Integrating stakeholders for urban innovation implementation: The role of formal management methods and tools

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Cite as:
Kroh Julia, Schultz Carsten (2019), Integrating stakeholders for urban innovation implementation: The role of formal management methods and tools. *Proceedings of the European Marketing Academy*, 48th, (9836)

Paper presented at the 48th Annual EMAC Conference, Hamburg, May 24-27, 2019.

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Abstract:

Urban innovations target the development and implementation of collectively used infrastructures and resources in cities, like initiatives for sustainability or smart city solutions. They differ tremendously from well-known innovation types like product, process, and service innovation, because they are necessarily realized in a city's complex and adaptive ecosystem. Intensive stakeholder integration is therefore decisive for urban innovation implementation, although this relationship is not finally clarified in literature. This study draws on stakeholder theory and project management literature to investigate the impact of stakeholder integration in urban innovation projects on their implementation. We suggest that the efficacy of stakeholder integration depends on the use of formal management methods and tools. Formal management may on the one hand help to cope with the complexity of stakeholder integration but may on the other hand reduce the flexibility and absorptive capacity of the project team. To explore such relationships we analyse 101 documented concepts for energy efficiency improvements in urban districts. Using text mining and survey data, this article provides empirical evidence that (i) intensive stakeholder integration positively affects urban innovations' implementation, and that (ii) intensive use of formal management methods and tools weakens this effect.

Keywords: stakeholder, urban innovation, project management

Track: Innovation Management & New Product Development

1. Introduction and Literature Overview

Urban innovations in the sense of innovative urban restructuring differ tremendously from well-known innovation types like product, process, and service innovation, because they are necessarily realized in a city's complex and adaptive (eco)system (Mieg, 2012). For example, implementing innovative district heating grids and offering car sharing services to create a new mobility infrastructure call for the acceptance and adoption of various local stakeholders like firms and residents. Urban innovation implementation is crucial to ensure urban restructuring and intensive stakeholder integration is therefore decisive for urban innovation implementation (e.g., Cozijnen at al., 2000). Formal management methods and the use of formal management tools in particular support such stakeholder integration processes, although too much formalization may result in the opposite. The objective of this research is therefore to investigate stakeholder integration intensity as a mean to support implementation of urban innovation, thereby examining the role of formal management methods and tools for urban innovation implementation.

Urban innovations are becoming increasingly relevant due to, for example, the world population's steady growth, with more than half living in urban areas. Urban innovations unite process, service, and ecosystem innovation characteristics (e.g., Gallouj and Weinstein, 1997; Gopalakrishnan and Damanpour, 1999). They are as complex as service and process innovations, and equally rely on tacit knowledge about ecosystem actors. Furthermore, urban innovations' implementation depends on the adoption and diffusion of innovations in the heterogeneous urban ecosystem where different public and private actors like private parties, industry, and public institutions interact in complex and non-linear ways for urban innovation (Gopalakrishnan and Damanpour, 1994; Katz, 2006). Engaging in urban innovation is thus challenging, because the implementation depends on a fuzzy, heterogeneous network with high entry barriers.

Integrating stakeholders ensures the specification of stakeholders' needs and the acceptance of an innovation alternative. In general, stakeholder integration therefore positively affects a firm's performance, its competitive advantage (e.g., Harrison et al., 2010), and its innovation performance (e.g., Li et al., 2018). Recent research shows that stakeholder integration is even more important to achieve high performance in complex innovation processes like urban innovation (e.g., Juntunen et al., 2018), supposing that stakeholder acceptance is the main driver of innovation implementation in complex systems. Only if all stakeholders support the suggested innovation alternatives, they will be willing to implement

them. Thus, our first research question is: *How does intensive stakeholder integration affect urban innovations' implementation?*

Managing complex innovation projects calls for formal structures like the assignment of clear responsibilities, tasks, and milestones to coordinate stakeholders (e.g., Dvir et al., 1998; Gann and Salter, 2000; Davies and Hobday, 2005). Formal management methods and tools like IT supported planning tools support those coordination and organization processes in complex innovation (e.g., Dos Santos et al., 2008; Richtnér and Södergren, 2008). However, in case of intensive use of formal management, this may lead to an opposite effect (Aggeri and Segrestin, 2007; Kavanagh and Naughton, 2009). Formal management methods facilitate stakeholder integration, but hamper the absorption of stakeholder's contributions, because handling heterogeneous and possibly inconsistent information is not possible when processes are too strictly defined. This may be true for the adaptive urban ecosystem. Given the complex nature of urban innovations and as a consequence thereof, their stakeholder diversity, our second research question is: *How does the use of formal management methods and tools influence the implementation of urban innovations in dependence on stakeholder integration intensity?*

This study analyses stakeholder integration intensity and formal management tool use in urban innovation projects and their implementation ratio by using a unique data set of a German public funded urban innovation initiative. A conceptual model was developed to investigate the influence of stakeholder integration intensity on urban innovations' implementation, moderated by the use of formal management tools. The developed model was tested in 101 German urban innovation initiatives by using a different data sources.

