

Determinants of Collaboration in the Development of Smart Cities: The Perspective of Public Libraries

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Abstract

In order to face some complex socioeconomic and environmental issues, local governments from around the world have designed and implemented smart city initiatives. In their strategies, various stakeholders, including non-state actors, contribute to the development of smart cities either individually or in collaboration with other organizations. In fact, emerging research shows that community actors such as public libraries can be salient partners in collaborations for smart city development. This ongoing research paper builds on this research and existing scholarship on collaboration to quantitatively analyze the determinants of current collaborations between public libraries and different stakeholders for the development of smart cities. Preliminary results show that agreement on initial aims, preexisting relationships, and leadership all have a significant positive impact on the extent and effectiveness of public libraries' collaborations in the development of smart cities.

Keywords

smart city, collaboration, public library, local government, effectiveness

1. Introduction

Faced with complex problems intensified by unprecedented urbanization, governments experience demands and challenges related to not only critical infrastructure and resources such as water, energy, land, and mobility but also to socio-economic development such as education, safety, equity, and employment (e.g. [1]). These pressing issues call for novel strategies beyond traditional approaches and require a multi-stakeholder collaboration [2]. In response, cities and other local governments have started smart city initiatives [3].

Mindful of the notion that a smart city is an interdisciplinary and multidimensional concept [4], this paper adopts a socio-technical definition of a smart city as a city that through technology and innovation tackles community challenges, improves citizens' quality of life, and contributes to sustainable development [1, 3].

Current research mainly aims at better understanding smart cities and suggesting how they can contribute to the general welfare. The literature acknowledges the involvement of different


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actors in smart city development and the value of their collaboration in this process (e.g. [5]). This discourse often recognizes a limited variety of actors as real contributors to smart city development, such as tech firms, local governments, and universities (e.g. [6]). In addition, existing studies do not pay enough attention to the role of other social actors and, in particular, community-rooted organizations such as public libraries (e.g.[7]).

Emerging research has identified public libraries as salient actors with whom local governments and other organizations could collaborate in the development of smart cities [8]. Public libraries have the potential to become strategic partners in the development of smart cities by providing access to technology and its use with a purpose, developing smart citizens, facilitating and enabling citizen participation, and offering space and overall environment for innovation [9].

Further, our recent national survey shows that many public libraries are collaborating with other organizations in various smart city initiatives and thereby contribute to smart city development. This study, therefore, strives to better understand the determinants of these collaborations by answering the following research question: what factors influence the extent and effectiveness of the current collaborations between public libraries and other organizational actors in the development of smart cities? Building on the work of Bryson et al. [10] on cross-sector collaborations, we answer this research question based on a national survey of 1,254 public libraries in the U.S.

The paper is organized into five sections including the preceding introduction. In section two, we present a framework of factors that could help explain the current collaborations of public libraries in developing smart cities. We also include the hypotheses of this study. Section three briefly describes the research design and methods. Section four discusses our preliminary findings based on a regression analysis of the impact of the multiple factors on the perceptions of libraries on the extent and effectiveness of the current collaborations and their effectiveness in developing smart cities. In the last section, we provide some final comments and share the next steps for this ongoing research.

2. Theoretical framework

As the literature on public libraries collaborating for smart city development is scant, our theoretical framework draws on the research on collaboration from multiple disciplines. In public management, collaboration is recognized as one of the ways to address complex public issues, in which non-governmental and private stakeholders actively participate in decision-making and problem-solving jointly with the government [11]. This perspective builds on an understanding that these problems cannot be effectively solved by a single agency and therefore require collaboration with other agencies and non-state actors [12]. In this study, we adopt a useful definition of collaboration “as the linking or sharing of information, resources, activities, and capabilities by organizations in two or more sectors to achieve jointly an outcome that could not be achieved by organizations in one sector separately” ([13], p. 44).

As this study focuses on public libraries that have been collaborating in the development of smart cities, the main purpose is to analyze factors that influence the extent and effectiveness of these existing collaborations. Therefore, the factors that are included in our quantitative

model are initial conditions, drivers, and linking mechanisms of collaboration, which have been identified in previous research [14, 13, 15]. In particular, the variables we are testing are: 1) agreement on initial aims, 2) preexisting relationships, 3) initial leadership, 4) consequential incentives, and 5) nature of the task.

First, collaborations require agreement on initial aims among stakeholders [11]. Such agreements could help parties jointly define a problem and vision, and reach a consensus on the capacities and resources needed to address the problem [14]. Through these agreements, parties not only better understand the roles and interests of the collaborators but also interdependence between them [16]. Collaboration could also be started with a partial agreement as common aims are, at times, difficult to reach [17]. To strengthen initial agreement and to improve the effectiveness, accountability, and credibility of collaborations, scholars recommend constructing a collective identity consisting of, among others, shared values, identity, mission, roles, and outcomes through authoritative texts [18]. In collaborations for smart city development, various actors participate in defining a common vision and goals in terms of formal strategies for how their cities become smart [19]. These strategies can then serve as frameworks that can distinguish the roles of stakeholders in smart city development [6]. We then hypothesize that:

