Co-creating Digital Services for Citizens: Activity Theory Analysis

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Abstract: Smart city development relies heavily on creation of digital services that are available for the citizens and for the city authorities. At best, these services are co-created by the authorities, citizens and the digital solution supplier companies. Digital service co-creation is, however, a complex process and includes several contradictions due to presence of several stakeholders. In this paper, we present a case study of smart city initiated digital service co-creation process through the analytical lenses of activity theory.

1 INTRODUCTION

In the development of smart cities there is a movement from top-down focus on city-planning and resource utilization towards opening of data and increased opportunities for citizens to be drivers and the target of urban innovation (Cook et al. 2015). Moreover, citizens are even invited to act as the co-creators of new kinds of services relying on digital solutions. When citizens are involved in the digital solution development, the amount of key stakeholders in the process increases, including heterogeneous group of citizens, varying amount of community authorities and the software development professionals from digital solution provider companies.

In this paper, we present an explorative, empirical case study of co-creation process of digital services in the context of smart city. The aim of the study is to explore the potential contradictions that may arise in co-creation process between several stakeholders that enter to the process with varying competences, needs and views. To better grasp the contradictions, we use activity theory as our analytical lenses.

This position paper presents early phases of an ongoing research project that studies digital governance and digital service creation in Finland. Results of the study provide initial insights for better understanding of the complexity of co-creation of digital services.

2 ACTIVITY THEORY AS THEORETICAL LENSES

Activity theory distinguishes between temporary, goal-directed actions, and durable, object-oriented activity systems (Figure 1, based on Engeström (2000). 'Activity' has a broader meaning than 'action' or 'operation' (consider an ice hockey game as an activity and hitting a puck as an action, for example). In this case, the activity is the co-creation of a new digital service for citizens. In activity theory terminology, the concept of activity means linking events to the contexts within where they occur (Blackler, 1999). The process of creation, use, and utilization of knowledge in networked organizations is not a spontaneous phenomenon (Vartiainen et al., 2011). Socio-cultural historical activity theory implies that there must always be a triggering action, such as the conflictual questioning of the existing standard practice in the system, to generate expansive learning (Engeström 2000). In this study, the co-creation of a new digital service could be considered as the triggering action. Expansive learning produces culturally new patterns of activity, and the object of

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the learning activity is the entire system (i.e., the new digital service) in which the actors (i.e., the project members and stakeholders) are working (Engeström 2001). Figure 1 below illustrates the systemic structure and components of collective activity.

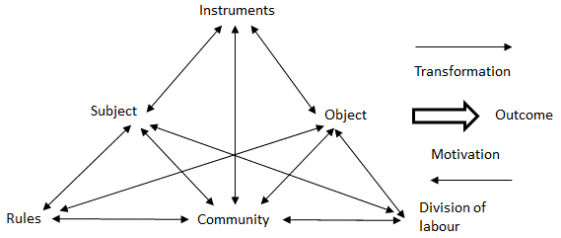

Figure 1: Systems of collective activity adapted from Engeström (2000).

In Figure 1, activity is described as a set of six interdependent elements, which are elaborated in more detail in Table 1.

Table 1: Activity theory key concepts (Engeström 1987, 1999).

Instruments/tools	The artifacts or concepts used by subjects to accomplish the task.
Subject	A person or a group engaged in the activities.
Object	The objective of the activity system as a whole.
Community	Social context and all the people involved.
Division of labor	The balance of activities among different people and artifacts in the system.
Rules	The guidelines and code for activities and behavior in the system

This study adopts the idea that the problem with management decision making often lies in the assumption that change from current circumstances towards desired circumstances are only possible, when the incentive to learn and to create new knowledge are given from above (Engeström 2000). Enabling and supporting knowledge sharing is required to generate new knowledge in networked organizations, but simultaneously there must be willingness to make use of bottom-up generated knowledge. Activity theory acknowledges that in activity systems there exists a wider community of stakeholders that bring their own perspectives, views and culture on the system (Mervyn et al. 2014). Therefore, it is important to understand not only the service providers (city) and users (citizens) perspective, but rather the perspectives of all subjects that are engaged in the activities of the activity system.

