The emergence and evolution of cross-boundary research collaborations: An explanatory study of social dynamics in a digital government working group

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ABSTRACT

Despite the increasing importance of cross-boundary research collaboration to tackle socio-technical challenges in digital government, little is known about how such research collaboration emerges, grows, and comes to fruition. This study investigates the social dynamics of cross-boundary collaboration for digital government research and identifies key variables that can affect the emergence and development of collaborative research networks. Using mixed methods, including social network analysis, we analyzed longitudinal data collected from a North American digital government research group whose members gather across disciplinary, organizational, and geographical boundaries. Social networks among the members heavily influenced the formation and maturation of the research group; face-to-face communication, grant-sharing, and coauthoring relationships coevolved over time in the observed network. It was also found that the impact of telecommunication on this process was limited, while government funding for digital government research played an important role. Based on the main findings, we then developed five propositions for future studies to empirically test.

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1. Introduction

Digital government, as a field of study, has matured and developed into a discipline over the past two decades. More than 5500 peer-reviewed journal publications have accumulated as of 2013 (Scholl & Dwivedi, 2014) and both the theoretical foundations and methodological rigor of these studies have continuously improved. Recent studies on digital government researchers and linkages among them have shown that cross-boundary research collaboration was one of the main factors that drove the growth in digital government knowledge (e.g., Khan & Park, 2013; Scholl, 2009).

This trend in cross-boundary collaboration will extend into future digital government studies and will incorporate additional relevant disciplines as the field continues to grow for three reasons. First, digital government by nature is multidisciplinary. Although the details of its conceptualization in the literature vary, digital government generally refers to the use of information and communication technologies (ICTs) in government in order to provide better public services and improve relationships with citizens, civil society, and the private sector (Reddick, 2012). Thus, research on digital government by definition

lies at the intersection of government, society, and information technologies and deals with multi-dimensional issues that require multidisciplinary perspectives and analysis (Khan & Park, 2013; Scholl & Dwivedi, 2014). Second, the increasing complexity of digital government environments calls for cross-boundary knowledge sharing and convergence to tackle the challenging problems that governments face. The speed and scope of changes in ICTs make it difficult, if not impossible, for any individual or single organization to have a firm grasp of the available knowledge in a limited time span. Some examples are the emerging technologies of artificial intelligence, the Internet of things, and data analytics, all of which have great potential for government operations, but simultaneously introduce unprecedented challenges and uncertainty when they are applied to e-services, information acquisition, or application systems in the public sector. Moreover, the concomitant changes in the social, economic, and political contexts of governments give rise to greater levels of complexity in digital government research and practice and pose questions that are difficult to answer (see Dunleavy, Margetts, Bastow, & Tinkler, 2006). Finally, this trend will continue because advancements in ICTs mitigate communication barriers imposed by different time zones and long distances, which increases the possibility of knowledge sharing and coproduction across geographical boundaries.

Despite the paramount importance of cross-boundary collaboration, much remains to be uncovered about the emergence and development

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of research collaboration networks among digital government researchers and practitioners. Since Smith conducted a pioneering study in 1958, research collaboration has been a popular research topic among scholars. However, previous studies focus on the micro- and macro-level factors that affect the formation of research partnerships and their effect on research performance, with topics ranging from the motivation of individual researchers (e.g., Fox & Faver, 1984; Melin, 2000; Trier & Molka-Danielsen, 2013), social, physical, and institutional pressures on the individual, such as research policies (e.g., Heinze & Kuhlmann, 2008), to physical distance (e.g., Hoekman, Frenken, & Tijssen, 2010; Khan & Park, 2013; Kraut, Egido, & Galegher, 1990). Meso-level factors, particularly social networks among the individuals, have rarely been considered (with the exception of a more recent study by Khan and Park (2013) who attempt to identify the patterns of connectivity among digital government researchers at the country, regional, and organizational levels). Collaborations of all kinds, including research collaborations, are "intrinsically social processes" (Katz & Martin, 1997, p. 4). For collaboration to achieve a common goal, research agents (i.e., individuals and organizations) and their research partners must exist, and many of their interactions and communications may be crucial to success (Crane, 1972; He, Geng, & Campbell-Hunt, 2009; Katz & Martin, 1997; Kraut et al., 1990). Prior collaboration experience and resource sharing between researchers may affect the emergence, maintenance, and resolution of the partnership (Katz & Martin, 1997; Lee & Bozeman, 2005; Milne, 2000; Smith, 1958). Studies that take a social network perspective, including Khan and Park (2013); Rodriguez and Pepe (2008), and Pepe (2011), however, provide us with only limited insight into the evolution process from social networking to a formal research collaboration. The micro and macro foundations of research collaborations can help us understand why people choose to collaborate. But many important questions remain unanswered, such as why networks with individuals who are initially motivated to participate ultimately fail to maintain over time and how social connections between participants encourage or hinder digital government research collaborations. In this article, we intend to bridge this knowledge gap by investigating the process by which a digital government research group, whose members have various disciplinary, organizational, and geographical backgrounds, emerges and evolves into an integrated and productive research network. It focuses on the social dynamics of cross-boundary research collaboration and identifies key variables that can affect the emergence and development of research collaboration networks for future empirical consideration. Specially, we investigate the following three questions.

