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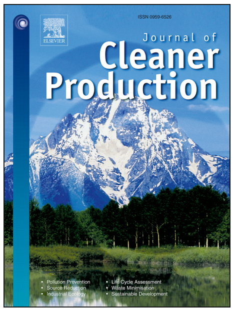

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The Social Embeddedness of Brownfield Regeneration Actors: Insights from Social Networks Analysis

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Abstract

Stakeholder involvement in land management has been considered in both normative and analytical terms, but often in an undifferentiated way. The article aims to compare these two perspectives by proposing, first, a mixed methods approach consisting of semistructured interviews and social network analysis. Second, it explores a social network of stakeholders by inductively developing and illustrating three indicators of social embeddedness. These are the relative embeddedness of stakeholder groups, the level of overall network coherence across multiple regeneration goals, and the relative distance between non-decision makers and those making decisions. The case study used is the regeneration of Area 2, a site in Porto Marghera, Italy. The article concludes by presenting a baseline assessment of the Area 2 regeneration network and suggesting several widely applicable ways to foster stakeholder involvement in regeneration processes via improved communication.

Keywords: brownfield remediation and regeneration, stakeholder involvement, social embeddedness, social network analysis, Porto Marghera

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The Social Embeddedness of Brownfield Regeneration Actors: Insights from Social Networks Analysis

1. Introduction

The involvement of stakeholders in environmental and land management is both a desideratum and an empirically observable fact. Both the normative and empirical aspects are important and have received extensive attention. As shown below, further insights can be gained from studying their relationships. From the normative point of view, the management literature defined early on stakeholders as "persons or groups with legitimate interests in procedural and/or substantive aspects of corporate activity" and assigned to stakeholders' interests "intrinsic value" (Donaldson and Preston, 1995, p. 77). In natural resource management, normative theories emphasized stakeholder's rights to participate in managing projects that affected their environments (Reed et al., 2009). Rist and his colleagues (2007) underscored the desirability of improving natural resource management via social learning processes involving stakeholders.

Similar arguments have been advanced in brownfield remediation and regeneration research. Stakeholder involvement was described as a "vital component in sustainable development" (REVIT, 2007, p. 11). Sustainable development strategies involving stakeholders were defined as a key requirement within several European research networks and projects (Cundy et al., 2013; Harclerode et al., 2015). Paralleling the social learning approach (Rist et al., 2007), contaminated sites investigators have linked the successful management of such sites to the development of a "large and multi-disciplinary knowledge base that straddles the [...] physical, engineering and social sciences" (Swartjes, 2011, p. 77). Achieving this base relied on multi-disciplinary teams including scientists, social scientists, and creative individuals but potentially including an even wider array of stakeholders with diverse backgrounds.

On the other hand, regardless whether it was desired or not, stakeholder involvement was recognized as a fact of life. Its effects on the quality of decision making could be either enhancing or limiting, depending on the institutional context of involvement (Reed, 2008). In the risk assessment literature, there was a growing interest for how "stakeholder agendas" (Pollard et al., 2002, p. 30) set the context for risk assessment. Sustainability research paid particular attention to stakeholder involvement. However, the understanding of the social aspects of sustainability was seen to lag behind those of the environmental and economic pillars (Cuthill, 2010). What the "social" should refer to in sustainability research was considered as one of the most theoretically elusive and least answered questions (Murphy, 2012; Partridge, 2005). In brownfield remediation and regeneration, researchers have increasingly recognized that "many factors important in sustainability are likely to be viewed subjectively by different stakeholders" (Bardos et al., 2011, p. 915).

The desirability and reality of stakeholder involvement have often been treated in an undifferentiated way. There was so far little preoccupation to integrate the two by asking, for instance: if a given level and kind of stakeholder involvement is desired, to what extent is it achievable in practice? This paper aims to bridge this gap by positing social embeddedness as a conceptual bridge between the desirability and reality of stakeholder involvement in regeneration projects. Social embeddedness describes the informal communication channels through which stakeholders may get organized in order to act upon, or react to, a given project or activity. To understand how stakeholders are involved in a given project and how they could be more effectively involved requires therefore an assessment of their patterns of social embeddedness.

The objective of the paper is twofold. First, a mixed methods design was developed, consisting of semistructured interviews and social network analysis (SNA), to explore the embeddedness of social actors in regeneration projects at case study level. Second, the social network was analysed to inductively derive and illustrate indicators of the actual embeddedness of stakeholders in regeneration processes. These are the relative embeddedness of stakeholder groups, the level of overall network coherence across regeneration goals, and the relative distance between non-decision-makers and those making decisions. These indicators can be compared to the desired level and form of stakeholder involvement, as stated by decision-makers or other practitioners. Far from being exhaustive, these indicators are illustrations for how the rich social embeddedness concept can be operationalized. The indicators were used in the conclusion to provide a baseline for improved stakeholder engagement strategies.

Following the introduction, the next section introduces the concepts of social embeddedness and SNA in regeneration research. Section 3 outlines the qualitative and quantitative methods used in the analysis, while section 4 explains how these methods were applied in the case study area. Section 5 summarizes and discusses the main results derived from this analysis, while the last section outlines the conclusions and future research directions.

2. Rethinking stakeholder involvement in brownfield regeneration: Social embeddedness and social network analysis

According to most definitions (Mitchell et al., 1997), stakeholders are social actors who are either affected (and thus are likely to react) or they themselves affect (and purposefully act upon) human activities that have an environmental impact. But how can one learn about the patterns of their involvement beyond ascertaining their existence?

This question was addressed by proposing the concept of social embeddedness and using SNA to measure different patterns of embeddedness that are consequential for stakeholders' possibilities of action. Embeddedness broadens the current understanding of stakeholder involvement from an atomized view in which each stakeholder has a one-on-one relationship with a project to an understanding that considers the multiple ties connecting stakeholders among each other in pursuing regeneration goals. Ties can be of a material or non-material kind. Social embeddedness refers to a specific form of non-material ties by which stakeholders' behaviour is viewed as "closely embedded in networks of interpersonal relations" (Granovetter, 1985, p. 504).

The study of such networks is worthwhile because it shows *how* stakeholders are involved in regeneration. In addition to identifying each actor as a stakeholder of a project (vertically), SNA takes into account the horizontal interpersonal channels by which actors might communicate and organize themselves for action. It also offers an objective picture since the collective patterns of relationships do not depend on the subjectivity of any one actor (Emirbayer and Goodwin, 1994). SNA offers a basis for measuring the objective possibilities of action within a given network configuration. Finally, by providing a 360-degree view of each actor's ties, SNA is particularly useful in settings that pose complex tasks and unforeseen situations (Bodin et al., 2011).

SNA refers to the investigation of how ideas or information flow via specific configurations of social ties (Bodin et al., 2011). A social network contains "sets of relations that apply to a set of social actors, as well as any additional information on those actors and relations" (Prell, 2011, p. 31). A social network thus offers a structured and measurable overview of informal relationships among stakeholders engaged in remediation or regeneration projects.

The building blocks of a social network are nodes (or vertices), who are the actors involved in an activity, and ties (or edges), which represent the relationships among actors (Prell, 2012). These relationships can be communication, exchange or trust. The structure of a social network can be described holistically in terms of its shape and size, of central and peripheral locations, and of relative distances between nodes (Hansen et al., 2011).

