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STUDYING REQUIREMENTS FOR DESIGNING A VITALITY DATA SHARING PLATFORM FROM A MULTI-STAKEHOLDER PERSPECTIVE

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ABSTRACT

With the proliferation of information communication technologies, increasing amounts of data are available through online platforms. In parallel, we see a growing interest in sharing data and a growing desire to give meaning and understanding to data. Data sharing has great potential to promote people's health and vitality by encouraging collaboration across a variety of parties. Nevertheless, the use of data lags behind due to the lack of consideration of various users' requirements in designing data sharing platforms. Despite the needs of the socio-technical aspect for designing data platforms, studies in this regard are still limited. In this paper, we present our study to understand diverse requirements from stakeholders for the development of a vitality data sharing platform by identifying what kind of data is related to vitality. Semi-structured interviews were conducted with two groups of stakeholders: (i) representatives of organizations involved in vitality (N=8), and (ii) citizens (N=20). From these interviews, we got an insight into the different expectations on such a data platform. Stakeholders require diverse formats of data as well as social discussion features.

Keywords: Vitality data, Data sharing, Multi-stakeholder, Socio-technical system, User study

1. INTRODUCTION

Open data aims to support participation and engagement among multiple parties, such as businesses, agencies, and citizens in order to innovate products, services, and solutions for societal issues (Ruijer et al., 2017; Wessels et al., 2017). This paper presents results of our study aimed at exploring multi-stakeholder perspectives on a data sharing platform and discusses challenges with vitality data. Consequently, our study contributes to providing insights for designing a data platform shared by multiple stakeholders in the domain of vitality.

The concept of vitality has been appealing to researchers in the field of (public) health (Smith & Lloyd, 2006) and physical activity (Guérin, 2012), and health professionals (Ryan & Frederick, 1997). Many scholars address the broad sense of vitality, such as “personal mastery”, ”energy”, ”aliveness”, and “enthusiasm”. Furthermore, vitality is a highly subjective concept, which relates to one’s feelings and emotions, and also consists of phenomenological aspects (Guérin, 2012; Penninx et al., 2000; Ryan & Frederick, 1997). Due to these diverse aspects, defining vitality data remains challenging.

Another challenge for the design of such a platform is the consideration of the socio-technical system. A number of scholars have discussed the lack of access to data platforms, regardless of their availability and the increasing number of data accessible online (Ojo, Porwol, Waqar, Harney, & Zeleti, 2016; Osagie et al., 2017; Ruijer et al., 2017). Osagie et al. (2017) argue that the designs of currently available data platforms are not considering non-technical users such as citizens and civil society organizations.

To help understand requirements posed on such platforms, semi-structured interviews with two groups of stakeholders, the representatives of organizations involved in vitality (N=8) and citizens (N=20), were conducted to address the following overarching research question: What are the requirements for a data-driven platform shared by multiple stakeholders in the case of vitality data? To answer this research question, we explored three sub-questions in these interviews: (i) What kind of data is related to vitality? (ii) What are the stakeholders’ goals and objectives? (iii) Which data is necessary to support stakeholders in achieving their own and mutual goals?

2. VITALITY DATA

2.1. Multi-dimensionality of Vitality

In a study comparing vitality, well-being, and quality of life, Guérin (2012) defines vitality as a “psychological sense of aliveness, enthusiasm or energy”. Including this study, several scholars discuss the phenomenological quality of vitality, which is experienced bodily by individuals (Guérin, 2012; Ryan & Frederick, 1997; Smith & Lloyd, 2006). Arising from the characteristics of phenomenology, physical activity is one of the focuses in vitality. The study by O’Connor and

Puetz (2005) found a positive relationship between chronic physical activity and feelings of energy. Other studies focused on the emotional aspects of vitality (Barbic, Bartlett, & Mayo, 2013; Penninx et al., 2000). Penninx et al. (2000) found positive emotions are the key to reduce the risk of subsequent disabilities and mortality among older disabled women. Those studies confirmed the influence of vitality on our health as well as the relationship of vitality with physical activities and emotions. Furthermore, several scholars addressed that one's vitality is influenced by social contexts (Penninx et al., 2000; Van Steenbergen, Van Dongen, Wendel-Vos, Hildebrandt, & Strijk, 2016). Vitality has a multifactorial nature and is individual (Ryan & Frederick, 1997; Van Steenbergen et al., 2016).

