Crowdsourcing urban sustainability. Data, people and technologies in participatory governance

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A R T I C L E I N F O

A B S T R A C T

The aim of this paper is to prefigure the future of urban sustainability governance by implementing crowdsourcing-based solutions for governance processes.

We explore the convergence between recent research in urban sustainability governance and crowdsourcing. This is done by reviewing the literature in order to acquire important evidence to support the inductive process of theory building, and to highlight the upcoming trends in participatory research and policy-making that exploit ICT and Web 2.0 social software.

Our analysis indicates that a transformative relationship between data and people creates new forms of distant search for solutions and decision making. We argue that interest in crowdsourcing has expanded from computing researches to social and environmental applications. This new practical dimension unlocks the futures of integration of crowdsourcing into best practices in the governance of sustainability in an urban context.

Building on evidence that implementing crowdsourcing into the forthcoming governance of urban sustainability is increasingly recognised as a common priority, the paper suggests policy makers to devote more resources to ensure openness, transparency, interoperability and adaptability of crowdsourcing platforms.

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1. Introduction

In recent decades interdisciplinary scholars have focused on cities as the appropriate space for researching innovative solutions for global sustainability (Breheny, 1992; McCormick, Anderberg, Coenen, & Neij, 2001; NÆss, 2001). The definition of policy priorities aimed at advancing urban sustainability principles has been addressed in all major U.N. meetings on environment and development, and has been included amongst the key issues in official documents (The United Nations, 1992; UN, 2002; MDGR, 2011; Rio+20, 2011).

At the same time, the Internet, personal ICTs and free software have led to bottom-up and urban sustainability-relevant data collection and data sharing through peer-to-peer and wiki-technologies. Similarly, high bandwidth storage and the Web 2.0 have been welcomed as a shortcut to the democratisation of governance processes (Brabham, 2013a; Bott & Young, 2012). Thus, crowdsourcing tools (e.g. smartphone software, blogs, wikis, social bookmarking applications, social networks, peer to peer software) and processes (e.g. social mapping, the collection of volunteered geographic information, geo-referenced social

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networking, co-designing, cloud processing, etc.) enable multiple web-based problem-solving, by involving large groups of users who perform functions (e.g. instantaneous broad communication, collection and analysis of big data, co-design, etc.) that would otherwise be difficult to automate or expensive to implement (Howe, 2006).

While crowdsourcing was originally defined as a web based business model requiring voluntary open collaboration in the development of creative solutions (Howe, 2006), it is now generally understood in the both scientific and grey literature as an online distributed innovation process (Brabham, 2008) that mobilises a number of dedicated tools for significant results also in public research and governance, too (Brabham, 2009; Brabham, 2012; Brabham, 2013a). It can thus be key in addressing challenging urban sustainability issues (such as energy consumption, transport efficiency, deprivation and unequal access to resources, water and sanitation, sewage, and the availability and distribution of environmental services).

The increasing circulation of information on the offline world through digital data is empowering a larger number of people to create new sustainability-oriented networks. Despite this, how crowdsourcing can foster virtuous governance towards the fulfilment of sustainability principles in the urban environment has only been marginally investigated.

In order to contribute to filling this gap, we explore the state of the art and prefigure future scenarios in science and urban governance characterised by the extensive diffusion of digital facilities, as well as the forthcoming development of crowdsourcing and its power to advance innovative participatory processes in sustainability-related fields.

We first survey the existing scientific and grey literature on urban sustainability and crowdsourcing, and then see how the two research areas can converge and offer new opportunities. We believe that integrating data from different, yet complementary research fields (environmental management, urban studies, science-technology and social studies, planning, etc.) can highlight the potential role of crowdsourcing in urban sustainability governance.

2. A longitudinal analysis of literature

How the extensive use of crowdsourcing tools can advance the governance of urban sustainability requires a theoretical exploration of the current transformation of data production/collection, management/elaboration and sharing processes. In addition entails pinpointing future-oriented signals emerging from everyday online activity which, despite being currently underground, are likely to lead to striking social transformations in the years to come (Glassey, 2012).

We used a three-step approach to analyse the largely unexplored intersection between crowdsourcing and the governance of urban sustainability:

1. We make a bibliometric analysis of the scientific production in the field of crowdsourcing and governance of urban sustainability;
2. We identify and classify the main theoretical contributions;
3. We 'join the dots' in order to develop new theoretical perspectives.

The first step involves testing a small set of relevant keywords that are expected to systematically occur within the body of relevant manuscripts. Through computer aided search and the extraction of records from the ISI Web of Knowledge database, publications are identified followed by a manual elimination of false inclusions (i.e. those manuscripts that only accidentally include the relevant keywords). Different streams of research are then analysed by map representations (van Eck & Waltman, 2010) in order to identify the most relevant clusters of theoretical contributions according to both relevance and centrality

A number of manuscripts, citations and impact factors of the journals were thus assumed as a proxy for the relevance of the manuscripts; closeness to the mainstream of the on-going debates was used as a proxy for the centrality. Each author of the present paper separately evaluated the closeness to the mainstream before agreeing on the final classification through a consensus meeting.

The second step involved analysing the logical connections between selected publications. Discussions with technical experts and colleagues held at the SDEWES 2013 conference led to a multi-disciplinary perspective, which was also adopted as the observational standpoint on grey literature. In the third step multi-disciplinary theory-building was exploited to join relevant elements from sectorial studies into a coherent logical framework.

2.1. Bibliometric research protocol

The analysis of scientific literature in the fields of "crowdsourcing" and "governance of urban sustainability" was based on a search of all the papers that include the pertinent keywords. Alternative key words were used (i.e. "crowdsourcing", "crowd-sourcing", "crowd sourcing") as well as changes in the order of the words (i.e. "urban" AND "governance" AND "sustainability"). In addition the selected papers had to match the selection criteria at least once in the title, abstract or in the body of the manuscript.

In order to build a representative dataset of literature, we adopted the ISI Web of Knowledge academic citation indexing and search service. Besides providing bibliographic contents and tools to analyse research information, this is widely acknowledged as being reliable (Aguillo, 2011).

After the computer-aided extraction, the resulting publications included 473 manuscripts on crowdsourcing and 874 manuscripts on governance of urban sustainability. After an analysis of the titles of the papers retrieved, the list of papers