petersburg Resident" service, where, unlike the first case, there is active feedback from the authorities and work to eliminate the shortcomings of the service.

Keywords. Digital Services, Social Networks, Messengers, Mobile Applications, Social Impact, User Satisfaction.

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1. Introduction

Currently, many governments are actively developing portals, public accounts in social networks and instant messengers, as well as digital services for interaction with citizens. But how to evaluate the impact of such interaction? We made an attempt to contribute answering this question. We reveal the fragments of a research project which aims to contribute to the measuring the social impact of digital urban services based on the case of St. Petersburg, Russia. For this purpose, a corresponding empirical base is collected using different research methods. In addition, digital services and their social impact are studied in conjunction with a specific local context, which differs, as expected, depending on the administrative level. We use the capabilities of a new automated tool that allows, based on user comments, to identify the demand for digital services by city residents using the cases of the digital services ecosystem "Digital Petersburg" (and its flagship project "I Live Here"), as well as the mobile application "Unified Card of St. Petersburg Resident". The study allows us to understand the reasons and motivation on the part of both city authorities and users.

Since urban digital services are provided to citizens by government, the process of using services can be considered as network interactions ranked according to the principle of satisfying citizens' needs for a specific service. Several studies (Alawneh et al., 2013; Kitsios et al., 2019; Horan & Abhichandani, 2006) developed the frameworks for evaluating citizen satisfaction with digital services. The studies a focus on specific fields (for instance, health) and countries (for instance, Jordan and Greece). Kitsios et al. (2019) applied the MUSA (Multicriteria Satisfaction Analysis) method to assess the users' satisfaction with an e-appointment system in Greece. Alawneh et al. (2013) conducted a survey of 400 employees in four universities of Jordan and identified five factors (security and privacy, trust, accessibility, awareness of public services, and quality of public services) that may affect the Jordanians' satisfaction with e-government. Novak, Hoffman & Yung (2003), Tang & Wang (2004) and Reynolds (2011) used usability/ease of use to measure electronic customer satisfaction. To summarize, it can be noted once again that the social impact of digital services (electronic interaction between citizens and authorities) is an indicator of

satisfaction with the services provided, in the form of a social resource of citizens (time, efforts, new communication opportunities, etc.) and a social resource of authorities (trust).

2. Research Case 1: Ecosystem of Urban Services "Digital Petersburg"

The unified ecosystem of city services "Digital Petersburg" (ECS) was launched on the initiative of the Government of St. Petersburg in December 2021. ECS is a model for providing digital services or services aggregated on a unified Internet platform (<https://petersburg.ru/mainPortal/services>). The mini-application "I Live Here", implemented on the VKontakte (VK, Russian online social media based in Saint Petersburg) platform, is the flagship project of "Digital Petersburg", launched in December 2022. The developers position the mini-application as the most useful project for users, so the conducted study is focused more on the analysis of the mini-application "I Live Here". In essence, the mini-application is an adapted catalogue of the portal's services for VKontakte users. In general, the ecosystem of urban services seems to be an innovative solution for creating and maintaining a sustainable urban environment, which can be scaled to other regions (Minaev et al., 2023).

However, as our previous research has shown (Filatova et al., 2024), not all services created by the authorities are in demand by citizens and only a small part of St. Petersburg residents access the ecosystem, although almost three years have passed since the launch of the ecosystem.

A series of focus groups conducted as part of the project showed that the use of digital services depends on two main factors: perceived quality of the service and awareness of it. Perceived quality is influenced by several external variables: how people perceive the security and privacy of a service; the discrepancy between supply and demand in terms of what is offered and what people are looking for; and the quality of the content, which includes web design and the quality of the information provided. However, as a very important reason, citizens named the poor awareness about the application "I live here" and the created ecosystem as an obstacle to the growth of the ecosystem. Therefore, as part of the research, we tested a tool for studying the dissemination of information in the media, social networks, instant messengers and mobile apps, which in the future can help in developing strategies for promoting new services.