2.2. Multi-stakeholder Perspectives of Vitality Data

Our goal is to design and develop a data platform, referred to as the Data System (DS) in the following, as part of the Vitality Living Lab (VLL) project to promote vitality in a region in Western Europe by the collaboration between businesses, public organizations, research and knowledge institutes. The DS shares vitality data among the project partners and citizens. Therefore, it is necessary to consider the multi-stakeholder perspective on vitality data. In the case of vitality, it has been attracted by many different fields such as Geoscience and Industrial Design. Researches from Geoscience such as Marquet and Miralles-Guasch (2015), have been looking into the relationship between built environments and human activities. In Industrial Design, there is an increase of interest in vitality research with various data-enabled applications for interventions by using user's behavioral data (Ren, Wang, Nast, Ettema, & Brombacher, 2019). As such, the different interests and usages of the term across stakeholders in diverse domains provide further challenges in identifying what kind of data is related to vitality.

3. SOCIO-TECHNICAL ASPECTS OF DATA PLATFORM

3.1. Related studies

The great potential of open data has not yet been unleashed due to the lack of focus on socio-technical systems (Zuiderwijk, Choenni, Meijer, & Sheikh Alibaks, 2012). Osagie et al. (2017) stressed the necessity of consideration for non-technical users with diverse backgrounds on open data platforms. Through the usability study of current open data platforms with various stakeholders, Osagie et al. (2017) found simplicity and understandability are the major barriers for non-technical users. Similarly, the empirical studies by Ojo et al. (2016) found that poor data quality, low relevancy of data, the lack of accessibility, and poor usability reduces the overall quality of data platforms. Ruijer et al. (2017) collected context specific user requirements on open data platforms, which relate to different societal issues to be solved. Their study identified common requirements (communication features to share findings with other users and also contact administrators) – which our findings presented here also confirm – and different requirements (the level and types of collaborations enabled by platforms) across different contexts.

3.2. Context Specific Data Platforms

It is assumed that context specific data platforms are effective to solve particular societal issues and encourage engagement from users. Ruijer et al. (2017) showed that random datasets on open data platforms do not support citizens' engagement. Their studies found the necessity of a context specific approach to data platforms to enhance collaboration among different parties to solve a concrete societal challenge.

There have been context specific data platforms that aimed to solve specific social issues. The following are some examples of where context was beneficial. *Health Data NY* ("Health Data NY," n.d.) has been used for emergency responses to natural disasters, to bring awareness of health related issues, and to make health care information transparent (Martin, Law, Ran, Helbig, & Birkhead, 2017). Crime mappings are a classic example of focusing on specific data and for providing open access to citizens in order to improve neighborhood safety (Wallace, 2009). Agencies in San Francisco developed a data driven platform, *TransBase* ("TransBASE," n.d.), to address the locations and volume of pedestrian collisions, which helped to identify streets that need to be improved and for requesting funding (Kronenberg, Woodward, Dubose, & Weissman, 2015). *SocialGlass* ("SocialGlass," n.d.) supports urban planning and its decision making by combining publicly available data and dynamic social media streams in interactive visualization formats (Bocconi, Bozzon, Psyllidis, Bolivar, & Houben, 2015).

4. DATA GATHERING

4.1. Semi-structured interviews with representatives of organizations involved in vitality

The first set of semi-structured interviews was conducted with the VLL project partners. The eight project partners represented the businesses, the municipality, the research/education institute, and sports organizations involved in the project. Each interview took between one and two hours. We audiotaped and photographed the interview after acquiring consensus from the participants. Interview notes were taken by two interviewers. Throughout the interviews, the researchers addressed the stakeholders' "visions", "concerns", and "feature requirements" on the DS. To explicitly elicit the feature requirements, we used cards showing potential data platform features with graphics representing them in these interviews. Closed card sorting (Whang, 2008) was selected because we expected the stakeholders could engage more if some information was provided a-priori (Eberleh & Hoque, 2011).

4.2. Semi-structured interviews with citizens

The second set of semi-structured interviews was conducted with citizens (N=20), to understand the perception of vitality and the kinds of vitality data that should be integrated into the DS. Convenience sampling was used at a design event "Dutch Design Week" in Eindhoven in 2019, which is visited by a wide variety of people. In the interviews, we asked the participants the following questions: (i) What is vitality?, (ii) What vitality data is required from the DS?, and

(iii) Would you be able to provide any vitality related data to the DS? First, the researcher confirmed with the participants regarding the procedure and the purpose of this interview. Before the second question, the participants were informed about the VLL project and the DS, which we plan to develop. No personal information was collected, neither were photos and audio recordings taken.

5. RESULTS

5.1. Semi-structured interviews with representatives of organizations involved in vitality

Thematic analysis (Anderson et al., 2014) was applied to analyze the data obtained from the semi-structured interviews with the eight project partners. A deductive coding approach was implemented to guide the analysis based on the researchers' theoretical or analytical interests (Anderson et al., 2014). In particular, audio recordings were coded on a sentence by sentence basis based on whether they express *visions* or *concerns* about the DS. Later, a constant comparative method (Boeje, 2002) was applied to organize key phrases within the themes as shown in Table 1.

