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Managing Citizen Science in the Humanities: The challenge of ensuring quality

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Summary

Nowadays, the organization of work and leisure time, the way we communicate and explore the world, are no longer subject to space and time constraints. The development and growth of the Internet has been essential in the emergence of new forms of organizing human activities. This dissertation examines the phenomenon of citizen science, which refers to a participative form of organizing and conducting scientific research, by involving citizens in the collection and processing of data through the Internet. In citizen science, citizens voluntarily contribute their time and knowledge to perform specific tasks to support scientific research projects. Citizen science has the potential to improve the public understanding of science, increase the time and resource efficiency of research projects and reach individuals with specialized or rare knowledge (Brabham, 2013; Franzoni & Sauermann, 2014; Shirk et al., 2012).

However, the quality of citizen science outcomes is a recurring point of concern in the scientific community in general (Oomen & Aroyo, 2011; Riesch & Potter, 2014; Sheppard, Wiggins, & Terveen, 2014; Wiggins et al., 2011). This concern stems from the need for quality of information inherent to scientific research, the existence of knowledge differences between scientists and the public (Miller, 2001), and the knowledge uncertainty of involving unknown citizens into a research project. That is, compared to other citizens, scientists go through lengthy and rigorous training to become experts in specific topics. Moreover, citizen science projects are characterized by open participation, meaning that citizens unknown to the project leader are free to participate. Quality concerns about the outcomes of citizen science seem therefore well justified.

In this dissertation, I seek to understand *how the need for quality is addressed in the organization of citizen science projects*. To this end, I have carried out an extensive qualitative multiple-case study by following and comparing five citizen science projects in the knowledge-intensive field of the humanities. This research approach and the context of my empirical study are discussed in Chapter 1. The following three chapters focus on quality and the organization of citizen science projects, the role of citizens and the use of technology.

Chapter 2 examines how the need, that project leaders have, for ensuring the quality of outcomes shapes the way of working and organizing in citizen science projects. Since citizen science often involves knowledge work, I approach this question through a knowledge management lens. The knowledge management challenge lies in ensuring quality in a context with knowledge differences and a priori uncertainty. To deal with this challenge, project leaders invest their time and efforts in managing and evaluating knowledge work. Project leaders

ensure quality outcomes by acquiring and sharing knowledge, organizing and assessing knowledge work in different ways. The different ways in which knowledge work is managed depend on: the number of citizen participants, resulting from the type of recruiting approach (open versus targeted calls); their geographical distribution; the characteristics of the tasks; and the type of technology used. The way knowledge is assessed depends on whether and how project leaders evaluate the source and the outcome of knowledge. The evaluation of citizens as sources of knowledge appears to be influenced by: 1) the extent to which project leaders know about participants' level of expertise, and 2) the similar social identity between project leaders and citizens (Kane et al., 2005; Lamb & Davidson, 2005). The assessment of knowledge outcomes depends on the quality standards that characterize each scientific field (Robertson et al., 2003).

Chapter 3 considers how the need for quality outcomes affects citizens' efforts and learning process. Citizens are individuals external to research organizations but connected to them through their voluntary participation in citizen science projects. Citizens' learning process and the improvement of their contributions are essential for ensuring that the outcomes of citizen science projects satisfy scientific quality standards. To examine this learning process, I build upon the 4I framework of organizational learning (Crossan et al., 1999; Zietsma et al., 2002) and introduce the concept of 'Extra-organizational learning'. Extra-organizational learning refers to the learning process of individuals external to an organization, who perform tasks essential for the activities of that organization. I zoom into one of the five studied cases and empirically examine how extra-organizational learning takes place and how one research organization facilitates it. The study shows that extra-organizational learning takes place when citizen participants remain involved in a project for longer periods of time. This type of learning is supported with guidelines and feedback, which are used to increase skills and reduce skill variability among citizen participants.

Chapter 4 covers the use of technology in citizen science projects and examines why technology is sometimes used differently than intended by its designers. Citizen science projects employ different technologies for different purposes. Web-based platforms, for instance, are used to integrate contributions from distributed citizens. To understand why a platform may be used differently than intended, I zoom into one citizen science project that illustrates this situation. I analyse the case by combining the concept of affordances and activity theory. Technology affordances refer to the potential actions that technology allows us to do in specific contexts (Hutchby, 2001). I focus on the distinction between designed, perceived and actualized affordances and show that the use of technology is expected to be different than intended when affordances are designed, perceived and actualized within different activity systems. The studied case indicates that even when affordances are not actualized as expected, the resulting unintended use of technology is meant to ensure quality outcomes. Therefore, the need for quality in citizen science means that the use of technology can take unanticipated turns without compromising the project's goal of scientific quality.

Taken together, these three chapters show that, the need for quality information resulting from citizen science involves project leaders investing their time and efforts in managing knowledge work. In other words, project leaders engage in knowledge management to support

the performance of activities and the learning process of citizens. At the same time, citizens learn and improve the quality of their contributions, which are standardized and integrated with the help technological artefacts that are sometimes used in unintended ways.

Overall, this dissertation contributes to the literature on knowledge management by emphasizing the importance of knowledge assessment, expands organizational learning theory by adding the process of extra-organizational learning, and integrates the literature of technology affordances and activity theory. Based on these findings, I would recommend research organizations to: (1) invest time and effort in supporting citizen participants' learning process; (2) consider beforehand the constraints and affordances of technology expected in their specific projects; and (3) open-up the intermediate outcomes of citizen science.