Sustainable brownfield regeneration refers to "the management, rehabilitation and return to beneficial use of brownfields in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations in environmentally sensitive, economically viable, institutionally robust and socially acceptable" ways (Rescue, 2003). Sustainable regeneration is a process of redeveloping underused urban areas, which may or may not require environmental remediation (Nathanail, 2011). Both remediation and regeneration processes involve mixes of diverse stakeholders. In fact, the more complex the remediation and the more diverse the final users, the higher the variety of stakeholders involved (Cundy et al., 2013).

Recently, there has been an interest in contextualizing sustainability in the remediation and regeneration of (urban) brownfields by exploring stakeholder involvement. For example, the width and depth of participation, referring to adequate opportunities for participation and to the possibility of actually influencing decision-making, were analysed in the context of Northern European urban policies (Bayulken and Huisingh, 2015). Sardinha, Craveiro, and Milheiras (2013) used a social learning framework to integrate different conceptions of place making from multiple stakeholders. Hou et al. (2014) used structural equation models to assess the effects of stakeholder influence and institutional pressures on the adoption of sustainable remediation practices. The present study aimed to rest participation, learning and influencing on an empirical basis of relational channels by which these and similar processes work out in practice. The paper also sought to contribute to the related literature on stakeholder categorizations in environmental management (Colvin et al., 2016; Rizzo et al., 2015). The aim was to map stakeholder categories onto the topography of social networks.

3. Methods

This section introduces the generic methods to study the social embeddedness of brownfield remediation and regeneration stakeholders. The methods included an exploratory (qualitative) stage and an assessment (quantitative) stage. Researchers first learned about the goals of several decision-makers and then used this knowledge to assess (map and measure) the social networks of stakeholders involved in regeneration. The data collection tools and outputs of each stage are described below.

3.1 Exploratory research for the identification of stakes and stakeholders

The aim of the exploratory component was to identify both the stakes of regeneration and those who hold those stakes. Stakes are the issues and interests that stakeholders "bring to the table" in negotiating brownfield regeneration projects (Doak and Karadimitriou, 2007). Stakes are understood in sociology as social commitments to pursue collective ends (Bourdieu and Wacquant, 1992; Fligstein and McAdam, 2012). Stakes thus indicate towards which goals actors orient their actions in a given field. Stakes have an activating function – mobilizing individuals for action – and are collective, because actors often rely on others to achieve common goals. The essential conditions for a stakeholder as defined in this paper were: (1) he/she recognized the stakes of a collective project and (2) was tied to other actors who were co-involved in the same project. These two criteria operationalized the concept of embeddedness in regeneration networks and identified (theoretically) who was part of the social network.

3.1.1 Identifying stakes

It is increasingly recognized today that brownfield sites are considered for a variety of possible requalification scenarios and initiatives. To gain insight into these stakes, social scientists often use techniques such as semistructured interviews and survey-based SNA (Reed et al., 2009).

Semistructured interviews are verbal interchanges between an interviewer and an informant. They are structured to the extent that the interviewer asks questions from a list of predetermined topics, the so-called interview guide. However, the list of topics can be used flexibly as the discussants are free to explore off-topic but related issues (Longhurst, 2010). The flexibility of semistructured interviews enables researchers to collect information to identify the stakes of a project or activity (Prell et al., 2009). In the present case, the information collected via interviews had to fulfil the criteria of being: (i) *current*, by revealing stakeholders' present goals and interests; (ii) *realistic*, by shedding light on the distinct social motivations underlying the often-observed "disparate range of goals, demands, perceptions, requirements, strategies and constraints" displayed by social actors (Doak and Karadimitriou, 2007, p. 67); (iii) and *specific*, by revealing the phrases used by most actors to describe their common interests (e.g. regeneration project names).

The expected result of the interviewing stage was the formulation of one or several goals that were recognizable to several stakeholders as that *which is currently at stake in their regeneration activity*.

3.1.2 Identifying stakeholders

The identification of stakeholders was closely linked to the identification of stakes. Prell, Hubacek, and Reed (2009) spoke of a "dialectic between issue definition and stakeholder identification. Without knowing the issues, it is difficult to know which stakeholders should be involved" (2009, p. 502). Researchers needed to first interview a few informants who had a great deal of knowledge in the area of interest (e.g. the regeneration of a particular site). These were called specialized informants and their breadth and depth of knowledge allowed them to speak competently (Bernard, 2006). They could be long-term site owners or managers, senior officials at municipal, regional or national levels, senior academic staff, technical experts or consultants (Rizzo et al., 2015; Syms, 1999). Specialized informants had to be selected based on their willingness to share their knowledge with researchers.

A widely used technique for identifying stakeholders is snowball sampling (Reed et al., 2009). This tool requires asking respondents to name other actors pursuing the same or related stakes. These actors were, in turn, interviewed and asked to supply further names of interested actors. The process was repeated until the names started to repeat (Sandström, 2011).

Snowball sampling can also be carried out by a qualitative technique, which involves asking interviewees to freely draw a figure of their ego-centred network. An ego-centred network "consists of a focal actor, termed ego, [and a] set of alters who have ties to [the] ego" (Wasserman and Faust, 1994, p. 42). These drawings provided valuable information as the respondent showed whom he communicated with about the stakes that he or she had just described during the interview. The nomination of stakeholders via ego-centred maps helped in identifying those who would be involved in the survey-based SNA.

3.2 *Survey-based social network analysis*

The aim of the quantitative component was to provide a visual and quantified assessment of the social embeddedness of actors in regeneration projects by means of SNA. Surveys are generally used to collect quantitative information on social actors and on their relationships (Bodin and Prell, 2011).

First, the issue of stakeholder identification becomes in SNA a question of who is part of the network. The network boundary was drawn, in the case discussed, around all those who were aware of the regeneration stake(s) identified during the interviews and communicated with others about that (those) stake(s). SNA researchers distinguish between ego-centred and whole network analyses (Prell, 2012). In this paper, the whole network approach was used, requiring that all possible participants in the network are considered in the analysis, rather than only a sample.

Second, the survey included questions by which respondents were asked to identify those they communicate with. These are called *name-generator* or *recall* questions (Prell 2012) and they provided researchers with relational data on stakeholder relationships. It was discovered not only who is a stakeholder in regeneration but also who are the other actors whom the respondent identified as stakeholders. Since communication is a reciprocal relationship, it was possible, as shown below, to establish how accurate this identification is: if actor A identified B as a stakeholder of regeneration, B was in turn asked if he or she self-identified as such.

Recall questions were used to continue the snowballing started at the exploratory stage, by requiring a set number of responses. As stakeholders were identified by a criterion that was essentially individual and relational (e.g. only A knows if he or she communicates with B or C, but not D), snowballing appeared to be the only applicable method. The snowball procedure needed to be applied until no new names were mentioned (Bryman, 2008). If this was unfeasible in practice, Knoke and Kuklinski (1982) argued that it was sufficient to start from an initial list of actors, identify a first "zone" of respondents' nominations and, if needed, identify a second zone of nominees' nominations (Prell, 2012), as detailed in section 5.2.2.

The expected output of SNA was twofold. First, it enabled the mapping of nodes and ties. Network maps are useful in that they offer "intuitions and insights into […] key locations within a connected population" (Hansen et al., 2011, p. 5). In the hypothetical case in Figure 1, boxes A to L are vertices, while the lines connecting them are edges. For example, if a tie referred to "knowing someone involved in brownfield regeneration", the network map in Figure 1 helps identify the *most popular* ("best known") actors in the network, in this case actors L, D and E.

