Brownfield regeneration in Europe: Identifying stakeholderperceptions, concerns, attitudes and information needs

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Brownfield Regeneration in Europe: Identifying Stakeholder Perceptions, Concerns, Attitudes and Information Needs

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ABSTRACT

Brownfield areas are a major concern in Europe because they are often extensive, persistent in time and compromise stakeholders' interests. Moreover, due to their complex nature, from the decision-making point of view, the regeneration of brownfields is a challenging problem requiring the involvement of the whole range of stakeholders. Many studies, projects and organisations have recognised the importance of stakeholder involvement and have promoted public participation. However, comprehensive studies providing an overview of stakeholders' perceptions, concerns, attitudes and information needs when dealing with brownfield regeneration are still missing.

This paper presents and discusses a participatory methodology applied to stakeholders from five European countries to fill this research gap, to develop a system to support the categorisation of the needed information and to support the understanding of which typology of information is the most relevant for specific categories of stakeholders also in relation with their concerns.

The engagement process consists of five phases: i) planning and preparatory work, ii) identification of stakeholder categories, iii) engagement activities (e.g. focus groups and workshops), iv) submission of a questionnaire, and v) provision of feedback to the involved stakeholders.

Thanks to this process, appropriate stakeholders have been identified as well as their perceptions, concerns, attitudes and information needs. Stakeholders' perceptions proved to be different according to the country: German and Italian stakeholders perceive brownfields as complex systems, where several issues need to be addressed, while Romanian stakeholders consider contamination as almost the only issue to be addressed; Czech and Polish stakeholders address an intermediate number of issues. Attitudes and concerns seemed to be quite similar between countries. As far as information needs are concerned, similarities between some groups of stakeholders have been noticed: site owners and problem holders are primarily interested in information on planning and financing, while authorities and services providers are interested in more technical aspects like investigation, planning and risk assessment. Some outstanding outcomes emerged from the scientific community and

research group, which shown an interest for remediation strategies and options and socio-economic aspects.

The research outcomes allowed to create a knowledge base for the future development of tailored and customised approaches and tools for stakeholders working in the brownfield regeneration field.

Keywords: brownfield regeneration; stakeholder involvement; stakeholder categories; stakeholder information needs; information categorisation system.

1. Introduction

De-industrialisation and abandonment of productive and mining sites have produced many brownfield areas all over Europe, which represent a major concern for many countries and municipalities. In fact, these sites have adverse effects not only on the economy and environment, but also on the social well-being and quality of life of a region (Alloway, 1995; CLARINET, 2002; Bartke et al., 2013). They are characterised by complex interactions, as indicated by the definition provided by the Concerted Action on Brownfields and Economic Regeneration Network (CABERNET), which defines brownfields as sites that "have been affected by the former uses of the site and the surrounding land; are derelict or underused; have real or perceived contamination problems; are mainly in developed urban areas; require intervention to bring them back to beneficial use" (based on the original CLARINET definition – cf. Oliver et al., 2005).

This complexity requires considerable efforts to successfully initiate and complete brownfield revitalisation processes, including a proper strategy for the involvement of a considerable number of stakeholders with potentially divergent interests (Alexandrescu et al., 2012, 2014b; Schädler et al., 2011; Agostini et al., 2007; Bardos, 2004). Reed and colleagues (2009) speak of stakeholders as any organisation, group or person who takes an interest in a project, or those who have the ability to influence its outcomes. Often, experts and decision makers are understood to be key stakeholders in terms of their perceived critical role in initiating and guiding the redevelopment process. Notwithstanding, the present work will emphasise and recognise the substantial role of the other stakeholders, too.

The involvement of stakeholders in all phases of the regeneration process has been recognised as an important prerequisite towards improving the acceptance of the decision-making process (Cundy, et al., 2013; REVIT, 2007b; RESCUE, 2005). Moreover, at the institutional level, the awareness of the importance of an effective stakeholder involvement lead to the promotion of public participation at brownfields and contaminated sites (Gallagher and Jackson, 2008), especially at local and site specific levels. A notable example is the REVIT project (Revitalising Industrial Sites, 2007a), which encouraged stakeholder involvement, public discussion and local participation in some European cities and urban areas affected by the presence of brownfields (Stuttgart in Germany, Nantes in France, Tilburg and Hengelo in the Netherlands, Medway and Torfaen in the United Kingdom). These activities concluded in the definition of shared redevelopment strategies, stimulated inhabitants to participate in the planning and in the execution of projects, enhanced effective communication and built the needed relationships with future generations (Revitalising Industrial Sites, 2007a). Sparrevik et al. (2011) present a study, where stakeholders were involved in order to collect and evaluate factors affecting their "risk perception of contaminated sediment disposal that occurred during a remediation project in Oslo harbor, Norway". Cundy et al. (2013) described the importance of stakeholder engagement when implementing green versus other remediation options at contaminated sites.

Even though the above described examples clearly demonstrate the importance of stakeholder involvement, nevertheless stakeholder engagement is only one of multiple factors for success in brownfield regeneration decision-making processes, and lately some concern that stakeholder engagement is not living up to some of the claims made is emerging (Reed, 2008). Additionally, inevitable trade-offs have been identified between certain stakeholder requirements on the one side and on the other side the pursuit of a normatively defined sustainable regeneration (Bartke and Schwarze, 2015).

Moreover it has to be taken into consideration that, even though the regeneration of brownfield sites can offer immense development potentials including economic, social and environmental benefits (De Sousa, 2002; Lange and McNeil, 2004a,b; Carrol and Eger Iii, 2006; Ganser and Williams, 2007; Chen et al., 2009; Strazzera, et al. 2010; Syms 2010; Schädler, et al., 2011; Wang, et al., 2011), still the exploitation of these benefits is hampered by uncertainties and information asymmetries (Bartke, 2011, Schädler et al., 2012). Environmental contamination may not be clearly detected, stakeholders' attitudes on a redevelopment might not meet the municipalities' nor the investors' interests. Despite the social desirability, brownfield sites are not perceived as an economically attractive solution for regeneration in the eyes of investors when compared with greenfield sites, as the latter do not require private or public intervention (Thornton et al., 2006; Bartke, 2013).

Furthermore, the availability of information on European brownfields and their regeneration is not always satisfactory to support successful decision making processes. On the one hand, there is a dearth of data on the scale of brownfield sites for a large portion of Europe (Oliver et al., 2005). On the other hand, there is a relative wealth of information on regulations, strategies, guidelines, tools as well as case studies pertaining to brownfield regeneration for several European countries, but this wealth of information is not used in its entire potential (Bartke et al. 2013).

Consideration and integration of the two above described issues, i.e. the importance of stakeholder involvement and the importance of availability and provision of useful information, is considered to be beneficial for successful brownfield regeneration decisional processes since it allows to identify all stakeholders involved in the decisional process and to be sure that all of them have access to the information they need to clearly communicate with each other and to take informed decisions.