3. Pilot Testing of an Automated Tool for Studying the Dissemination of Information in Social Networks and Instant Messengers

For the pilot testing of the new tool, the task was to collect all publications in the media and posts in social networks and instant messengers for six months that contain the phrases "ecosystem of urban services" and the separate service "I live here". Next, it was analysed how users discuss these topics in social networks and instant messengers and how information is disseminated.

The stages of the study included several key steps. At the initial stage, the analytical service "Medialogy" was used to collect data, which allowed collecting all messages and publications that contained the phrases "I live here" and "Ecosystem of city services" from various sources, such as media, social networks and instant messengers. These data were accumulated and stored in a database for subsequent analysis. Based on the collected data, topic modelling was carried out using machine learning algorithms such as LDA (Latent Dirichlet Allocation) to identify the main topics and sentiments in the discussions. The topic modelling stage allowed identifying key topics related to the use of the "I live here" service, determining positive, negative and neutral user sentiments, and detecting the trends in the discussions. The final stage of the study was a comparative analysis of data collected from social networks and messengers.

The messages were collected for the period from February 1, 2024 to May 1, 2024. The database for the query "I live here" consisted of 17,691 posts and 9,935 comments. However, this is too common a phrase, so the words "service", "application" and others were added to identify comments on the topic of the application. As a result, 3,820 thematic posts and 115 comments on the topic were identified. For the query "ecosystem of urban services", 928 posts and only 5 comments were found.

Table 1 presents the results of topic modelling performed using the LDA (Latent Dirichlet Allocation) algorithm to analyse the corpus of comments containing mentions of the "I Live Here" service. LDA is a machine learning method for topic modelling that allows to automatically detect hidden topics in texts. The main principle of the method is that each document is considered as a mixture of several topics, and each topic is represented by a set of words associated with certain probabilities.

The algorithm identified four key topics in the analysed dataset (Table 1). The topic 2 contains mostly general words that do not carry a specific information load. Topics 1, 3, and 4 include more subject groups of words related to various aspects of the service. The first topic concerns issues related to energy resource management and news about power outages, the third topic concerns issues related to kindergartens and the provision of services through

the public services portal, and the fourth topic concerns the availability of preschool institutions for children in different age groups and areas.

Overall, the analysis showed that, with some exceptions, no residents discuss the topic of urban digital services provided by the city government. Thus, only five key news items were identified over the six months, which were initially released by the government of St. Petersburg, and then these same news items were verbatim posted a large number of times in various government public pages, mainly in the accounts of schools, kindergartens, and housing agencies. Comments on them are extremely rare and almost always with zero engagement.

Table 1. Results of topic modelling

No.	Topics
1	water, follow, energy resources, news, development, group, service, being developed, notifications, shutdowns
2	I live, application, service, residents, month, meaning, unfortunately, pick up
3	kindergarten, portal, translation, online, carried out, course, reception, submit, public services
4	children, available, level, places, areas, age, availability, preschool, age, present

4. Research Case 2: Mobile Application "Unified Card of St. Petersburg Resident"

To conduct the study, a parser program was created that allowed to automatically collect all reviews for the period 2019-2024 from the Google Play Market platform related to the mobile application "Unified Card of St. Petersburg Resident" (Russian abbreviation: EKP). As a result, more than 600 reviews were collected, which contained both text data and user ratings (grades). The analysis included several stages: collecting data from the platform, preprocessing the text array, classifying reviews and topic modelling using the LDA (Latent Dirichlet Allocation) method.

To prepare the data before applying LDA, they were pre-processed to improve the quality of the analysis. At this stage, the texts were "cleaned", including the removal of punctuation, numbers and extra spaces, as well as conversion to a single lower case. Stop words that do not have a semantic value were excluded, and lemmatization was carried out, allowing words to be converted to basic grammatical forms.

The next step was to implement the topic modelling procedure using LDA. The algorithm, trained on the prepared text data, identified a specified number of topics. The key topics related to the functionality of the application, the quality of its implementation, the convenience of the interface, and the desired expansion of functionality by users were identified (Table 2).