H1 [a|b]: An agreement on initial aims has a positive effect on the extent | effectiveness of the collaboration of public libraries in developing smart cities

Second, given the multi-actor nature of collaborations, preexisting relationships also play an important role. Established relations between collaborators could help them better understand each other's capacities, strengthen the trust between them, shape their perceptions of each other, and serve as a basis for selecting collaboration partners [13]. The quality of preexisting relationships among collaborators can also impact both current and future collaboration as low trust can hinder it and high trust can encourage it [14]. Public libraries have endured as trusted community organizations and salient partners in community development [20]. Further, public libraries offer programs and support initiatives that respond to evolving needs and demands of the citizens including the unserved and underserved through collaborations with other organizations such as providers of social and health services [21]. These preexisting relationships can impact current collaborations between libraries and other organizations for the development of smart cities. We hence hypothesize that:

H2 [a|b]: Preexisting relationships have a positive effect on the extent | effectiveness of the collaboration of public libraries in developing smart cities

Third, leadership is one of the well-studied topics in the literature and is essential to the extent and effectiveness of collaboration. In this regard, leaders play different roles, which require certain leadership characteristics and skills [13]. Leaders, for example, can bring stakeholders together, ensure the implementation of collaborative policy and agenda, nurture the relationships among the partners, and empower those that are underrepresented [11]. Also, leadership in collaborations is not static as there can be multiple leaders, formal and informal. Informal leadership is important, for instance, when the partners cannot rely on a centralized direction [13]. For libraries, studies have suggested that leaders are instrumental in directing and helping libraries to become partners and actors in the development of smart cities [8]. Based on this, we hypothesize that:

H3 [a|b]: Leadership has a positive effect on the extent | effectiveness of the collaboration of public libraries in developing smart cities

Fourth, consequential incentives can also be factors that either intrinsically or extrinsically motivate organizations to collaborate. In the literature, consequential incentives are defined as external or internal drivers for collaborative actions whether they are positive or negative [22]. The internal drivers could be problems, resource needs, interests, or opportunities, while external could be situational or institutional crises, threats, or opportunities (Emerson, 2018). Funding and other incentives allocated to new approaches such as smart city initiatives to address a myriad of public problems [19] can be compelling drivers for collaboration in developing smart cities. Based on this, we hypothesize that:

H4 [a/b]: Consequential incentives have a positive effect on the extent | effectiveness of the collaboration of public libraries in developing smart cities

Finally, the nature of the task or its complexity can influence who are the partners and the actual process of collaboration. For example, extreme events such as hurricanes necessitate a collaborative response [10] and reaffirm the notion that complex tasks cannot be solved by a single actor and require collaboration and resource- and capacity-sharing [15]. Smart city development calls for a comprehensive view of a city that, through technological and human development, seeks to enhance the efficiency of urban operations, increase the quality of life, and advance economic development while maintaining environmental sustainability [19]. This multidimensional, intricate task requires collaboration among various stakeholders that contribute to different aspects of smart city development [23]. Based on this, we hypothesize that:

H5 [a/b]: The nature of the task has a positive effect on the extent | effectiveness of the collaboration of public libraries in developing smart cities

3. Research design and methods

3.1. Survey Design

To test our hypotheses, we created a survey. Following two pretests and one pilot test with 5% of the sample (N=433), we adjusted the content of the survey and its administration process. To reduce the common method bias, responses were anonymized and measures of independent and dependent variables were separated in the survey [24].

The survey was sent to 8,230 public library directors and members of library associations across the United States. The survey was administered to each group separately and over a month with the former group receiving invitations to respond between October-November 2020 and the latter between December 2020-January 2021. The majority of the respondents were public library directors (83.78%) with an average work experience of 12 years. In total, we received 1,254 responses.

Five independent variables are measured using scaled-response questions (Likert scale 1-10). *An agreement on initial aims* determines whether there is a formal agreement on collaboration between the public library and other organizations. *Preexisting relationships* are assessed by the extent of previous collaborations between the public libraries and other parties. *Leadership* is the average of eight indicators that characterize leaders such as: 1) understanding of community issues, 2) ability to marshal resources and support to address community issues, 3) ability to communicate the significance of the community issues to diverse collaborators, 4) level of

commitment, 5) open-mindedness in discussions and collaborative mindset in decision-making, 6) ability to coordinate work internally and externally, and 7) fairness to the staff and partners. *Consequential incentives* are measured as the average score of two indicators as drivers for collaboration: 1) the extent of community issues and the availability of funding that supports collaboration. *The nature of the task* is measured by the extent of community challenges that call for collaboration among various actors.

For the dependent variables, the *effectiveness of current collaboration* in developing smart cities and communities is assessed by scaled-response questions (Likert scale 1-10). The *extent of current collaboration* is measured as the number of different types of organizations that libraries are collaborating with to develop smart cities.

3.2. Sample and method

This study includes 222 public libraries that indicated that they have collaborated with other organizations in developing smart cities. For the missing values in the scale-response questions, we applied the multiple imputation technique.