RQ1:. How does a cross-boundary research collaboration network for digital government emerge?
RQ2:. How do social connections, such as face-to-face communication, grant-sharing, and past coauthorship, affect the growth of the research collaboration network?
RQ3:. How is the growth of the research collaboration network related to knowledge coproduction among the members?
  We conduct a single case study, utilizing both qualitative and quantitative data, including social network data collected from a working group of 18 digital government researchers and practitioners from 7 disciplines, 11 organizations, and 3 North American countries.
  The paper is organized into six sections, including the foregoing introduction. Based on a review of existing literature, the following section discusses prior research on research collaboration networks. Section 3 describes the research design and methods used in this study. Section 4 presents the main research findings, and Section 5 presents a set of propositions that characterize the dynamic nature of network-based, cross-boundary digital government research collaboration. This paper concludes by

discussing the limitations of the present study that could be addressed in future research.

2. Research collaboration and networks

This section summarizes the advantages that prior studies have claimed for networks forms of collaboration. In addition, it discusses the connection between the emergence and evolution of research collaboration networks and the multiplexity of social relations within them.

2.1. Benefits of research collaboration in networks

Why do researchers choose to collaborate in research, rather than working alone? The answers to this question have been well documented in the literature. The first and most obvious advantage of conducting research in a group is to acquire new knowledge resources for one's self and enhance research productivity through knowledge conversion. Due to increased scientific specialization, the information, skills, and techniques necessary for scientific knowledge creation today easily surpass the knowledge resources possessed by an individual researcher or developed within a single discipline. By working with others, researchers can learn new skills and techniques that cannot be easily transferred through documented materials, so-called tacit knowledge (He et al., 2009). Through collaboration, research groups consisting of individuals who have different skills, techniques, know-how, and domain knowledge can have a higher chance of creating significant scientific knowledge (He et al., 2009). Many empirical studies have demonstrated such benefits. For example, Melin (2000) surveyed 195 coauthors of peer-reviewed journal publications; they ranked the opportunity to learn new knowledge from their partners and increase the quality of research through the partnerships as the foremost benefit of research collaboration. Lee and Bozeman (2005) revealed a strong positive association between the number of collaborators and the number of publications, thereby increasing the quantity of research products.

Even when researchers do not seriously suffer due to more limited knowledge resources, group-based research programs can be beneficial in fostering the efficiency of the members through division of labor and other forms of resource-sharing (Fox & Faver, 1984; Leydesdorff & Wagner, 2008). Usually research is conducted through a set of labor- and time-consuming sequential activities, including research design, data collection, data processing, data analysis, and presentation of the results. Coordination and division of the tasks can reduce duplication of efforts to generate knowledge that others already possess or acquire knowledge that is new, but necessary for multiple researchers to proceed with the research project (Fox & Faver, 1984). In addition, easy access to resources that others possess, such as data, research equipment, and grants, is one of the primary reasons for participation in collaborative research (Lee & Bozeman, 2005; Melin, 2000; Smith, 1958). Price (1965) argued that coauthoring papers is the product of symbiotic relationships among scientists who share financial, physical, and professional resources; economic, rather than intellectual, dependence can better account for the emergence of research partnerships as represented by coauthorship.

On the other hand, the literature has shed light on the noneconomic advantages of research partnerships. Fox and Faver (1984) claimed that research collaboration can arise out of researchers' motivation to build a collegial environment. According to them, even when a division of labor or other types of economic benefits are not expected, researchers collaborate in research to escape from isolation. Visibility, recognition, and popularity in academic communities are social benefits that can drive research collaboration (Katz & Martin, 1997; Melin, 2000). In particular, through social networks gained via research collaboration, researchers can get information on research collaboration opportunities