This paper aims to present and discuss a participatory methodology for identifying brownfield regeneration stakeholders, for collecting and analysing their perceptions, concerns, attitudes and information needs and for finding out what information is most relevant for their communication and decision-making process.

Accordingly, this paper focuses, first, on what the main categories of stakeholders are, also in terms of stakeholder group perceptions, attitudes and concerns with regard to brownfield sites. Second, it aims to identify a specific range of information needs (included under specific categories) for these stakeholders as well as the information that they deem most critical. Third, this paper investigates whether specific stakeholder concerns are associated with certain information needs.

Within this main aim, a focus will be dedicated to highlight which information needs are the most important, useful and critical for specific categories of stakeholders, in order to define a categorisation system for the collection of information on brownfield regeneration.

The developed methodology has been applied to stakeholders from the case studies of the European project TIMBRE, located in the Czech Republic, Germany, Poland and Romania, as well as to stakeholders from Italy,.

In the following, this methodology of stakeholder engagement is introduced and its five proposed phases are described. Next, the case studies are presented. Section 4 will provide an in-depth overview on the results and discussion, before a final section will outline the conclusions.

2. Methods: The stakeholder engagement methodology

The proposed methodology for the identification and analysis of perceptions, concerns, attitudes and information needs of stakeholders involved in the brownfield regeneration process consists of five phases: 1) planning and preparatory work; (2) stakeholder identification and selection; (3) workshops and focus groups; (4) web-based questionnaire; and (5) feedbacks to stakeholders. The main results expected from the methodology will be derived from the second, third and fourth stages of the engagement process. More exactly, the second stage will help to develop a comprehensive list of stakeholders potentially involved in brownfield regeneration. As part of the third and fourth steps, the stakeholders' profiles will be identified, along with their perceptions, concerns and attitudes on brownfield regeneration. Within these stages, the focus will also be on recognising information needs and highlighting which are the most important, useful and critical for specific categories of stakeholders and in relation with the identified concerns. The final result achieved within these two stages will be to classify the collected information needs within a categorisation system for the collection of information on brownfield regeneration. The above mentioned methodological steps are illustrated in Figure 1, along with the expected results, which are reported as rectangles. The specific motivations and characterisations for the suggested phases are discussed in the following sub-sections.

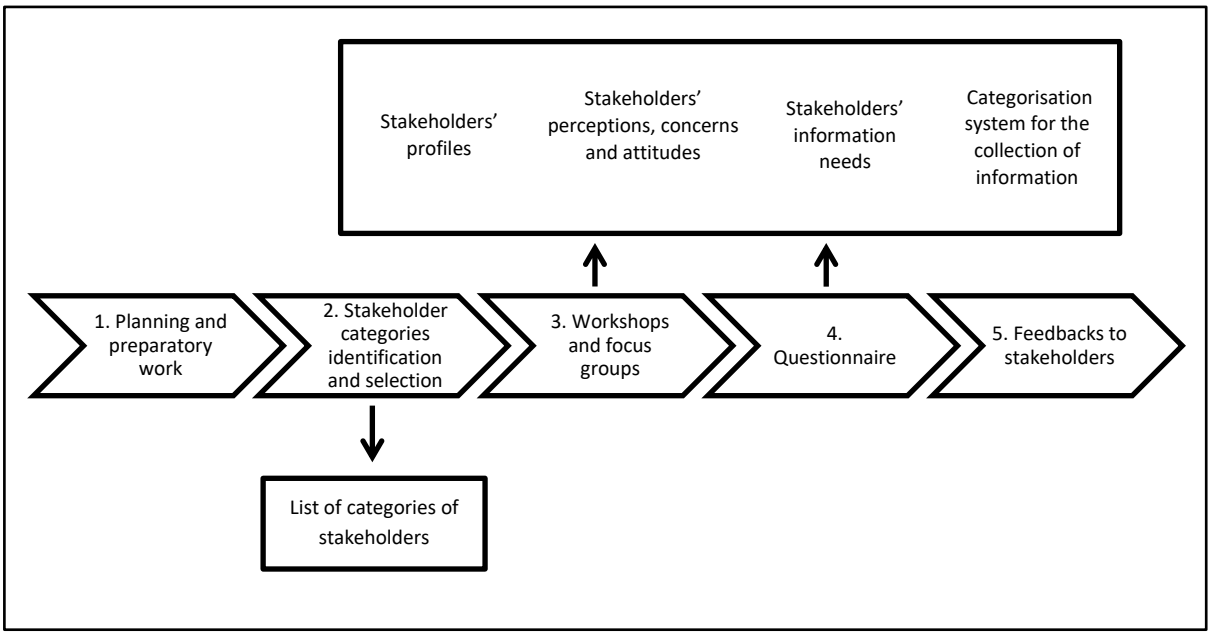

Figure 1 Stakeholder engagement process for the systematic collection of perceptions, concerns, attitudes and information needs.

2.1. Planning and preparatory work

It has been agreed that stakeholders as well as researchers are likely to gain from an engagement process (Rounsevell et al., 2012). Stakeholders can gain extra knowledge about their role within the brownfield regeneration process and their relations with other stakeholders. Researchers can collect useful information necessary for the main aim of their study, and in particular information concerning

stakeholders' perceptions, concerns, attitudes and information needs when dealing with brownfields, which is useful for the development of more tailored methodologies, approaches, tools and strategies in the field of brownfield regeneration. Researchers can then feed-back the outcomes of the engagement process to the stakeholders. Before discussing different forms of stakeholder engagement, the four concepts of perceptions, concerns, attitudes and information needs shall be explained. Stakeholder perceptions are the ways in which stakeholders describe and define a given problem, for example that of brownfields. Their concerns reflect more specifically the negative aspects of those perceptions. The attitudes of stakeholders reveal how important a given problem is for stakeholders, in relation to the things they value (e.g. health or economic costs). Finally, the information needs suggest the kinds of information that stakeholders say they would need in order to deal with a given problem, thus suggesting a proactive stance.

Enengel et al. (2012) differentiate among three forms of stakeholder engagement: a) information, b) consultation, and c) knowledge co-production and empowerment. The involvement of stakeholders with expertise in the field of brownfield regeneration was considered necessary for the achievement of the above listed objectives. The selected degree of engagement is the "consultation" level, consisting of gathering information from participants (Alexandrescu et al. 2014a, Rowe and Frewer's, 2000). Two methods were adopted in order to engage stakeholders: meetings in the form of workshops and focus groups, and an online questionnaire. In fact, it is a common practice to use focus groups in combination with other methods (NOAA Coastal Services Center, 2009), and one of the most common pairings is to combine meetings (i.e. workshops or focus groups) with questionnaires (Morgan, 1996).