In case of a digital service for citizens, there is either an external or an internal need for learning in the entire activity system (e.g., a new digital service development project). The external triggering action may be a value conflict with stakeholders, for example. Internal triggering action could be, for instance, the product owner's lack of experience, or conflict within the project organization (e.g., personal chemistry).

Engeström (2000) suggests that the motivation to learn is embedded in the connection between the outcome and the object of the activity. The object of the collective activity (e.g., the project plan and sprint plan) is transferred to the practical outcome (e.g., an information system) (Figure 1). Achieving practical results through this transformation creates the motivation to change. It could be argued that there is a need for modeling action patterns in order to ensure knowledge diffusion in the activity system of the project.

3 EMPIRICAL STUDY

3.1 Research Methodology

An empirical study was carried out in smart city region called Hämeenlinna in South Finland with qualitative research methods. Semistructured individual interviewing was the most commonly used method of data collection (King & Horrocks, 2010) and this method was particularly useful for exploring the complex case of co-creating digital service as it offered rich views on the real-life occasions. Altogether 16 interviews were carried out. These consisted of interviews with the project management office representing the community authorities, the digital transformation company responsible for service design and software development of OmaOlo, software developers from HAMK University of Applied Science that were responsible for development of Hämeenlinna in pocket smartphone application, and the service providers. Among the service providers, two social and healthcare professionals were interviewed representing Hämeenlinna city. These respondents represented different pilot sites for the implementation of the new digital government service (OmaOlo).

Activity theory lenses were used in analysing the empirical data.

3.2 Case Study

In 2017 the City of Hämeenlinna made a strategic decision to provide all the municipal services for citizens in digital form by 2020, requiring rapid progress in practically all areas of smart city development. As part of this strategic goal, the City decided to design and create a smartphone application that provides citizens with the most commonly used digital services and a platform for digital participation.

A development project was set up and named "Hämeenlinna in pocket", which was carried out jointly by the City and Häme University of Applied Sciences (HAMK) (Kunttu, 2019). Development of the Hämeenlinna in pocket smartphone application was initially based on the use of the Open City Application platform, which provided a framework for software development of the application. In the first version of the application, launched in March 2019, the following features were included.

Table 2: Hämeenlinna in pocket application features (Kunttu, 2019, Kukkamäki et al., 2019).

Application feature	**Description**
Events	The application provides the user with a list of general and public events taking place in Hämeenlinna, including all cultural, educational, and sports related events. The events can be viewed as a chronological list or located on a city map. The mobile application retrieves the event information from an open data based interface that collects all the event information in the Hämeenlinna area.
Topical information and news	The application includes a news channel giving the news, announcements, and information provided by the City. Users have an option to select the information they prefer to receive. The mobile platform can also provide targeted information for citizens based on their own neighborhood. This, in turn, enables collaborative activities and participation at the individual level on matters related to decision making and planning in the citizens' own neighborhood.
Public transportation information	The application contains a route planning tool for public transportation. The user submits the target address and receives a suggested easiest route to the target with bus times. The application also reports possible delays or changes in the public transportation system.
Digital library card	The application enables the user to take out a digital library card, which replaces the traditional loan card used in public libraries. The user can install the digital card in the application by logging into the library system through an interface. The user can then use the digital card by showing the barcode from the screen of the mobile phone to the library's user interface
My health platform (Oma olo)	Through the application interface, the user has access to the digital health portal provided by the City. The portal provides a variety of instructions for self diagnosis and care, and also access to consultation with a nurse.
Schedules for free-time sports activities (Liikuntalukkari)	The application provides weekly schedules of the free-time after-school sports activities for school-age children organized by the City.
Care-time allocations for nurseries	Through the application interface, parents of small children can book their weekly care-times in nurseries.
Feedback channel	The user can send feedback, questions, or comments to the City authorities through the application. The system classifies the feedback and sends it to the appropriate City authority for further analysis and actions. The user can link the feedback to location information. This is particularly helpful when users report, e.g., faults or problems in their living environment.
Digital participation tool	The application includes a digital participation tool that allows users to participate in decision making and planning, as part of municipal governance.'