Second, SNA provided a number of quantitative measures to characterize the network as a whole, individual actors within the network or specific subgroups in the network (Prell, 2012; Scott, 2014). Different measures capture different patterns of embeddedness.

Figure 1. [Approximately here] Example of a social network with 12 vertices and 15 ties. Source: authors' simulation using NodeXL software.

The network as a whole can be measured by its density and diameter or average path length. Density is a rough measure of how cohesive a network is while the diameter measures how far actors are from each other (Prell, 2012). The density of a network represents the number of actual ties in the network in the total number of theoretically possible ties. The density of the network in Figure 1 is 15/66[3] = 23%. Network density can vary between 1, which means that every node is connected to all the others and 0, in which case no node is connected to any other node. Bodin and Crona stated that "the more social ties, the more possibilities for joint action and other kind of collaborations" (2009, p. 368).

The diameter is the longest geodesic distance, where a geodesic is the shortest path between any two actors (Prell, 2012). The average path is the average of the geodesics in the network. In Figure 1, the diameter of the network is 4, for example from actor A to actor J. The average path length for the same graph is 2.

Components are groups within the network, whereby all the actors in a component are connected to one another by at least one path (Prell, 2012). In Figure 1 there is only one

[3] The formula for density: $d = L / n(n-1)/2$, where L is the number of ties in the network and n the number of nodes (Prell, 2012).

component, since each actor can be reached starting from any other actor. However, disconnected components reveal a fragmented network.

The direct influence that an actor has in a network is measured by his or her degree centrality. This measures the number of direct ties of an actor to others. In Figure 1, actor L has the highest degree centrality (6 ties), followed by actor D (5 ties) and actor E (4 ties). Having reviewed these basic methods, the next section shows how these methods were applied to the regeneration of Area 2 of Porto Marghera.

4. The application of SNA to stakeholder involvement in regeneration

4.1 *Case study of Area 2 regeneration*

Within the EU-funded research project "Nexsus" (Network-Based Expert-Stakeholder Framework for Sustainable Remediation), a case study on stakeholder involvement in regeneration was completed. The study site is a 8.8 ha large brownfield area located in the first industrial zone of Porto Marghera, Venice, Italy. Area 2 belongs to the Venice Gateway Science and Technology Park (henceforth Vega STP). The Vega STP is subdivided into four areas, numbered 1, 2, 3 and 4 (Vega, 2006). Area 1 has been regenerated between 1993 and 2006 and now hosts the six buildings of the Vega STP.

Area 2 covers the former petroleum coastal depots of the Agip company (currently Eni). Land reclamation was carried out with biopiling, by fertilizing the soil to remove hydrocarbons by bacterial digestion. A total of 34,000 tonnes of soil[4] were remediated between 1998 and 2002, which represents the most important project in Italy using this technique. The reclamation returned a highly attractive piece of land that overlooked a waterway leading into the Venetian lagoon.

Following a second remediation stage between 2009 and 2010, the redevelopment of Area 2 started in 2012 with the construction of the Expo Venice pavilion. The Expo was an official side event of the Universal Exposition in Milan and its theme was "Water". The exhibition hall covered an area of 10,000 m^2 and provided a flexible exposition space. The pavilion was part of a wider project of urban regeneration *cum* real estate development called Venice Waterfront (Condotte, 2015).

4.1.1 Identification of the stakes of regeneration on Area 2

The semistructured interviews revealed that, since 2012, there was a distinct urban regeneration phase on Area 2. Once the clean-up process was completed in 2010, those involved became increasingly interested in redeveloping the newly remediated area. The interviewees explained that this is a challenging process, for several reasons. First, the research and development functions that the "old" Vega STP had sustained over the years could not simply be continued on Area 2. This was due to a decline in investment for technological platforms and a concomitant lack of demand for R&D space from those sectors (nanotechnology or ICT) that had previously driven the growth of Vega STP (SCR07, DI01[5], Venice, 2014). Second, there was consensus among the interviewees on the need to rethink the uses of the newly remediated land. One of the decision makers called this approach "place making": "[this] is a process in which you put in a greenfield or in a brownfield [a] temporary use destination […] to start a new positive loop for the development of this field" (DI07, Venice, 2014). The Expo Venice pavilion was the first step in this process. While this was

[4] The hydrocarbons present in the soil included benzene, ethylbenzene, toluene, APH high tox. and APH low tox.

[5] These are identifiers for the interview respondents, based on their stakeholder category: SCR is a member of the scientific community and research category, while DI is a developer investor (for a description of all stakeholder categories on Area 2 see section 5.3.1). The numbers (01, 07) attached to each category refer to individual respondents, while preserving their anonymity.

being completed, the interviewees also suggested three redevelopment scenarios consisting of specific projects.

The first scenario contemplated an expansion of the exposition space on Area 2 through three distinct urban regeneration endeavours. The Venice Waterfront was proposed as a "multifunctional urban district" with two main towers that could become a "true landmark of the new urban landscape" by 2019 (Condotte, 2015). The second was the Green Tree Strategy, an ambitious and far-flung concept starting from the waterfront and enveloping the whole Porto Marghera area by "welcoming new processes of urban regeneration" (Condotte, 2015). The third project – Primo Ramo – was a micro-scale illustration of the Green Tree Strategy aimed to rejuvenate the perception of the old Vega STP.

The second scenario envisioned a continuation of the current activities of the Vega STP, by encouraging spin-off, start-up, and innovative enterprises in the form of business incubators (SCR07, 2014). The third scenario was based on an academic project associated with the IUAV University of Architecture in Venice under the name "W.A.VE / Urban Archaeology". This was an experimental form of urban design involving students and architecture professors worldwide.

In sum, the three scenarios yielded a number of six specific regeneration stakes for Area 2[6]. SNA analysis requires that the determination of networks is stake-specific. As it was impractical to consider all six stakes in the SNA survey, the researchers chose only those stakes that were known to all eight interviewees and in which the envisioned redevelopment took place within the physical limits of Area 2. The two stakes chosen for the SNA survey were the completed Expo Venice (2015) and the near-term Venice Waterfront (2015 – 2019).

Interestingly, both projects were associated with a heightened level of stakeholder input. For example, "mixing ideas", "doing business together", "thinking of projects in common" among different people (DI07, Venice 2014) and looking for new cultural questions and "sharing goals" (AC03, Milan, 2014) within urban communities were emphasized by two respondents. "Bridging" producers and end users (SR07, Venice, 2014) was an important aspect of regeneration for a third interviewee. From these and similar ideas, it was inferred that connecting diverse stakeholders was a distinguishing mark for this new regeneration phase.

4.1.2 Identification of stakeholders

The Nexsus researchers carried out eight semistructured interviews with eight specialized informants, in late 2014 and early 2015, averaging about one hour. Starting from the first respondent, snowball sampling was used so that each of the next respondents was recommended by a previous interviewee. The first respondent was a university professor from one of the Venetian universities and a former CEO of the company managing the Vega STP. The second interviewee, the current CEO of the Vega company, played a key role in describing the then-current stakes of regeneration on Area 2. The other six respondents were asked to elaborate or comment on those stakes, and they included two representatives of the Venice municipality, two of the Venice Port Authority, an environmental expert and an architecture consultant. All of these specialized informants conveyed their views in some decision-making capacity, either as current or former decision-makers or influential neighbours of the site.

Figure 2 [approximately here]**.** Example of an ego-centred network for DI01 (developer/investor)
Note: Dotted lines represent groups of actors; arrows suggest links among alters.