2.2. Identification of stakeholders categories and selection of participants

On the basis of the outcomes of the planning phase, the second phase is aimed at defining categories of stakeholders and at selecting participants able and willing to participate in focus groups and respond to a questionnaire (Reed, 2008). Defining the categories of stakeholders relies on expert opinions, focus groups, interviews, literature reviews, or a combination of them (Reed, 2008). Once the categories have been defined, participants must be contacted and selected. This can be done by means of calls for participation in workshops, which aim to mobilise all stakeholders with an interest in brownfield regeneration, and snowball sampling, in which stakeholders contacted during workshops provide references to other potential research participants. One aspect that needs to be considered is the required expertise and knowledge (Glicken, 2000). Glicken (2000) identifies three types of knowledge through which stakeholders can contribute to the engagement process: cognitive knowledge, based on technical knowledge and expertise; experiential knowledge, based on practical and professional experience; and value-based knowledge (socio-political knowledge), based on endorsement of social values.

In this study, key stakeholder categories were identified through a close collaboration between the TIMBRE partners and the expert members of the project International Advisory Board (IAB). For the identified categories of stakeholders, TIMBRE researchers proposed to contact some representatives on the basis of the following characteristics:

- expertise in their field: it was agreed that knowledge and experience in the brownfield regeneration process were fundamental for the value of the engagement process, thus covering the first two types discussed above; and
- propensity to participate: another fundamental aspect to consider was the availability and willingness to participate in the engagement process.

2.3. Workshops and focus groups

As agreed in the planning phase, workshops and focus groups have been selected as the first operative phase of the engagement process. Workshops are meetings where experienced people in responsible positions come together with experts and consultants to find solutions to common problems (WHO, 1987). They have the aim to facilitate the flow of information from experts to researchers, thus having a primary informative rather than data-collection role. As such, they were considered appropriate for the initial stages of stakeholder engagement, in which stakeholders needed to be introduced to the problem and to the researchers and to each other.

Focus groups are a special type of setting used to gather information from a limited number of members of a clearly defined target audience. They are composed of six to twelve stakeholders who are similar in one or more aspects and are guided by a facilitator through a discussion focussing on several related topics in order to gather information about the opinions and expertise of group members in a comfortable environment (Rennekamp & Nall, 2003, Wilcher et al., 2000).

In the proposed methodology, workshops were used mostly to introduce the TIMBRE project and the related issues of concern to participants, to stimulate discussions about their perceptions, concerns, attitudes and information needs concerning brownfield regeneration, to establish a good relationship for the continuation of the study and to present a preliminary structure of the categorisation system for the collection of information on brownfield regeneration. Within this scheme, the main phases of the risk-based regeneration process are identified and correspond to thirteen "information categories" (Rizzo et al., 2013). The proposed categorisation system was the result of an analysis of the available brownfield rehabilitation schemes and frameworks developed in previous programmes and projects on contaminated sites and brownfields (Sanja et al., 2000; NORISC, 2001-2003; RESCUE, 2005; CABERNET, 2006; Pizzol et al., 2009).

Workshops were organised at the Hunedoara TIMBRE project site in Romania, in which the regeneration process is in its incipient phases (– cf. Alexandrescu et al., 2014b), at the Szprotawa project site and in the regional capital Zielona Góra in Poland (Pizzol et al., 2012b).

Stakeholders were contacted through a formal written invitation. In order to avoid loss of information, meetings were held in the languages of the participating stakeholders. Before the involving activities, a facilitator was trained in order to create the right conditions to lead the meetings.

Workshops lasted for several hours and they were structured in two parts. During the first part, the facilitator and the researchers introduced to stakeholders the TIMBRE project and the related issues of concern to stimulate a discussion on possible perceptions, concerns and attitudes, as well as on the above mentioned categorisation system for the collection of the needed information on brownfield regeneration. In the second part of the meetings, stakeholders were asked to provide opinions, comments and suggestions about the proposed system.

Focus groups were used at a later stage in the research process, when respondents seemed to be reasonably familiar with handling information related to the different stages of the brownfield regeneration process, with the aim of discussing the categorisation system and collecting information on their perceptions, concerns, attitudes and information needs.

Focus groups were two hours long and involved a limited number of stakeholders having a broader experience in brownfield regeneration, such as those in Bucharest, Romania, and Ostrava, the Czech Republic. After a brief presentation of the system for the collection of information on brownfield regeneration, the participants were asked to convey and exchange their views on it in terms of its

perceived usefulness for their information needs. As for the workshops, stakeholders were invited to write down comments on a poster displaying the information categories. The discussions between stakeholders were recorded, with their consent, transcribed and translated for later analysis.

2.4. Web-based questionnaire

After workshops and focus groups, the second operative phase consisted in the administration of an online questionnaire to stakeholders. A questionnaire is an individual form of engagement and it consists in a set of questions for obtaining information from respondents. It is a very convenient way of collecting information from a large number of people within a relatively short period of time (Ng, 2006). Questionnaires include two formats of questions (Dillman et al., 2009):

- Closed-ended questions: questions that limit the respondents with a defined list of possible choices from which they must choose the answer (e.g. yes-no, multiple choice, and Likert questions);
- Open-ended questions: questions that allow respondents to develop their own answers.

In this study, the questionnaire was adopted in order to confirm and extend the information collected during workshops and focus groups, and to highlight the differences in perceptions, concerns, attitudes and information needs between stakeholder categories.

Moreover the questionnaires supported: i) to achieve a shared and agreed categorisation system for the collection of information on brownfield regeneration by collecting stakeholders' opinions and suggestions on information categories and by identifying possible gaps; and ii) to identify the order of categories of information from the most relevant to the least relevant one for all information users as a whole as well as for different categories. (iii) The questionnaire also allowed the cross-examination of stakeholders' concerns and of their information needs.

The questionnaire was structured in three parts. In each of them a specific combination of open-ended and closed questions was used:

1. Stakeholders' profile: the participants were asked, via closed questions, about the stakeholder categories to which they belong, and about their main activities related to brownfield regeneration. Given the factual nature of such questions, the closed format was deemed to be the most appropriate.
2. Brownfield perceptions, concerns and attitudes: this part of the questionnaire was used to capture the understanding of respondents about the presence and regeneration of brownfields. The first question was open-ended and asked about the respondent's experience-based description of a brownfield site (stakeholders' perceptions). The second question was closed and was devised to assess the degree of concern that respondents had with regard to ten possible problems generated by the presence of brownfield sites on a scale from 1 ("very low concern") to 5 ("very high concern"). The third question was also closed and asked respondents about the opportunity of brownfields regeneration under different scenarios (stakeholders' attitudes towards brownfields).
3. Stakeholders' information needs and categorisation of information: in the last part of the questionnaire, stakeholders were asked to evaluate and provide comments on a proposed categorisation system for the collection of information on brownfield regeneration (Figure 2). This preliminary structure was developed by the TIMBRE researchers with feedbacks from the workshops and focus groups. Most questions in this part of the questionnaire were closed, with the aim of assessing as precisely as possible the usability of the information structure

according to different stakeholders' needs. For collecting descriptive feedbacks on stakeholders' choices of information categories, open-ended questions complemented the closed ones. Stakeholders were guided through the evaluation of the system with a series of instructions that asked them: a) to select the categories of information on brownfield regeneration fundamental for their work; and b) to rank the selected categories in order of importance, always referring to their objectives within the brownfield regeneration process (from 1, indicating the most relevant category, to n, indicating the n^{th} relevant category of information).