2. Method

2.1 Data sample

The research questions were investigated based on text mining and survey data from a German urban innovation initiative, in which concepts are developed that describe selected innovation alternatives for innovative urban restructuring. A project team, consisting of, e.g., public administration, energy providers, and housing companies, suggests such innovation alternatives for implementation in a specific urban environment. The overall objective of the initiative is the same for all project teams, so the list of potential innovation alternatives is constant. Therefore, we are able to compare the nature of individual innovation projects within our sample. To overcome the likelihood of common method bias, all of the project team's organizations were invited to participate in the survey. In total, this research draws on

101 urban innovation projects from different regional ecosystems including 129 organizations (1.28 participating organizations per urban innovation project) and their responses. Table 1 shows further sample characteristics like the regional ecosystem's size (represented by the cities' size) and the organizations' functional background.

Size of the regional ecosystem (based on the city's size)	**Number**	**Percent**	**Size of the urban innovation project (based on the city districts' inhabitants)***	**Number**	**Percent**
Rural community (<5,000 inhabitants)	10	9.9%	<740	22	22.5%
Small town (5,001-20,000 inhabitants)	28	28.7%	<1787	26	26.5%
Medium-sized town (20,001-100,000 inhabitants)	37	36.6%	<4596	24	24.5%
Large city (>101,001 inhabitants)	25	24.8%	≥4596	26	26.5%
Number of informants per urban innovation project			**Size of the project team**	**Number**	**Percent**
1 informant	77	76.2%	2 team members	19	178.6%
2 informants	20	19.8%	3 team members	37	36.3%
3 informants	4	4.0%	4 team members	20	19.6%
			5 team members	10	9.8%
			6 team members	4	3.9%
			≥ 7 team members	11	10.6%
n=101					
Kind of organization participating	**Number**	**Percent**	**Role in the urban innovation project**	**Number**	**Percent**
Architects/Engineers/Planners	63	48.8%	Urban innovation project contracting authority	19	14.7%
Community/City	16	12.4%	Urban innovation development	95	73.6%
Construction company	1	0.8%	Urban innovation implementation	8	6.2%
Energy agency	7	5.4%	Others	7	5.4%
Energy provider	12	9.3%			
Housing company/Real estate company	4	3.1%			
University/Research institute	9	7.0%			
Others	17	13.2%			
n=129			n=129		

*inhabitants categorized according to the .25, .50, and .75 percentile of the sample size

Table 1. Sample Characteristics

2.2 Measures

To overcome single source bias, the *implementation ratio* was measured based on text mining (Meyer et al., 2008). The concepts of the investigated 101 urban innovation projects were thereby decomposed into text blocks, containing only words that occurred more than once per concept. Following the principle of sentiment analysis in opinion mining (e.g., Pang and Lee, 2008), we state that the more often words like "implementation", "realization", and "application" are used in a concept, the higher is the implementation ratio, because the project team had a clear implementation focus during the innovation development phase. Therefore, a wordlist containing 76 German words that indicate high willingness to implement the urban innovation alternatives was developed and its content validity was assessed via experts from practice. The number of words from the word list was then counted in every concept and

divided by the total number of the concept's words. The weighted word count is then used as implementation ratio in the following regression analysis.

The text mining data was combined with survey data based on established indicators from prior research, and measured with five-point Likert-type scales. The variables that were assessed by several project team organizations for one urban innovation project were aggregated to an urban-innovation-project score by calculating the mean values across their individual responses.

The *stakeholder integration intensity* was captured based on the collaboration intensity during the urban innovation development process. The respondents could choose 22 different stakeholders to be relevant for their urban innovation project. These stakeholders were originated in a city's ecosystem (Kastalli and Neely, 2013) and include businesses (e.g., energy providers, real estate companies, service providers), residents (e.g., citizens' groups, owners, tenants), academia (e.g., research institutes, university), and government and utilities (e.g., non-profit associations, city government, national government). The respondents were asked to evaluate the collaboration intensity during three different development phases (information generation, development of innovation alternatives, and decision on relevant innovation alternatives) on a five-point scale from "no collaboration" to "very intensive collaboration" (Heravi et al., 2015). The collaboration intensity at the three phases was summed for every stakeholder group and an average value including all stakeholder groups was calculated.