Table 2. Results of user comments topic modelling

No.	Topics
1	card, travel, code, enter, ekp, in general, get, metro, excellent, application
2	cards, balance, top up, application, metro, application, world, extremely, idea, developers
3	applications, balance, ekp, application, metro, money, top up, application, cards, activate
4	application, stop, works, sheet, card, convenient, support, map, entrance, transport
5	application, fit, metro, ekp, googl, pay, opens, password, updates, upd
6	works, application, record, updates, application, applications, enter, balance, confirmed, travel card
7	in general, application, cards, opportunity, pin, enter, travel card, stopped, constantly, top up
8	useless, card, password, impossible, map, application, works, internet, get, bank
9	card, application, cards, fingerprint, data, writes, transport, metro, podorozhnik, balance
10	works, application, writes, application, cards, impossible, top up, activation, useless, card

The overall analysis shows that the main concerns of users are related to technical problems, balance management, and functionality in the context of transport. User comments contain a lot of useful information for improving the application. Figure 1 shows that this mobile application was evaluated in more than half of cases as "1" (369 out of 638), the lowest grade on a 5-point scale.

Authorities' responses (Table 3) to user feedback focus on several key aspects: Technical troubleshooting; Feedback and

support; New features and expanded capabilities; Security and Access.

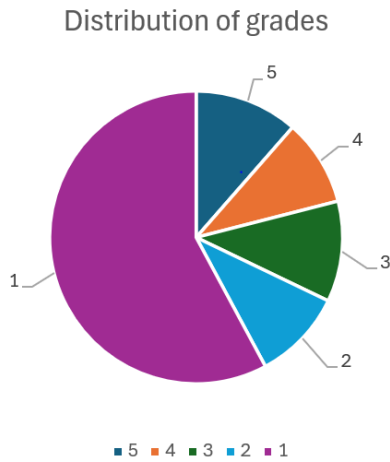


Fig. 1. Distribution of grades

Table 3. Results of authorities’ responses topic modelling

No.	Topics
1	moment, application, ekp, evaluate, additional, inclusion, we plan, is, informational, in nature
2	technical, absent, independent, reasons, electronic, unfortunately, wallet, replenishment, possibility, application
3	apologies, we bring, inconvenience, eliminated, temporary, technical, pay, real, moment, will appear
4	should, application, clarify, errors, could, incident, payment, ekp, I ask, be sure
5	version, form, feedback, understand, model, indicating, we ask, review, error
6	authorization, service, support, ekp, application, mobile, contact, site, go through, public services
7	find out, store, incentives, application, project, surveys, news, service, you can, participate
8	pin, login, code, code, configure, cards, qr, you can, system, come up with
9	application, continue, work, useful, increase, number, functions, soon, problem, googl
10	pay, payment, add, vtb, ekp, rustor, available, first, samsung, mir

The general trend shows that authorities are actively working to improve the technical component of the application, its functionality and interaction with users, especially in terms of security and stability. There are also changes in feedback from the EKP: in 2019 about 10-15% of comments remained unanswered, but after 2022 all comments began to be answered. This indicates increased attention to user opinions and the readiness to improve the service.

5. Conclusion

The St. Petersburg government is campaigning to promote the city services ecosystem, and in particular the mini-application “I Live Here”, but users still rarely use it. Citizens say that there is a lack of necessary information about the digital ecosystem, and also point out the lack of interactive functions for providing feedback. There are noticeable problems with the web design, navigation and search in the mini-application. The citizens are concerned about security and privacy issues. In fact, citizens are practically unaware of the “I Live Here” services and the product has no value for users yet. At the same time, we can talk about the high demand among citizens for the “Unified Card of St. Petersburg Resident”, where, unlike the first case, there is active feedback from the authorities and work to eliminate the shortcomings of the service.

The further research will be related to identifying the reasons for the widespread use of non-governmental digital channels by citizens and the low use of government digital services, as well as a comparative analysis of data characterizing the behaviour of citizens with indicators of offline user activity.

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