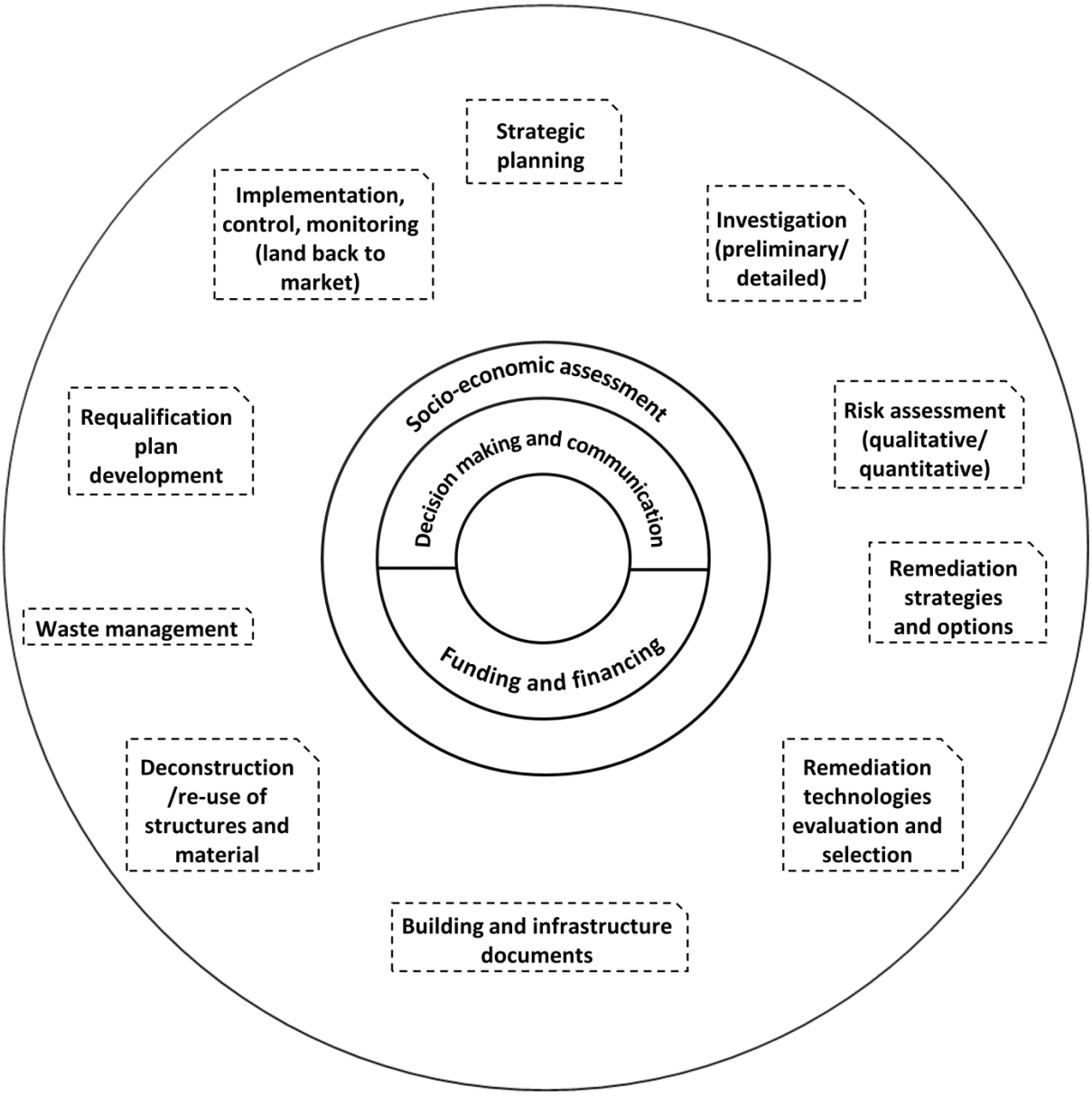

Figure 2 System of information categories for brownfield regeneration processes evaluated by experts-stakeholders.

For the evaluation of the rankings of the information categories according to the relevance scores, the Kemeny-Young method has been used (Kemeny, 1959; Kemeny & Snell, 1960; Young & Levenglick,

1978; Young, 1988). Kemeny-Young is a statistical method to analyse different rankings of elements and find the most frequently chosen ranking among them. The method considers all possible rankings provided by the respondents and gives a score to each of them. It is not mandatory for respondents to rank all the elements. Those categories that were not classified are interpreted as "least preferred" and they go to the bottom of the rank. The ranking with the highest score is the most agreed between all the respondents. The "winner" ranking might be one of those provided by the respondents, or a new, constructed ranking, which takes into account all the rankings provided by the respondents.

Once the questionnaire had been developed, it was pre-tested by sending it out to a limited number of stakeholders of the Romanian case study in order to detect possible errors or to identify possible misunderstandings and doubts of the respondents. Often, questions may look clear to the researcher but not to the respondents. It is, therefore, good practice to "pilot" the questionnaire with a small sample of respondents before distributing it to all respondents. Any amendments highlighted by the pilot should be made to the questionnaire before issuing a final version (Kirklees, 2008).

The questionnaire was then translated in the five languages of the case studies and then submitted to the stakeholders through the internet. The online format was chosen because the questionnaire could be easily filled directly in a webpage without the need to print it or send it back by e-mail, and because the data were automatically saved upon completion in a dedicated database. It was considered necessary to contact a minimum number of 30 stakeholders from every country, in order to obtain a sufficient number of responses. Out of 182 questionnaires sent, a total of 55 (30%) were returned. Different numbers of stakeholders were contacted in the five countries and the final response rate for each country was: Czech Republic 32%; Germany 52%; Italy 22%; Poland 18%; and Romania 36%.

2.5. Analysis of results and feedbacks to stakeholders

The last phase of a stakeholder engagement process usually consists in collecting and evaluating results, and then providing feedbacks to the stakeholders that participated in the process. Qualitative data resulting from meetings (workshops and focus groups) were obtained from audio/video records realised during the events, transcribed into a word processing software, translated in English by project partners and then directly analysed. Quantitative and qualitative data resulting from the web-based questionnaire were collected and then analysed using descriptive statistics and visually represented through graphs and charts in order to summarise the answers of respondents on specific questions. Feedbacks to stakeholders have then been provided both through the provision of project deliverables, which are available to the public via the TIMBRE web site, and presentations at national and international conferences, to which also participants of the workshops, focus groups and questionnaires have been invited.

3. Case studies

The stakeholder involvement methodology has been applied to stakeholders directly related to the TIMBRE case studies from the following countries: Czech Republic, Germany, Poland and Romania (see Table 1). One additional country is Italy, where stakeholders have been involved by the group of researchers that performed this study on the basis of professional networks.