[6] The six projects are: Expo Venice, Venice Waterfront, Green Tree Strategy, Primo Ramo, Vega Incubators and W.A.V.E/Urban Archaeology.

In the conclusion of five of the eight interviews, respondents were asked to draw their ego-centred network "maps", with the aim of establishing a link between their stakes in regeneration and the alters they discussed those stakes with (Figure 2). In this way, the identities and contact details for the initial list of survey respondents were collected and a qualitative picture of the stakeholder categories involved was obtained.

4.2 ***Social network analysis: The Nexsus online survey***

Surveys designed to collect SNA data need to ensure easy completion and anonymity for the respondents and speed and ease of administration for the researchers. For these reasons, the online survey tool "SurveyMonkey" was chosen for constructing and distributing the survey.. This section briefly introduces the structure of the online survey and presents the snowballing approach used.

4.2.1 The structure of the survey: Regeneration stakes and networks

The online survey was structured into four main sections. The first section was designed to collect information on the social network of those communicating on regeneration[7]. Respondents were asked, via open-ended name-generator questions, to provide the names and organizational affiliation of up to five individuals, from outside their own organization, with whom the respondent had communicated most often (literally "has spoken to") on the regeneration of Area 2, for professional purposes, over the last year[8]. The number of choices was limited to five to avoid overburdening the respondent. However, a control question was asked about the extent of the network beyond the 5 names indicated.

The second and third sections asked the same network and control questions in relation to Expo Venice and the Venice Waterfront, as two urban and landscape regeneration projects. The aim was to learn if those who communicate on the regeneration of Area 2 also have the communication channels to debate – and perhaps reach agreement on - these specific regeneration goals..

The last section collected information on the categories to which stakeholders belonged, on the sustainability practices of their organization and on their decision-making role in the regeneration of Area 2. Secondary sources, such as project documentations, were also used to complement the information from the interviews and surveys.

The survey was translated into Italian, pretested with two experts, and applied via SurveyMonkey. The expected results of the survey are an overall "regeneration of Area 2" network and two goal-related networks (Expo Venice and Venice Waterfront).

4.2.2 Snowballing

An initial list of 81 potential respondents identified during the "ego-centred network" exercise was developed. Their email addresses were either provided by the respondents or retrieved from the websites of the organizations to which they belonged. All these individuals received an email with a link to the Nexsus online questionnaire. The completed surveys were first analysed for the name generator questions. All the new nominations, those who were not included in the initial list (N=81) formed the first sampling zone (Knoke and Kuklinski, 1982), consisting of 64 names. These individuals were invited, in turn, to fill out the online survey. Their responses generated further nominations, 8 new names, which formed the second sampling zone. As none of the latter individuals returned any completed survey, the sampling process was stopped.

[7] The first section also included a set of questions related to sustainability goals in regeneration. The analysis of these responses will be featured in future publications.
[8] The question dealing with the regeneration of Area 2 in general was suggested by a specialized informant during the pretesting of the online survey.

The snowballing approach pursued here aimed to describe the complete network of stakeholders. The initial list and the two sampling zones ought to describe – theoretically - the whole network (see Figure 3).

The survey was sent to a number of 153 individual respondents, out of which 50 have provided complete or partial responses, for a response rate of 33%. The response rate varied by sampling zone, from 43% in the initial list, 23% in the first sampling zone and 0% in the second. This can be explained by circumstantial factors, for example by the fact that several respondents from the initial list and from zone 1 knew the researchers personally and likely had a greater incentive to respond.

The accuracy of nominations also varied among the sampling zones. A total of 13 respondents (9 from the initial list and 4 from the first zone), provided a negative response to the question whether they have communicated on the regeneration in Area 2 over the last year, although they were nominated by others as being their interlocutors. These cases had to be eliminated from the analysis. Along with the response rate, a network detection accuracy of the sampling method is needs to be specified when applying SNA to stakeholder involvement[9]. This measures the percentage of respondents who confirmed that they are part of the network. It is dependent on the response rate and has a value of 79% for the initial list and 73% for the first sampling zone.

Figure 3 [approximately here]. Graphic representation of the sampling zones used for the SNA.

The social network data collected were analysed with NodeXL Excel Template 2014 (version 1.0.1.354)[10], a dedicated software that supports the visual and analytical exploration of network graphs.

4.2.3 Benefits and limitations of the applied methods

The main benefit of combining semistructured interviews and SNA resulted in network maps displaying both stakeholders and the informal channels connecting them. Using the name generator combined with snowballing until no new names emerged allowed the identification of the whole network. Finally, the survey provided information to map communication channels not only among individual respondents but also for different stakeholder categories and different stakes.

The limitations for both the qualitative and quantitative research stages were context dependent. Both methods required a high level of interest and participation on the part of respondents, which was only partly met in the case analysed. First, although a focus group was initially planned to validate the stakes identified during the interviews, interviewees' feedback showed that a follow-up discussion might overburden the respondents and prompt a withdrawal from the study.

Second, the same risk had to be considered in designing the SNA questions within the survey. These questions needed to be asked in three separate sections, and the research team decided to limit to 5 responses each name generator question, rather than asking for 10 names in each section. The latter was actually the average number spontaneously nominated by the respondents in drawing their ego-centred networks. Moreover, the control question prompting

[9] The formula is: NDA = A_c/A_r x 100, where A_c is the number of respondents who confirmed to be part of the network in the initial list or in a sampling zone and A_r is the total number of respondents in the list or zone.

[10] This version was released on October 12, 2015. The main features used are: Graph metric calculations (e.g. for degree centrality, network density and size), flexible layout and adjusted appearance (e.g. for highlighting decision-makers) and dynamic filtering (e.g. for displaying the Expo Venice and Venice Waterfront sub-networks).

respondents to estimate how much larger their network might be beyond the 5 names given, showed that the personal networks of almost two thirds of the respondents were more than 50% larger than their nominated interlocutors, while for another third the network was up to 50% larger. It is recognized that a large number of stakeholders and communication ties were missing from the picture.

Third, this limitation was compounded by the low response rate on the SNA questions. This was driven partly driven by the lack of interest or time to complete the survey, confidentiality concerns or faulty email addresses. Of the 50 individual respondents, 37 have talked to others on the regeneration of Area 2 during the past year. Of these, 32 have named other individuals with whom they communicated, while three respondents had erroneously mentioned organizations rather than people as their interlocutors. This left 29 respondents to be considered as part of the Area 2 regeneration network. The response rate for the SNA question was thus 19% (29 of 153).

Fourth, since the stakeholder selection started from decision-makers, this was useful for exploring how the stakeholders seen as important by decision-makers were actually embedded in the latter's network. Had the initial selection started from non-decision-makers or individuals at lower hierarchical levels, a different network configuration might have emerged. Future research is needed to explore regeneration networks starting from different hierarchical levels.

For these reasons, the results reported for the Area 2 case should be interpreted with caution. By inductive reasoning, it was nevertheless possible to derive three distinct indicators by which to characterize the actual embeddedness of stakeholders in comparison to the importance and roles assigned to them by the decision-makers.

5. Findings and discussion

In sections 3 and 4, the first objective of the paper was pursued, by describing and applying two methods to study who is involved in regeneration and why[11]. This section addresses the second objective by developing from the Area 2 case three indicators. The first shows how levels of social embeddedness varied among different stakeholder groups (section 5.1). The second reveals how coherent the network of stakeholders was when different regeneration goals were considered (section 5.2). Third, it is shown how the distance between each non-deciding network member and decision-makers is highly variable (section 5.3). First, some general remarks on the network as a whole are reported below.