Half of the public libraries (50.79%) included in this study were established between 1901-1950 while about a quarter (27.75%) were founded between 1951-2000. About sixty-five percent of them (64.35%) have one central library. Nearly forty percent (42.03%) serve a population of more than 25,000 whilst thirty percent (29.47%) serve a community of less than 5,000. Almost fifty-five percent of them (55.26%) have less than 10 full-time employees but thirty percent (32.89%) have more than 10 full-time employees. About seventy percent of libraries (69.28%) have fewer than 10 part-time employees, and about half of them (47.54%) have between 1-10 volunteers that support library operations. For annual budgets, thirty-five percent of the public libraries (35.00%) have an annual budget between 0.1 million to 0.5 million dollars, twenty-three (23.00%) have a budget between 1-5 million dollars, and twenty percent (20.00%) have a budget of less than 0.1 million dollars. More than half of libraries (57.32%) have devoted less than ten percent of their annual budget to purchasing and updating technology offerings in the public libraries. Our respondents noted that the pandemic has negatively affected the numbers related to staff, volunteers, and annual budgets.

As far as technology in the public libraries, about forty percent of the public libraries (39.89%) have less than 10 public access computers while twenty-five percent (25.84%) have between 11-20 computers. Twenty-two percent (22.47%) have relatively new computers (less than a year old) and more than a third (35.96%) have computers that are less than 3 years old. Almost all computers (98.68%) have an Internet connection. Further, almost all public libraries (98.20%) extend wireless Internet access to their patrons. Among these public libraries, the top three most offered technologies are 1) color printers (84.23%), 2) scanners (83.33%), and 3) netbooks and laptops (51.80%).

To analyze the data, we used multiple regression as our goal is to determine the relationships between one outcome variable (i.e., extent or effectiveness of collaboration) and more than one predictor. When its assumptions are met, this method is considered the best unbiased and efficient linear estimator of the coefficients in the model. However, multiple regression is sensitive to outliers and noise in the independent variables and relies on assumptions of linearity and independence among the variables. Aware of these potential shortcomings, before

hypothesis testing, we checked for the independence of errors, multicollinearity, normality, and homoscedasticity of the errors, as well as the linearity of the relationship between the independent variables and each of the dependent variables.

4. Preliminary results

In Table 1, model (1) shows results for the impact of independent variables on the extent of collaboration, and model (2) on the effectiveness of collaboration. Model (1) explains 28.5% of the variance in the extent of current collaboration in developing smart cities. The standardized coefficients indicate that agreement on initial aims ($\beta=0.146$, $p<0.05$), preexisting relationships ($\beta=0.187$, $p<0.01$), leadership ($\beta=0.303$, $p<0.001$), and consequential incentives ($\beta=0.171$, $p<0.05$) have a statistically significant positive effect on the extent of the said collaboration. In this light, hypotheses H1a, H2a, H3a, and H4a are supported by our data.

Model (2) explains 31.1% of the variance in the effectiveness of current collaboration in developing smart cities. The coefficients indicate that agreement on initial aims ($\beta=0.150$, $p<0.05$), preexisting relationships ($\beta=0.409$, $p<0.001$), and leadership ($\beta=0.163$, $p<0.01$) have a statistically significant positive impact on the effectiveness of current collaborations between public libraries and other organizational actors in developing smart cities. Hypotheses H1b, H2b, and H3b are therefore supported by our data.

Table 1
Regression estimates (with standardized beta coefficients)

Predictors (N=222)	(1) Extent of collabor	(2) Effectiveness of collabor
Agreement on initial aims	0.146* (0.0572)	0.150* (0.0476)
Preexisting relationships	0.187** (0.0679)	0.409*** (0.0566)
Leadership	0.303*** (0.0876)	0.163** (0.0730)
Consequential incentives	0.171* (0.110)	-0.027 (0.0913)
Nature of the task	-0.105 (0.0931)	0.001 (0.0775)
R-squared	0.285	0.311

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5. Final comments and next steps

Our preliminary results suggest that agreement on initial aims, preexisting relationships, leadership, and consequential incentives have a statistically significant positive effect on both the extent and effectiveness of collaboration between public libraries and other stakeholders in the development of smart cities.

Our evidence suggests that public libraries can play an important role as collaborators in the development of smart cities [9]. Therefore, this study provides theoretical and practical implications for scholarship on collaboration with non-traditional actors in smart city development. It also suggests that existing collaboration frameworks are relevant to studying these complex relationships that could be instrumental to achieving various public objectives and goals. Moreover, this article contributes to knowledge on how to strategically manage collaborative processes in transformational socio-technical undertakings such as smart city initiatives.

Our next step is to continue analyzing and testing the data from our survey. In particular, we plan to test other factors including but not limited to trust and commitment, shared understanding of the problem, and legitimacy [10] that could affect the actual collaboration process and ultimately the extent and effectiveness of collaboration. Further, the results should be tested in different contexts and with a higher response rate. Also, the interrelationships between the two dependent variables could be explored. Given that public libraries collaborate with different stakeholders, future research could also test whether the results change depending on the type of organizations that public libraries collaborate with.

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