The involvement methods (i.e. workshops, focus groups, and questionnaire) applied in the different countries and the number of involved stakeholders are reported in Table 1.

Table 1. Number of stakeholders involved within each engagement method, for different countries and cities.

	Romania	Poland	Czech Republic	Germany	Italy
WORKSHOP	60 (Hunedoara)	70 (Zielona Góra)			
FOCUS GROUP	15 (Bucharest)		9 (Ostrava)		
ON LINE QUESTIONNAIRE (number filled in / number distributed)	17/47	7/39	9/28	12/23	10/45

3.1. Workshops

The first TIMBRE stakeholder engagement event was a workshop that brought together about 60 actors interested in brownfield regeneration in Romania. This event took place in Hunedoara, in October 2011 (Bartke et al., 2012). During the Hunedoara workshop, project researchers met local and national stakeholders in order to establish a first acquaintance with them. The instauration of a good relationship was considered to be a crucial step to guarantee stakeholder involvement also in the subsequent activities. The involved categories of stakeholders were the following: site owner, local authorities, region and sub-regional government, regional and national regulator, developer/investor, consultant, contractor, media, scientific community and researcher and end-user. Another workshop was held in Poland, in Zielona Góra in March 2012 (Bartke et al., 2012). Nearly 70 people representing public administration of national, regional and local levels, non-governmental organisations and various experts such as architects, experts in spatial planning and scientists participated in this workshop.

3.2. Focus groups

Two focus groups have been organised, one in Bucharest (Romania) in January 2012 and one in Ostrava (Czech Republic) in October 2012. The focus group in Bucharest involved 15 participants, while the one in Ostrava brought together 9 individuals.

Considering that brownfield regeneration in Romania is still at an early stage with regard to perceived needs, knowledge/expertise on what revitalisation involves and actual revitalisation experience, the Bucharest focus group aimed to provide a hypothetical categorisation encompassing all phases of brownfield regeneration to collect stakeholders' perceptions and information needs. The represented stakeholder categories were the following: site owners, contractors, technology providers, regional and national regulators, scientific community and researchers. The Ostrava focus group brought together local and regional stakeholders from the Moravian-Silesian Region, a region with a large number of brownfields and substantially more expertise but also divergences in viewpoints with regard to regeneration strategies, compared to Romania. The involved stakeholder categories were: site owners, researchers, consultants, local authorities, site neighbours, public interest groups.

3.3. On-line questionnaire

On the basis of the outcomes from workshops and focus groups, a questionnaire was developed and submitted to stakeholders from the case studies located in Czech Republic, Germany, Poland and Romania and other "external" stakeholders, including Italian stakeholders. They were asked to respond to the online questionnaire in order to collect information on their attitudes on the

394 brownfield regeneration process and feedbacks on the proposed categorisation system for the
395 collection of information on brownfield regeneration. The respondents belong to all the categories of
396 stakeholders reported in Table 2, with the exception of the "Insurer" category.

397

398 ## 4. Results and Discussion

399 In this section, we present the obtained results of the systematic engagement process. These results
400 contribute to better understand who the stakeholders of brownfield regeneration are and what they
401 know and expect from this process. The results are structured in four sections: first, the identification
402 of representative categories of stakeholders is outlined. Then stakeholders' profiles are introduced.
403 Third, we present stakeholders' perceptions, concerns and attitudes, followed by a discussion of
404 stakeholders' information needs. The latter are correlated with the categories of stakeholders and
405 their main concerns, to identify what kinds of brownfield stakeholders are likely to be interested in
406 certain categories of information.

407

408 ### *4.1. Identified categories of stakeholders*

409 The categorisation of stakeholders is the result of a TIMBRE consortium internal discussion session
410 together with experts from the project's International Advisory Board (IAB). Consortium partners and
411 IAB members have proven expertise in brownfield regeneration research, regulation and practice.
412 Several of the members also have significant expertise in inter- and trans- disciplinary research and
413 projects. A specifically devoted project meeting session in June 2011 was organised, to define, for the
414 TIMBRE project's future activities and tasks, a categorisation of stakeholders relevant in brownfield
415 regeneration processes. The list of categories of stakeholders and of the sub-groups to be involved in
416 the participatory process is reported in Table 2.

417

418 *Table 2. Stakeholder categories selected for the engagement process.*

Stakeholder category	**Sub-group**
Site owners	Landowner/Problem owner, Subsidiary interest group
Site neighbours	Immediate (< 1km), further afield
Local authorities (town or city)	Local authorities dealing with Urban planning, Environmental health, Soil/Groundwater protection
Region and sub-regional government	Region and sub-regional authorities dealing with Spatial planning and land management
Regional and national regulators	Protection agencies dealing with Soil/Groundwater protection, Waste, Environmental management, Occupational Health and safety, Preservation order, Regional Development
Local community groups (neighbourhood, districts)	Local residents and business users dealing with social issues
Public interest groups	NGOs, Grassroots movement
Developer/investors	Market actors Re-use planners
Technology providers	Companies that develop, produce and sell innovative solutions for environmental problems, Innovation seekers
Consultants	Designers, Environmental experts, Ecologists, Town planners, Marketing agents
Financiers	Public, Private companies
Contractors	Companies providing remediation, Infrastructure, Construction, Landscaping, Worker's health & safety

Insurers	Companies which support Risk transfer, Carrier of ongoing risk, Carrier of residual risk
End-users	Occupier, Residents, Businesses, Leisure, and Casual visitors
Media	Press (TV and Radio), Web, Other
Scientific community and research	Students, Natural science researchers, Social science researchers, Engineering science researchers, Other
Other	

Source: TIMBRE consortium & International Advisory Board.

4.2. Stakeholders' profiles

In order to define the spectrum of stakeholders willing to fill in the questionnaire, their profile was described by the type of organisation they are working for, their stakeholder categories and their area of expertise. Identifying the profiles of stakeholders is aimed, as a first step, at distinguishing the different views of stakeholders involved in the brownfield regeneration process.

More than two-thirds of the stakeholders who took part in the questionnaires belong to public sector organizations (69%), followed by those belonging to the private sector (15%) and to research organizations (11%). Non-for-profit organisations are the least represented among the respondents (only 4%).

The categories of stakeholders selected by the respondents (see Figure 3) overlap for most stakeholders, which means that most of them indicated to belong to more than one stakeholders' category, with an average of 1.7 categories per respondent. The most represented stakeholder categories are regional and national regulators (17.2%), and consultants (17.2%), followed by members of the scientific community and researchers (16.1%). All categories with the exception of "insurers" have obtained at least one selection. As a result it was possible to collect information from almost all the relevant categories of stakeholders needed for the objectives of this research. The categories with low percentages of participation must be treated with caution, as they are based on the responses of very few individuals and bar generalisation. Despite this fact, the identification and the overall number of respondents make us confident in reporting results which bear potential conclusions of interest.