The name generator question was answered to different degrees by the 29 network members: 41% provided all five names, 62% mentioned at least four names, 90% indicated at least three names and 100% at least two names.

The overall network included 112 actors and 234 ties connecting them. The density was low at 0.14[12] , which had both positive and negative implications (Scott, 2014). Low density allows for diversity of action and innovation, while it is also associated with a low spread of information and difficulty of coordinated action (Janssen et al., 2006). The diameter of the network was 9, while the average geodesic distance between any two actors was 4. Along with the low density, this underscores that the network was not well connected: it took four ties, on average, to find an informal communication channel between any two actors.

These figures suggest a relatively sparse network, as can also be observed in Figure 4. The sparseness is given by regions of variable density, which have implications for the effectiveness of communication. The centre of the network has a relatively dense pattern of communication ties, which means that, for example, actors DI01[13], DI06, NR03_PL03 and

[11] To paraphrase Reed et al. (2009).

[12] From a theoretical maximum of 1680 ties (112 vertices x 15 possible "choices" for each) only 234 ties were present: 234/1680 = 0.14

[13] The acronyms are explained in Table 1.

AC05 can communicate with ease among themselves, either directly or via several intermediaries (the central red shapes in Figure 4). In contrast, the peripheries are weakly connected to the rest of the network, often via a single “bridging” actor. For example, SCR17-OC07 is connected to the centre of the network via two actors, but SN14, SCR10 and the eight actors located in the fan-shaped structure (left bottom part of Figure 4) are entirely dependent on him to pass their messages along.

The network also had two components that suggested fragmentation: a large one of 106 actors and a “star” of 6 actors unconnected to the large component (bottom part of Figure 4). Although they communicated about the regeneration of Area 2, the latter actors could not exchange information with the rest of the stakeholders, which represents a barrier in the flow of information.

Figure 4. [Approximately here, colour on the web, black-and-white in print] The Area 2 regeneration network
Note: The symbol for each stakeholder group is specified in Table 1.

5.1 *The social embeddedness of stakeholder categories*

There is widespread interest in land management to develop stakeholder classifications for both analytical (top-down) and action-oriented (bottom-up) goals (Reed et al., 2009). The present analysis mapped a Europe-wide classification of brownfield regeneration stakeholders (Rizzo et al., 2015) onto the social network of Area 2. The aim was to differentiate the embeddedness level of various recognized stakeholder categories. Of the 16 categories, 11 were confirmed in the present case study (see Table 2 and Figure 4). There were 5 new categories in Table 2, mostly local specifications of the categories from Rizzo et al (2015). For instance, in addition to the municipality (LAM), the Venice Port Authority (LAP) had a say in decision-making. Architecture consultants, especially landscape architects, were found to play an important role in the regeneration of Area 2, as they do in urban regeneration processes generally (Williams and Dair, 2007). Political leaders, as distinct from representatives of government authorities were also identified as key players on Area 2 (REVIT, 2007). Reflecting the strong industrial heritage of Porto Marghera, representatives of industrial associations and trade union leaders also figured among the stakeholders of this regeneration process.

Stakeholder categories (Rizzo et al. 2015)	**Percentage of total**	**Label**	**Symbol**
Site owner*	N/A	SO	N/A
Site neighbour	12	SN	▲
Local authority municipality	13	LAM	■
Local authority Port	4	LAP	■
National Regulator	3	NR	◆
Public interest groups	4	PI	△
Developer investor	6	DI	●
Technology providers	4	TP	•
Architecture consultants	17	AC	○
Other consultants	5	OC	∘
Financiers	1	FIN	◇
Media	2	M	◇
Scientific community and research	15	SCR	▲
Industrial & commerce chambers	11	ICC	□
Political leaders	3	PL	◆
Trade union	2	TU	△
Total	100		

Table 1. Stakeholder category identification (N=112), labels and symbols.
Source: Rizzo et al. (2015) and authors' own data.
* New categories are in italic. Two site owners (SO) have been assigned to other categories which described them better.

The individuals in the 16 stakeholder groups differed on the number of ties they held[14]. The number of ties indicates how well a given stakeholder category is embedded within the network (see section 4.2). The more communication ties stakeholders in one group have among themselves and with others, the easier it is for them to access information or articulate their interests within the informal negotiations that often precede the formal decisions.

Stakeholder categories (Rizzo et al.2015)	**Average degree centrality**	**Normalized degree centrality**
Developer investor (including site owner)	**5.9**	**1**
National Regulator	**4.7**	**0.76**
Trade union	**4.5**	**0.71**
Local authority municipality	**4**	**0.61**
Technology providers	3.8	0.57
Local authority Port	3.3	0.47
Political leaders	2.7	0.35
Architecture consultants	2.6	0.33
Scientific community and research	2.6	0.33
Industrial & commerce chambers	2.3	0.27
Site neighbour	*1.5*	*0.10*
Local and regional authority transport	*1.4*	*0.08*
Public interest groups	*1.2*	*0.04*
Other consultants	*1*	*0*
Financiers	*1*	*0*
Media	*1*	*0*

Table 2. The average degree centrality and normalized degree centrality for the nodes in each stakeholder category (high values with bold, low values with italic).

[14] The average degree centrality for all nodes is 2.8

Some of the decision-makers of the Area 2 regeneration indicated during the interviews whom they considered important to communicate with. The 15 categories spontaneously mentioned by five respondents overlap in part with those in the Area 2 network. This allowed an assessment of how well certain stakeholders mentioned by the respondents are embedded within the communication network of Area 2. As expected, stakeholders representing the Venice municipality and port authority as well as national authorities – which were among the top choices of the interviewees – were well embedded. In contrast, other categories, including research & development and industrial associations, universities and public interest groups, that figured among the preferences of some interviewees, were far less well connected, with the exception of technology providers (see Table 2). On the other hand, categories that hardly figured in the interviews, such as developers and investors or trade unions[15], had top centrality scores. The discrepancies between the stakeholder groups discursively identified as important in a regeneration process and the groups actually well connected within the stakeholder network suggest that additional channels need to be built to ensure that the relevant stakeholders are also part of the decision-making process.

In addition to the (absolute) degree centralities in Table 2, a relative embeddedness indicator can be calculated for each stakeholder group, by normalizing the distribution (column 3). This indicator (varying between 0 and 1) allowed the measurement of how well each stakeholder category partakes in informal exchanges in relation to others[16]. Given the stakes of Area 2, namely urban regeneration via expositional spaces and redesigned urban landscapes, the opportunities of interaction and exchange (via workshops or focus groups) should be enhanced for universities, various cultural associations and site neighbours (García, 2004).

5.2 *Social networks and regeneration stakes*

It has been observed in land regeneration that stakeholders often adhere to different visions of development (Cundy et al., 2013; Pierce et al., 2011). Once a regeneration process is underway, however, one can expect that stakeholders will agree on both the overall regeneration process and on its immediate and short term stakes. In the Area 2 case, these stakes were the Expo Venice and the proposed Venice Waterfront. As a minimal condition for reaching an agreement on regeneration goals, the existence of informal communication channels functions as a proxy.