The use of *formal management methods and tools* was assessed with five items from previous literature (White and Fortune, 2002; Teller et al., 2012). The respondents evaluated their formal management based on the use intensity of management methods and IT instruments (e.g., IT platforms and planning tools). The applied measures were tested for validity and reliability, Cronbach's alpha coefficient was calculated, which ranged at satisfactory levels above the threshold of 0.7 (Nunnally and Bernstein, 1978). Principal component analysis (varimax rotation), which were conducted separately for each construct's items, only extracted one factor with eigenvalues greater than one, demonstrating these items' unidimensionality.

Several covariates were included in the model to control for the effects of the urban initiatives' size, the size of the project team, the urban innovation concept's content breadth, and the number of integrated stakeholders. The respondents stated the *size of the urban project* by reporting the number of inhabitants that were directly affected by the innovation alternatives created in the urban innovation project. The number of inhabitants was included

in the regression model as continuous control variable. The number of authors of the concepts was used as the *project team's size*. To control for the *content breath* of the urban innovation project, the amount of developed innovation alternatives was summed up in each concept, ranging from one to 57 developed innovation alternatives. Finally, the survey respondents stated the *number of stakeholder group*s that were integrated during the development process.

3. Results and Discussion

3.1 Regression Results

The regression results reveal a positive and significant influence of the stakeholder integration intensity on the implementation ratio (β=.30; t=2.43; p≤0.5) and a negative significant interaction between stakeholder integration and formal management maturity (β=-.18; t=-2.19; p≤0.5). Table 2 shows the results of the regression analysis.

	Model 1a			**Model 1b**			**Model 1c**		
	β	**p**	**t**	**β**	**p**	**t**	**β**	**p**	**t**
Controls									
Constant	**.00**	**.99**	**.00**	**.02**	**.83**	**.22**	**.08**	**.41**	**.83**
Size of Urban Innovation Initiative	**.27**	***.007**	**2.76**	**.24**	**.01**	**2.49**	**.24**	**.02**	**2.47**
Size of Project Team	**-.05**	**.61**	**-.52**	**-.04**	**.67**	**-.44**	**.01**	**.91**	**.11**
Number of Integrated Stakeholders	**-.06**	**.56**	**-.56**	**-.16**	**.15**	**-1.44**	**-.23**	**.05**	**-2.03**
Content Beadth	**.02**	**.83**	**.21**	**.00**	**.97**	**.04**	**-.02**	**.86**	**-.18**
Predictors									
Stakeholder Integration Intensity				**.18**	**.12**	**1.59**	**.30**	**.02**	**2.43**
Formal Management Methods and Tools				**.10**	**.37**	**.91**	**.15**	**.17**	**1.39**
Stakeholder Integration Intensity x Formal Management Methods and Tools							**-.18**	**.03**	**-2.19**
R^2		**.08**			**.12**			**.16**	
F		**2.06**			**2.07**			**2.53**	
+ p ≤ .1; * p ≤ .05; ** p ≤ .01; *** p ≤ .001				**n=101**					

Table 2. Regression Results

3.2 Moderation Analysis

Figure 1 graphically illustrates the effect of stakeholder integration intensity on the implementation ratio in dependence on the level of formal management method and tool use. The plot shows the moderation effect regarding a low (mean minus -1SD), medium (mean), and high level of formal management methods and tools (mean plus +1SD). The significant moderation effect illustrates that the relationship differs between low (β=.47; t=2.72; p≤0.1), medium (β=.30; t=2.40; p≤0.5), and high use of formal management methods and tools (β=.12; t=1.05; n.s.).