It is also possible to notice that the first most represented stakeholder category "Regional and national regulators" has been selected mostly by Romanian stakeholders (12.6%), followed at great distance by German (3.4%) and Italian (1.1%). This partly reflects the greater availability of respondents from the regulator category in Romania, given that one of the Timbre consortium partners was a national-level regulatory organization. At the same time, the relatively high number of regulators, compared to the near-absence of consultants in Romania, is symptomatic for an emergent brownfield market that has not been yet opened up to sustained regeneration processes (Alexandrescu et al., 2013). The second most represented stakeholder category "Consultant" has been selected mostly by German (8.0%) and Polish (5.7%) stakeholders, followed by Czech (2.3%) and Italian (1.1%). The third most represented stakeholder category "Scientific community and researchers" has been selected in comparable proportions by stakeholders from all the countries analysed.

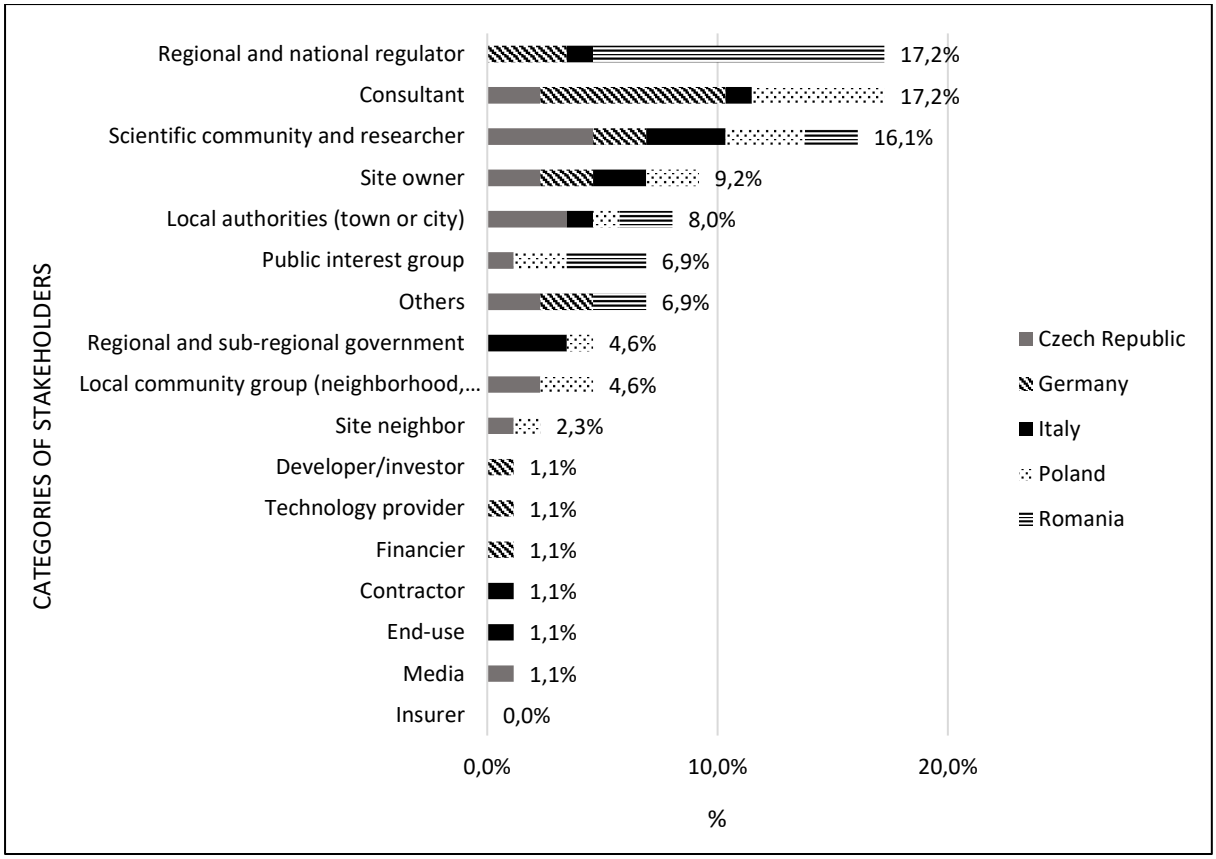

Figure 3 Graph representing the distribution of answers, within the indicated stakeholder categories, given by respondents from the five countries.

Considering the areas of expertise described (see Figure 4), one can observe that the most represented areas are: Characterisation/monitoring/control (24.2%), followed by Decision making process (20.5%) and Risk assessment (15.2%). Each of these was chosen by stakeholders from the five countries in comparable proportions.

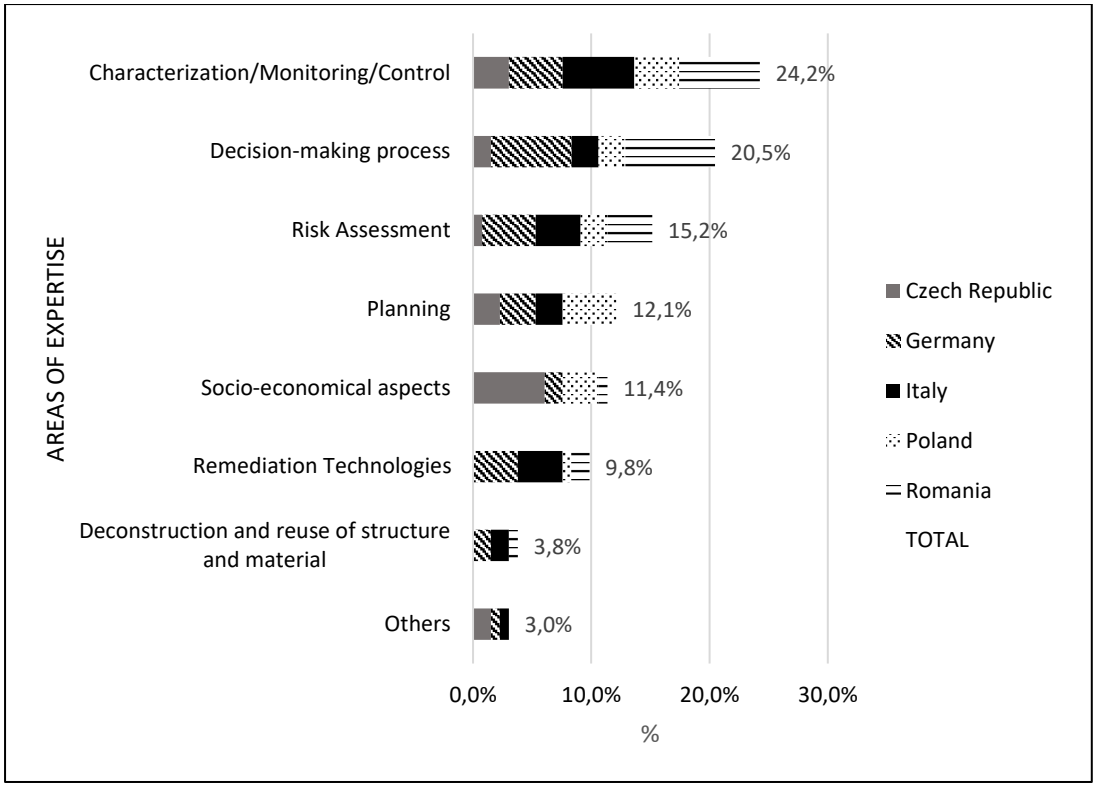

Figure 4 Graph representing the areas of expertise given by respondents from the five different countries.