The issue of regenerating Area 2 was a topic of communication for two distinct network components: a large one comprising 95% of nodes and a small one (5%). This meant that within the overall regeneration process, only a small group was isolated from the main component. For the Expo and Waterfront projects, the coherence of the networks supporting these stakes fell apart. In the Expo network, there were only 72 actors who were split into one major component (71 % of nodes) and five smaller unconnected components, while the Waterfront network included only 45 actors divided among one main component (64% of all nodes) and three smaller components. These multiple components suggest that stakeholders often find themselves as disconnected “oases” in a veritable “communication desert”. While the need to regenerate Area 2 is widely recognized, informally negotiating the terms in which this should be done appears as nearly impossible.

Figure 5. [Approximately here] Maps for the “Expo Venice” (**α**) and “Venice Waterfront” (**β**) social networks

[15] For this category, the figure should be interpreted with caution as there are two representatives, only one of them very well connected.

[16] More finely tuned indicators, based on the distinction between intra stakeholder group communication and communication with other groups, can also be developed but will not be presented here.

The proposed indicator for goal-specific network coherence can be calculated by dividing the total number of stated goals for a regeneration project by the total number of network components corresponding to these stakes. For Area 2, the value of the indicator was 3/(2+6+4) = 0.25. For an ideal case, in which each stake has only one network component, which means one fully integrated communication network for each stake under discussion, the result would be 3/(1+1+1) = 1. By using this indicator and the stake-specific network maps, it is possible to identify which communication channels need to expanded from regeneration in general to a particular regeneration goal.

5.3 *The relative accessibility of decision-makers*

Based on self-identification within the Nexsus survey and on secondary information, a number of 12 decision-makers were identified in the Area 2 regeneration. SNA enables taking into account both the formal decision-making position and the informal influence (degree centrality) (Bodin and Crona, 2009). The expectation that the self-identified decision-makers occupy key locations in the network was empirically supported for several of them. The degree centralities of these actors, 18 for developer DI01, 15 for the architect AC01, 12 for the national regulator NR03_PL03 and 11 for the industrial association representative ICC0311 showed that their formal influence was buttressed by informal prestige (Figure 6).

Hou and Al-Tabbaa (2014) underscored the role of key stakeholders – such as site owners/developers or consultants – in exerting pressure on other stakeholders to improve remediation practices. By reversing the direction of influence, can stakeholders with no formal decision-making roles "exert pressure" on decision makers? What channels are there to allow non-decision-making stakeholders connect to decision-makers? Figure 6 suggests that while some actors have ample access to decision-makers (developer-investor DI06 having no less than six direct connections, red in Figure 6), others have only indirect connections (e.g. site neighbour SN02, with blue).

Based on this, an accessibility indicator was developed for all non-decision makers. This counts the inverse of the geodesic (shortest possible) distance from each stakeholder to a decision-maker, multiplied by the number of decision-makers found at that geodesic distance. After normalizing it[17], the accessibility of decision-makers for the Area 2 network was calculated (see Table 3).

For each non-decision-maker, there were….	Accessibility indicator values	Percent of cases
No accessible decision-maker (disconnected stakeholders)	0	6
Closest decision-maker(s) (1 or 2) *three* ties away or further	0.13 – 0.33	19
Closest decision-maker(s) (1 or 2) *two* ties away	0.25 – 0.5	32
Direct tie to *one* decision-maker	0.5	30
Direct tie to *two* decision-makers	1	13

Table 3. Accessibility of decision-makers based on distance and number of decision-makers.

Figure 6. [Approximately here, colour on the web, black-and-white in print] Direct (red) vs. indirect (blue) connections with decision-makers (red shapes).
A new graph for Figure 6 is attached.

[17] The normalization was done based on the highest value of the indicator, which was set at 2 after removing the outlier value of 6.

Almost one third of the stakeholders had a direct tie to a decision-maker, as expected given that the snowball selection started from several decision-makers. Moreover, 13 stakeholders can be said to have privileged connections with two or more decision-makers. However, the data also showed that slightly over half of all network members had only indirect connections to decision-makers, some as far removed as four ties. Worse still, six stakeholders, the ones representing the second isolated component, had no access to decision-makers at all via the existing ties. Considering decision-makers' interest in stakeholder dialogue and collective thought processes, their low (i.e. indirect) accessibility to other stakeholders is an obvious concern. This can become critical for those stakeholder groups deemed most important for a given regeneration goal.

6. Conclusions

To summarize, the regeneration goals and stakeholder groups supporting them were identified in a context-specific way through interviews with decision-makers. Via snowball selection, the network of actors communicating on the regeneration of Area 2 was delineated, even if subject to limitations. SNA then helped reveal different patterns of embeddedness and three indicators for exploring the informal connections among regeneration stakeholders were suggested. These indicators suggest the wider applicability of SNA to study stakeholder involvement by comparing the desired with the actual level of involvement, whether defined by top-down or bottom-up criteria.

The present case study showed that the social embeddedness of stakeholders in relation to this regeneration process had several shortcomings. Learning from them, a baseline for more effective involvement strategies is proposed for each indicator.

The differential embeddedness of stakeholder categories pointed to two interrelated problems. First, the overall level of connectedness among stakeholders was low, with 2.8 ties on average and a network density of 0.14. Second, some of the groups that were discursively important for decision-makers, in terms of providing unique insights into the regeneration process had very few channels at their disposal to make their views heard. By creating opportunities for informal exchanges within workshops, conferences or focus groups, the number of ties can be expanded. Particular attention is to be paid to the stakeholder groups identified as isolated or very weakly connected.

The combination of semistructured interviews and SNA showed that the overall coherence of a regeneration network can be deceptive. When probed at a deeper level, by asking about specific projects, the network fell apart into smaller components. This indicates that the stakeholders of a given regeneration process might hold only a general stake in it, while at the same time pursuing dissimilar goals within the overall process. If this is a communication problem, SNA can help rectify it. By knowing the layout of the overall network, stakeholders can use the same channels to expand the content of their communication, from general to specific regeneration topics.

Finally, the ability to measure the shortest distances between decision-makers and those who would convey their expectations to the former is a key strength of SNA. More than half of the regular network members in Area 2 were either disconnected or only remotely connected to decision-makers. As before, SNA indicates who are the stakeholders likely to be disenfranchised from a communication point of view. This situation can be addressed by formally instituting communication channels and grievance mechanisms.

Acknowledging that SNA is a data-intensive method, future research on the social embeddedness of stakeholders in regeneration would benefit most from cases with the following characteristics. First, the stakes of the regeneration topic chosen for investigation should be highly salient and important for a variety of stakeholders to ensure the availability of interview and survey respondents. The geographical context may also play a role in this, as Western European actors are considerably more experienced and willing to engage in debates compared to their Eastern counterparts, who are often reluctant to place this issue on the public agenda (Alexandrescu et al., 2014).

Second, the desirability of stakeholder involvement should be among the priorities of decision-makers. This would enable researchers to identify both regeneration goals and the stakeholders who support them and calculate the indicators suggested here on a solid empirical basis. A highly connected network would allow the development of more specific indicators for all three issues. Third, SNA is highly compatible with action-oriented and transdisciplinary research, in which the stakeholders themselves learn to use the tools of social science, including SNA, to enhance their communication and collective definition of goals.