Table 1: Interview participants' vision and concerns on the DS

Participants	Visions	Concerns
Business 1 Director of an international sports management agency	- Encourage data sharing - Enhance stakeholders' connections - Dynamic visualization of the data - Expand to a global system	- Data availability - Data privacy - Ownership of the DS
Business 2 Owner of an advisory organization in innovation management	- Encourage data sharing - Provide evidence by data - Showing how "smart city" can be realized - Self-sustainable data fits all stakeholders - Citizen's participation	- Difficult to reach social domains - Lack of evidence in the domain of vitality
Municipality 1 Area manager of a park	- Make people vital - Create a vitality indicator - Verify the contribution of parks for vitality - Gather public interests	- Data availability - Data source and status (unorganized and not ready for use)
Municipality 1 Sports program leader	- Collect public data - Make public space attractive for physical activities - Measure the results of implementations (e.g. public projects) - Provide data and insights to business	- Data availability - Inefficiency of data management at the municipality - Inadaptability of data visualization to diverse users
Sports Organization 1	- Create a system sports organizations trust	- Lack of legal and technical

Cluster manager for sports innovation	- Define vitality data	expertise with regard to data - Data availability
Sports Organization 2 Manager at a sports organization	- Create awareness of how technology contributes to a vital life - Data-driven policy making, innovation, and business creation - Collect various data - Create a scalable system	- Neglection of data and its potential
Research/Education 1 Program manager at a non-profit R&D organization	- Build a strong ecosystem - Gain insights from citizens - Foster startups/entrepreneurship - Support inspirations and the validation of ideas by visualizations	- Lack of knowledge to maintain the DS
Research/Education 2 Program director of vitality at a university	- Adapt to specific and general cases - Be a long-term project - Connect people and agencies - Support citizens to become more active by data visualizations	- Lack of knowledge about data among the stakeholders

In the theme of *concerns*, four participants stated "data availability" as their concern. "Lack of knowledge or expertise" was also remarkable, which was mentioned by three participants. From the theme of *visions*, five participants addressed the promotional and branding aspect of the project. Following this finding, "adaptability/scalability", "business creation/enhancement", "connection/collaboration", "data collection", "data visualization", "intervention", "verification" (each addressed by three participants), and "data sharing", sustainability/continuity", and "vitality indicator" (each addressed by two participants) have emerged in *visions*.

The results of the card sorting were analyzed in order to investigate specific requirements for the features of the DS. We ranked the order of the card sorting results by reviewing the photos taken at the end of each interview. We assigned ranks to the following categories created by the participants during the interviews: (4: Core / Base / Must / Essential, 3: Need to have / Main or basic features, 2: Nice to have / Insights / Optional, 1: Later / Ambition / Extra, 0: Unnecessary). One participant's data was not included in this analysis since we could not fit his card sorting categories into the ranking scheme. This participant categorized the features without any inherent hierarchy. The final ranks of required features with aggregated points was as follows: Dashboard (23), Data Visualization (23), Login/Authorization (22), Data Analysis (20), Help Navigation (20), Sorting and Filtering (20), Data Sharing (19), Quick Guides (18), Data Upload (17), Contact Data Provider (15), Data Auto Update (15), Data Download (15), Notifications (15), Health Parameters (14), Comments on Data (13), Street Parameters (13), General Comments (12), Real-Time Data (12), Route Planner (7).

Several participants stated that separation is needed between the project partners and general users. The municipality and the research/education institute intended to open this platform to citizens. Half of the participants showed their interest in data generated from citizens.

5.2. Semi-structured interviews with citizens

The data was analyzed using the KJ-Method in order to organize the qualitative data into groups for ideation and prioritization (Scupin, 1997). Two researchers investigated the keywords obtained from the semi-structured interviews with citizens (extracting all norms, which answered the questions) to explore the three aforementioned questions. We generated 42 keywords from the first question, 40 keywords from the second question and 7 keywords from the third question. The third question was not analyzed further due to the few responses and the resemblance of the emerged keywords.

The analysis of the first and second questions found psychological, physical, subjective, and social aspects of vitality and vitality data, which aligned with the studies from previous researches (Guérin, 2012; Penninx et al., 2000; Ryan & Frederick, 1997). From the first question, we generated the groups of stamina (capability, endurance, resilience, etc.), activeness (movement, energy, and activeness), aliveness (liveliness, power of life, etc.), health (physical health, mental health, well-being, etc.), happiness (good feeling, positivity, happiness), and social/environment (family, society, environment).

The major finding from the second question was that citizens generally expect high-level information such as tips related to health, food, and sports (22 out of 40 keywords) through the DS. Interest in food and nutrition was noticeable, which were 5 out of 40 keywords. 14 out of 40 keywords related to some status about vitality in the society such as activities and social classes. In contrast, 4 out of 40 respondents showed interest in highly subjective vitality data, such as personal evaluation through the DS.