Stakeholders provided also a brief description of their work activity, past or present, related to brownfield regeneration. The described activities can be summarised under three categories: i) brownfield regeneration planning and decision making (e.g. urban planning, creating redevelopment scenarios, assessment of investment costs, decision making and involvement of stakeholders), ii) carrying out technical tasks (e.g. characterisation, risk analysis, remediation, disposal of waste, monitoring), and iii) providing information to interested parties (e.g. provision of inventories of brownfields, media activities).

4.3. Stakeholders' perceptions, concerns and attitudes towards brownfield regeneration

In this section, a more detailed characterization of stakeholders in terms of their subjective, and at the same time practice-based, orientation towards brownfield regeneration is provided.

4.3.1. Stakeholders' perceptions

Stakeholders' perceptions regarding brownfields have been identified by the analysis of the definitions provided by respondents through open-ended questions, in comparison with the CABERNET definition (cf. Oliver et al., 2005). Five main issues identified within the CABERNET definition (i.e. brownfields are likely: affected by former uses, derelict/underused, affected by real or perceived contamination, located within urban areas, requiring intervention) have been analysed by checking how many of these issues were explicitly mentioned by each respondent. The stakeholders, subdivided into five groups according to their respective country, clearly differentiate themselves in how they describe brownfields.

Figure 5 shows radar graphs, where the tips of the pentagon represent the five characteristics identified within the CABERNET definition. Within each graph, the percentage of respondents that

explicitly included the characteristics within the definition they provided is reported (the centre of the pentagon corresponds to 0% of respondents, while the most external line indicates the 100%).

First, the main differences are those in the number of characteristics mentioned. This ranges from all the characteristics being mentioned, albeit with different frequency, in Germany and Italy, to almost only one characteristics being mentioned, in the case of Romania. Czech Republic and Poland occupy intermediate positions, with respectively three and four issues being mentioned.

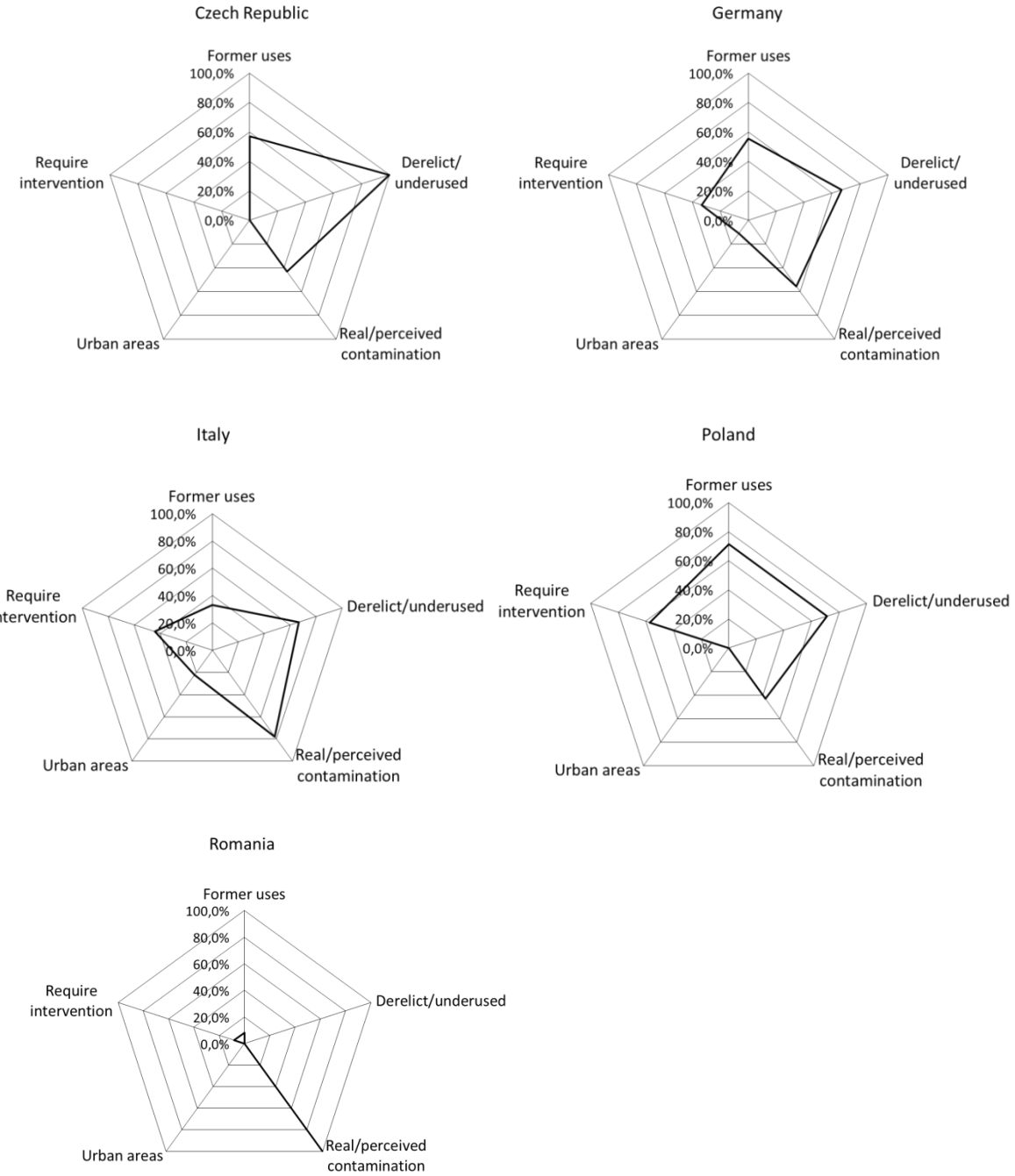

Figure 5 Radar graphs representing how respondents from the five countries describe a brownfield.

What is not indicated in Figure 5, but is worth mentioning, is that some definitions provided by the respondents pointed out the lack of economic attractiveness that may characterise brownfield land.