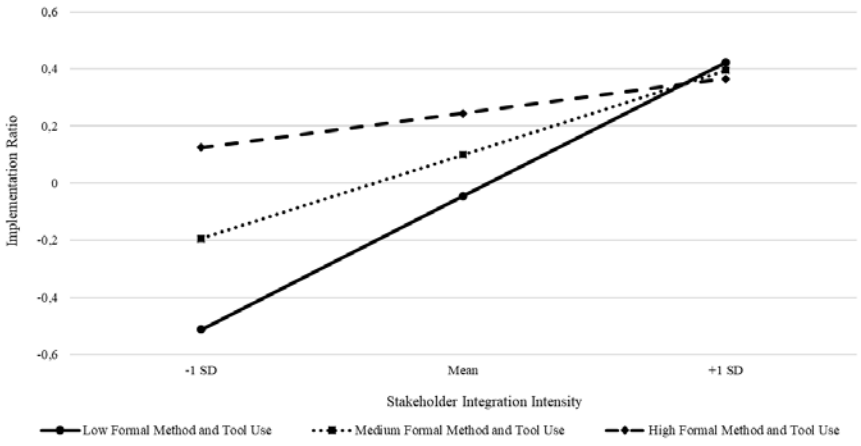

Figure 1. Plot of Moderation Effect

3.3 Discussion

The results show that stakeholder integration intensity positively affects urban innovations' implementation (see Figure 2). Intensive collaboration with stakeholders, independently of the number of involved stakeholders, during the urban innovation development process increases later on the ratio of implemented innovation alternatives. This is in line with previous literature that highlights the importance of stakeholder integration in complex innovation processes (e.g., Katz, 2006; Juntunen et al., 2018). Intensive use of formal management methods and tools has the opposite effect: The more intensive the use of formal management methods and tools for stakeholder integration, the lower is the effect on the implementation. In urban innovation projects, formal management methods and tools may lead to a too high degree of formalization and thus hamper agile and flexible stakeholder integration and the project team's absorptive capacity. Therefore, the intensive integration of few influential stakeholders, using a moderate level of formal management methods and tools may be the best way to achieve a high implementation.

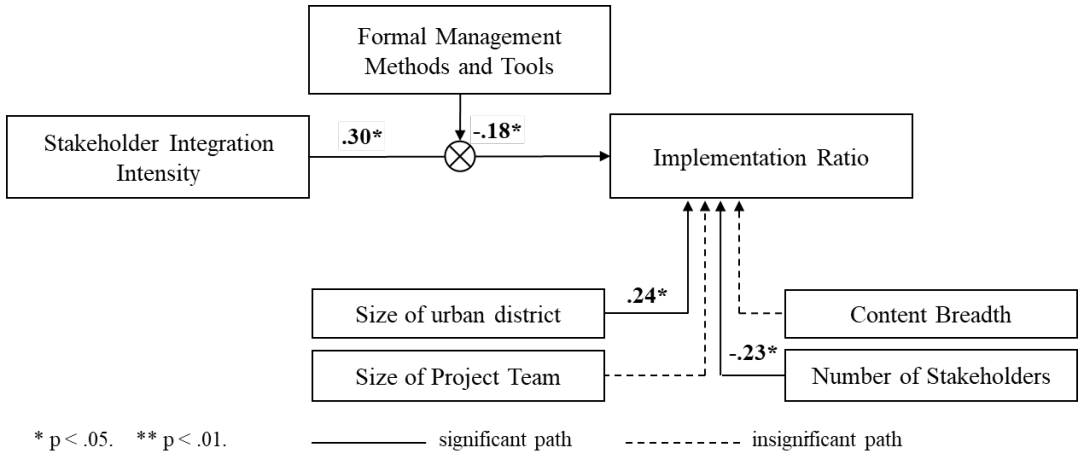

Figure 2. Model and Path Coefficients

4. Implications and Limitations

The contribution of our study is twofold: First, stakeholder integration intensity positively affects urban innovations' implementation. Second, the results show that an intense use of formal management tools and methods weakens the positive effect of stakeholder integration on urban innovations' implementation. Consequently, formal management methods and tools should be used for stakeholder integration at a moderate level to ensure a high implementation of urban innovations.

This research helps to understand stakeholder integration as a mean for urban innovation implementation, thereby extending current knowledge on how stakeholder integration influences innovation implementation in complex (system) innovations like urban innovation. Additionally, this article extends research on urban innovation management, which so far is mainly published in public governance and urban planning literature.

Based on the proposed and empirically tested model, several recommendations for (project) managers can be proposed. First, managers should analyze which stakeholders are relevant for urban innovation implementation. Although intensive integration of stakeholders is recommendable to increase the implementation of innovation alternatives, the more stakeholders are not necessarily better. Second, managers should observe the use of formal management methods and tools, and keep it on a moderate level for stakeholder integration in complex innovation projects like urban innovation.

Despite its contributions, this study has certain limitations that need to be taken into account. Although the model contains covariates, further covariates could be necessary to explain more of the predicted variable's variance. Moreover, the use of formal management methods and tools may not be the only moderating variable in the model. Besides the integration of different innovation phases in the stakeholder integration intensity measure, it could be interesting to see how the implementation evolves over time. Now, the model does not include this effect. The study's sample size includes 101 German urban innovation projects. Future research could extend the sample size and include urban innovation projects that are not executed in Germany.

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