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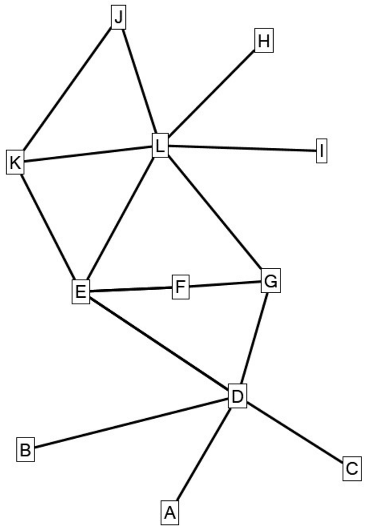
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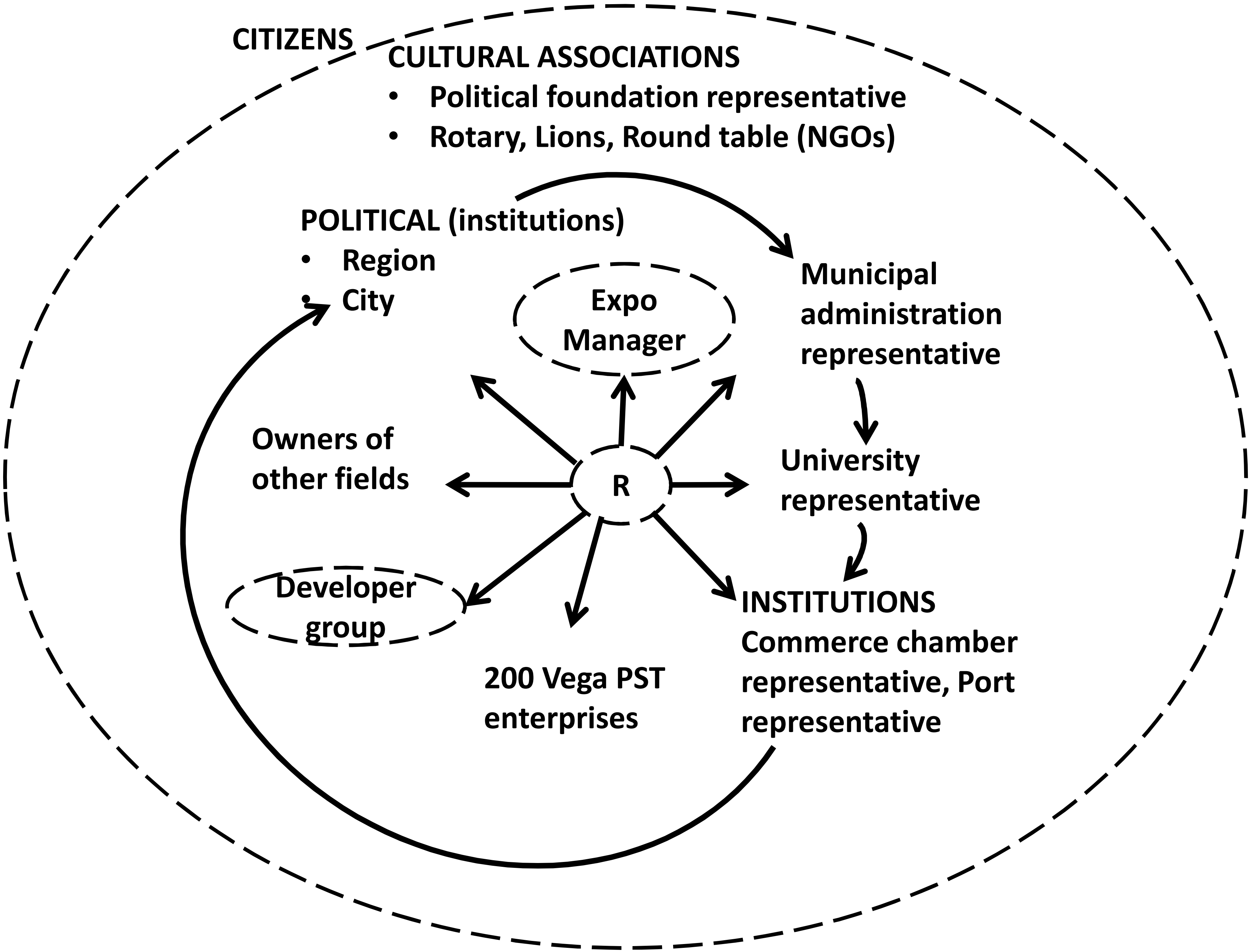
CITIZENS
CULTURAL ASSOCIATIONS
Political foundation representative
Rotary, Lions, Round table (NGOs)
POLITICAL (institutions)
Region
City
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Expo Manager
Owners of other fields
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University representative
Developer group
200 Vega PST enterprises
INSTITUTIONS
Commerce chamber representative, Port representative

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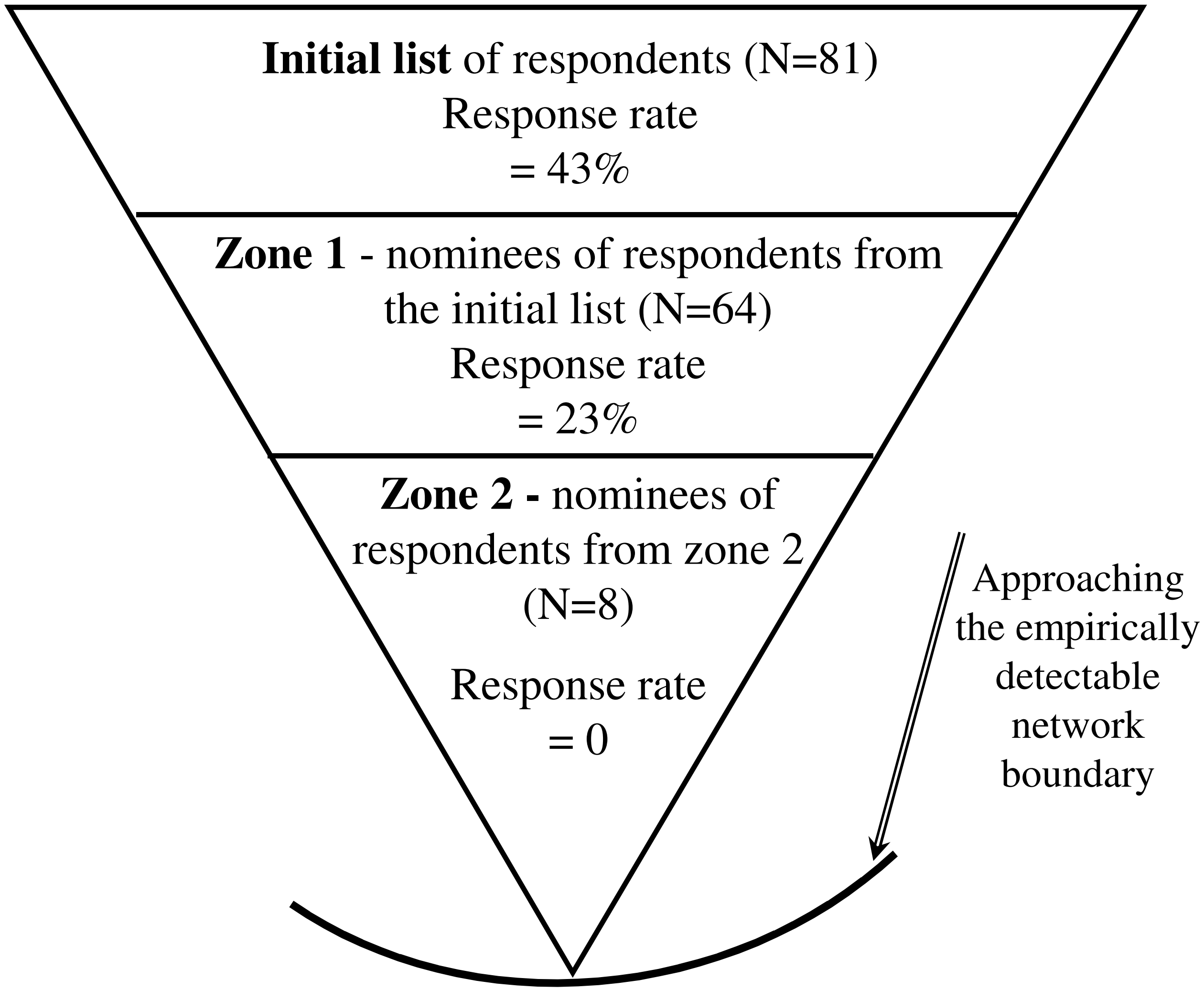
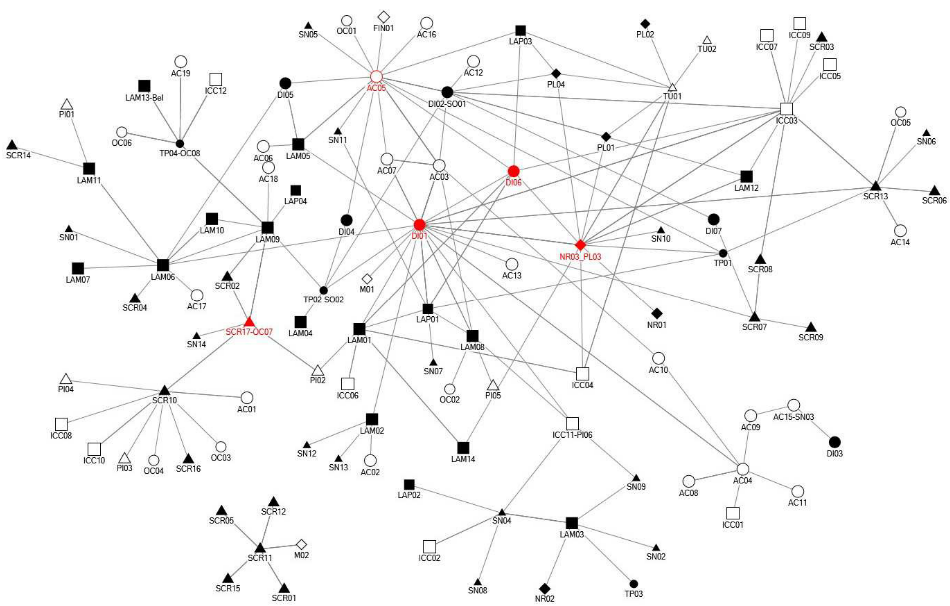