During development of the application it was realized that the Open City Skeleton developed in 6aika (2018) project had outdated components and, for example, did not meet the user interface requirements set for Hämeenlinna in pocket smartphone application. Therefore, Hämeenlinna in pocket was mostly developed from scratch. Nevertheless, the Open City Skeleton served as a useful model in building the application. The main

menu of Hämeenlinna in pocket application and the Omaolo application menu is introduced in Figure 2.

3.3 Activity Theory Analysis of OmaOlo Platform

We chose the OmaOlo feature development into closer look through the activity theory lenses. OmaOlo feature co-creation happened as part of a larger, nationwide digital governance project called ODA.

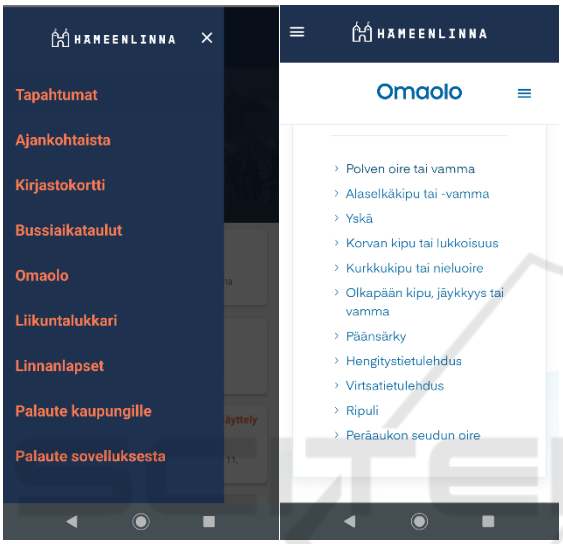

Figure 2: Hämeenlinna in pocket smartphone application main menu and OmaOlo application.

Key stakeholders include a project office whose role was to carefully test and validate by medical professionals the developed application, the citizens that are the application users, digital service provider company responsible for the development of the digital government service, a non-governmental organization responsible for the development of the knowledge base and algorithms for evidence-based decision support service providing accurate recommendations based on the information that the citizen inputs into the system, and service providers that provide the citizens with social welfare and healthcare services. Thus, in terms of activity theory, there were several subjects participating in the co-creation activity system. In following figure 3 the activity system and its identified elements in the case is presented.

The biggest challenge in the co-creation activity system was related to project scheduling. According to the interviewees, the schedule for the development tasks for the service provider should be available about 6 to 8 weeks in advance. Development activities were mostly done in addition to other duties (e.g., consulting hours), which indicates that development tasks had to be scheduled in the shift plan. Schedule delays or missing schedules may result in situations where there are no personnel available to test versions of the digital service, or to give the necessary feedback. In some pilots, dedicated personnel were disappointed because the development work did not proceed as scheduled, and they could not participate later on. Consequently, some pilot members had difficulties in recruiting personnel to test versions of the digital service. Some pilot members expected the testing schedule from the project office, and reported disappointment when no such a schedule was delivered. The interviewees pointed out that the pilot members received quite extensive tasks and requests to comment on different aspects of the digital service at short notice, but the professionals did not have the time or competence to contribute (e.g., doctors were asked to give opinions about technical aspects of the service). Some interviewees considered the progress of the project to be extremely slow.