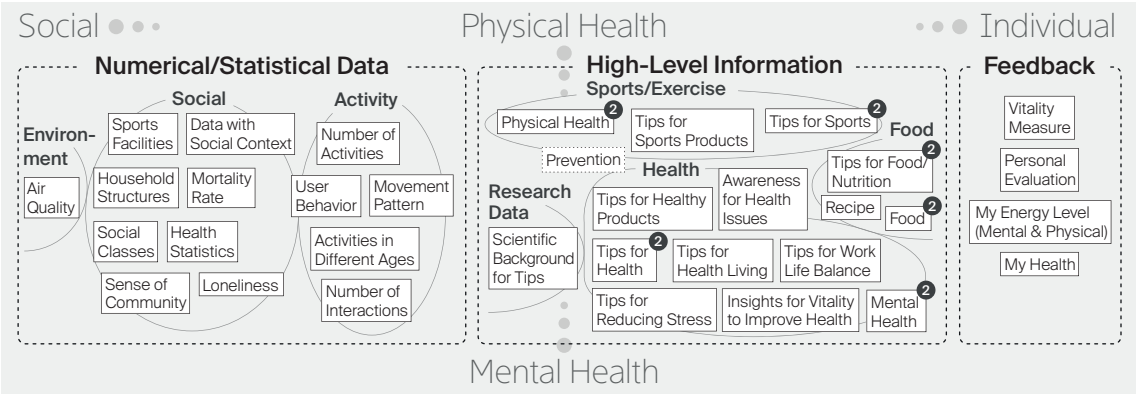

Figure 1: **Dimension of vitality data with groups and subgroups.** Each card is a keyword obtained from the second question, i.e., what vitality data is required from the DS. Numbers on the top right corners of the keywords show how often the keyword was mentioned.

Only seven respondents answered that they would be able to provide their vitality data to the DS. The types of data they could provide are mainly activity data (e.g., travel distance, exercise, food intake, and sleep) from their smartphones. A few of them showed their interest in receiving feedback and evaluation to improve vitality based on the activity data they share. Regardless of the small responses, this finding could be an opportunity to provide citizens' data to the project partners but would require careful considerations of data privacy policies such as the General Data Protection Regulation (Voss, 2016).

6. DISCUSSION

We conducted semi-structured interviews with the VLL project partners and citizens to understand requirements on the DS. Based on the interviews, the project partners are expecting the DS to support their decision-making process by providing low-level data and to enhance the connection among stakeholders including citizens. Citizen generated data (e.g., movement and behavior) are also considered to support their objectives. Both municipality and research/education organizations considered citizens not only as a data source but also as active users who shall be able to gain useful information through the DS. Citizens, on the other hand, had a fewer interest in low-level data, rather in tips about the topics they are interested in or worry about, such as food, health, and exercise. Throughout the interviews, we also explored the question of what kind of data is related to vitality. Our study confirmed that vitality data is multifactorial and subjective in nature as is the concept of vitality itself as also evident from past studies (Ryan & Frederick, 1997; Van Steenbergen et al., 2016).

This gap of expectations and the different aspects of vitality data require further exploration for the design of the DS. Considering this platform will be used for the specific purpose (promoting vitality) and also in a specific region, the context specific information (tips) from the project partners - who are experts in the domain of vitality - could be appreciated by citizens and potentially supports citizens' engagement with the DS. Furthermore, connecting citizens and project partners, features to support interaction between them could be one of the keys to the DS. The necessity of social discussion and collaboration features are also confirmed in prior studies (Ojo et al., 2016; Osagie et al., 2017; Ruijer et al., 2017).

Our study is based on the VLL project and as such highly case specific which, on the one hand, is beneficial as the application context plays an essential role in data platforms but also limits the generalizability in some way. Additionally, the study is limited to a specific region in Western Europe and was conducted with relatively small sample size. Studying in multiple regions and in diverse cultures with a larger sample may yield different conclusions. Nonetheless, our study contributed to understanding the requirements from multiple stakeholders on a context specific data platform in the domain of vitality. Yet, more, similar studies, with different approaches are needed in the future for further verification.

7. CONCLUSION

Our paper reports on results from semi-structured interviews to understand the requirements on a data sharing platform among multiple stakeholders in the domain of vitality. Our study confirmed the multi-dimensional aspects of vitality and vitality data and found diverse requirements within the project partners and also between them and citizens. Organizations involved in vitality services generally expect low-level data for their decision making. On the other hand, citizens strive to gain more general information to solve their current problems or concerns. This finding suggests that various levels of information are required on data platforms to satisfy the variety of users. Moreover, the features to enhance social discussions are required, which may support interactions among stakeholders to understand their needs each other. Further studies need to examine what different information is appreciated and which features enhance the connection among multi-stakeholder.

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