Initial list of respondents (N=81)
Response rate
= 43%
Zone 1 - nominees of respondents from the initial list (N=64)
Response rate
= 23%
Zone 2 - nominees of respondents from zone 2 (N=8)
Response rate
= 0
Approaching the empirically detectable network boundary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AC12
PL04
TU01
PI01
DI02-SO01
ICC03
OC05
SN06
OC06
TP04-OC08
SN11
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SCR14
AC06
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AC09
AC15-SN03
ICC08
LAM02
ICC11-PI06
DI03
ICC10
PI03
OC04
SCR16
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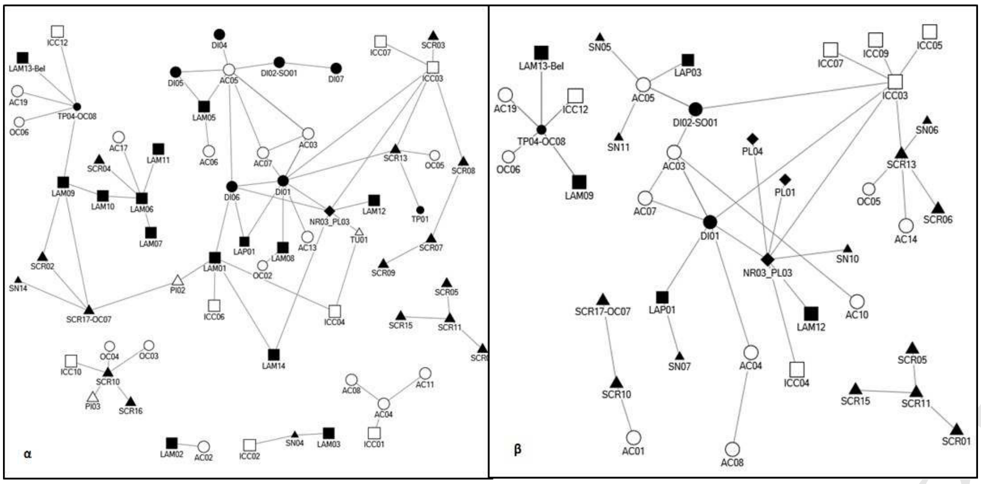

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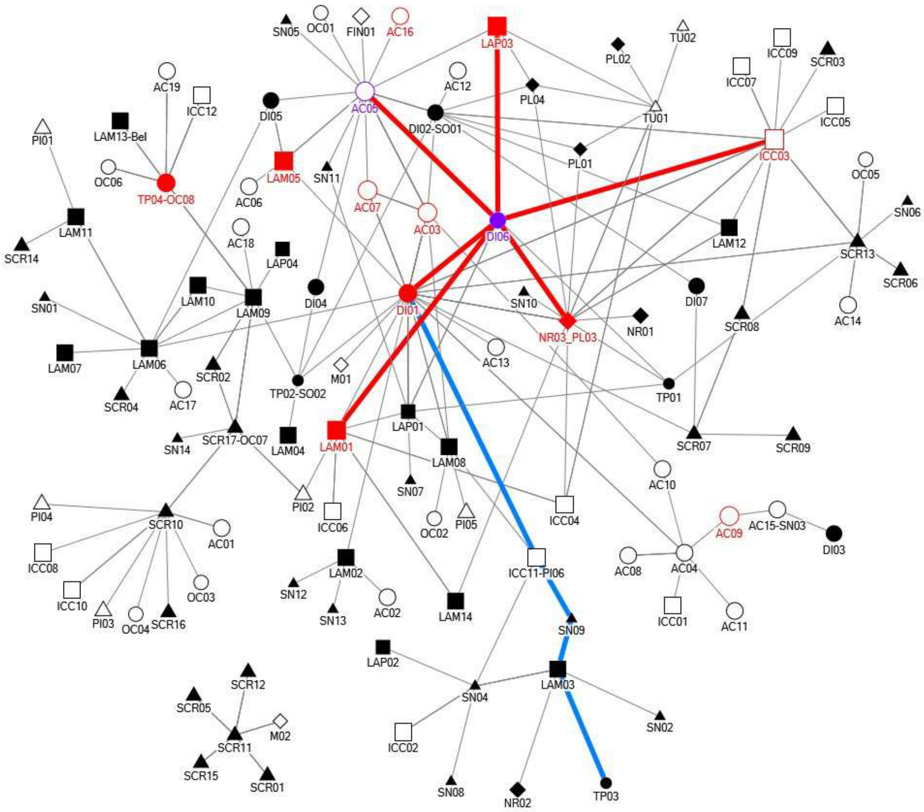

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Highlights

- Stakeholders are not involved in projects in isolation but are socially embedded in them
- Semistructured interviews and social network analysis (SNA) were used to differentiate among patterns of embeddedness
- The case study concerned a regenerated brownfield in Porto Marghera, Italy
- Three indicators of social embeddedness were developed and graphically illustrated
- These indicators can foster stakeholder involvement in regeneration via improved communication