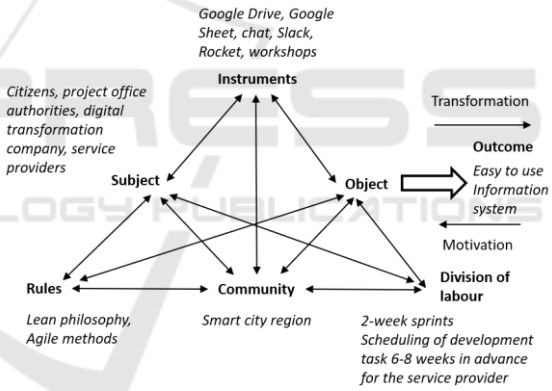

Figure 3: Co-creation activity system.

Communication posed another identified set of challenges in the co-creation process. According to the interviewees, there was a lack of information regarding the overall process of the project. Many interviewees pointed out that although comments were requested at short notice, no one knew how the information was utilized and contributed to the development work. In some pilots, healthcare professionals could not test the service as planned, because of delays and/or problems in technical development that the service providers were not informed of. In addition, communication challenges between different professional groups were identified; professionals in social and healthcare services had difficulties understanding the technical

developers and vice versa. Communication occurred mainly via digital channels, and some interviewees would have preferred face-to-face communication to avoid misunderstandings. The project utilizes various digital communication channels (e.g., chat, Google Sheet, Slack, Rocket), which increased the confusion among pilot members.

The overall structure of the development project caused another challenge. The project initially included 38 different pilots altogether, which entailed separate development work and creating a pilot environment for each pilot. Moreover, many pilots concerned similar services or service processes. This was not seen as the most reasonable way of developing the service. It would have been more practical to do the development work in groups of pilots focusing on similar services (e.g., symptom assessment). During the investigation period, the project office did in fact recognize this issue and re-organized the pilots into six groups to facilitate knowledge sharing and improve coordination between the pilots. The interviewees from the service provider also pointed out that the project office coordinated the development work and acted as intermediary between service providers and technical developers in the digital transformation company. However, the interviewees wished for more direct face-to-face communication and co-operation with the technical developers, for example in the form of workshops so as to avoid misunderstandings and delays in the project. Some interviewees were concerned about the role of end-users/citizens in the development work. According to them, citizens should have been engaged more at the beginning of the project in order to map out more carefully the service needs and to assess whether digital services would be able to fulfil those needs in the first place.

4 CONCLUSIONS

Based on the analysis of the empirical study, and presented in activity system terminology, the main contradictions in the co-creation activity system were concentrated on division of labor, object, and instruments/tools.

Division of Labor was perceived as a contradiction by all parties. One central issue was that software was developed in two-week sprints following scrum; however, the service providers needed to know the scheduling of development and testing tasks for its staff 6-8 weeks in advance, which is clearly in contradiction with scrum and agile software development. Another central issue was the fact that several similar pilots were carried out in different cities with minimal coordination and knowledge sharing in between. Grouping the 38 distinct pilots into six groups of pilots (across city boundaries) was one solution to this issue.

Object, especially concerning the project plan and sprint plan, was perceived as contradictory by both the service provider and the digital transformation company. Sprints are time-boxed events, where the work in the Sprint Backlog is not a commitment, but rather a forecast, whereas, in traditional plan-driven software development, the goal is to deliver exactly what was planned within the time promised. When there is a need for the service provider to know the schedule 6-8 weeks in advance, there is an obvious challenge in incorporating agile software development principles.

Instruments were perceived as a contradiction by the service providers, who were somewhat unused to the digital channels and were confused by the role of each tool. This contradiction was not shared by the digital transformation company, or the project office.

The identification of contradictions by activity theory analysis pinpoints issues in co-creation processes that may not necessary be problematic from the point of view of one stakeholder, but that may lead to conflicts, delays, dissatisfaction, or sub-optimal performance in the activity system. Therefore, identification of contradictions and turning them into expansive learning in the activity system is essential in co-creation processes that involve multiple interdependent stakeholders.

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