They described brownfield land as a land which is not economically worth "developing", of any interest for the market, not developable without financial support and, at the same time, unable to attract investors and financial investments. The results of stakeholder groups' varied definitions add to the findings of Frantal et al. (2012) on the heterogeneous status of brownfield concepts in the TIMBRE case studies and respective nations. The distribution of brownfield descriptions for Romania warrants one additional comment. Following the general understanding of brownfields as sites "associated with the contamination of land" (Cobârzan, 2007, p. 29), the question translated into Romanian in the questionnaire asked specifically for the description of a contaminated site. There is no equivalent single word for "brownfield" in Romanian. The fact that most responses referred in some way or another to the contamination aspect of the CABERNET definition should come as no surprise. Notwithstanding, this overwhelming majority might actually also represent the Romanian view on brownfields to a certain degree (cf. Kaiser, 2009, p. 14). A contrary example is the German case, where neither a specific word for brownfield is widely accepted but rather a term is used in legislation that refers to land (potentially) affected by contamination. Despite the fact that the translated question in the questionnaire used the more general, unspecific word similar to brownfield, it must be assumed that respondents referred in their mind-sets also to some degree to the legally defined setting in Germany – however, still they choose a diverse set of categories, for which one explanation could be, that German participants in comparison to their Romanian colleagues on average have more experience in brownfield regeneration and, hence, are more aware of the diversity of driving factors.

4.3.2. Stakeholders' concerns

The presence of brownfields does raise concerns among the stakeholders interviewed (see Figure 6).

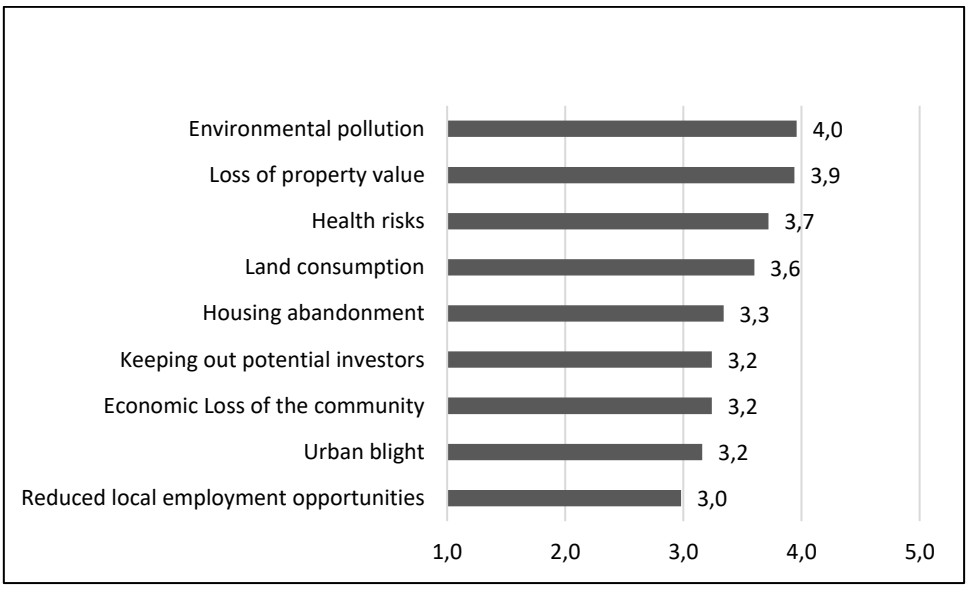

Figure 6 Bar chart representing the mean of the points provided by the respondents for the 9 proposed concerns. Mean values can range on a scale from 1 ("very low concern") to 5 ("very high concern"). Respondents were allowed to skip the evaluation of concerns. The total number of respondents for this question is 50.

All the entries have obtained a significant score showing that the presence of a brownfield raises different concerns to the people who have to deal with them or are affected by their presence. The results are presented without a breakdown by countries because the trend was similar in all of them. The two entries with the highest rate are the concerns for environmental pollution (mean equal to 4) and for the loss of property value (mean equal to 3.9) of the surrounding area. Both correspond to a high level of concern. On the other end, the entry that generates the least concern among experts in brownfield regeneration is the reduction of local employment opportunities. However, the mean

values for all the concerns do all range between mean values of 3 and 4, indicating that all these concerns are relevant for the respondents and cannot be neglected. Other specific concerns that have pointed out by the respondents and that are not reported in the figure are the following: future profitability of the municipality, development paralysis (due to the inability to add new factories, plants, establishments or to expand the existing ones), worsening of the image of the owner, reducing the advantages generated by the spatial aesthetic of the surrounding area, and worsening of the image of the town. It becomes clear that not merely the sheer complexity but also the significant extent of concerns drive the persistence of brownfields dereliction and the reluctance in regeneration.

4.3.3. Stakeholders' attitudes

Stakeholders' attitudes indicate under which conditions stakeholders consider the brownfield regeneration process worthwhile, ranging from an "A" scenario (regeneration should generate short-term economic benefits) to a "D" scenario (in which the social and environmental benefits are deemed predominantly important, regardless of economic return). There are two intermediate scenarios – called "B" and "C"- in which the economic benefits are equal or smaller than the costs, respectively (see Figure 7).

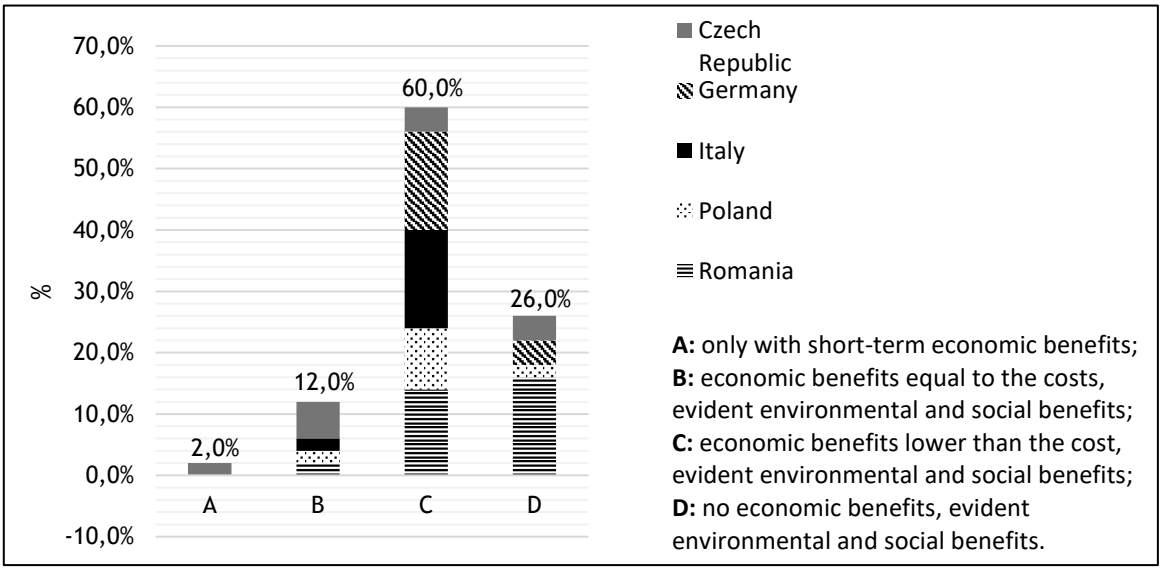

Figure 7 Stakeholder's attitudes towards brownfield regeneration process.

Of the four options, C and D are the most frequently selected by the respondents. This is not surprising, given that most respondents work in the public sector and are, therefore, likely to see the regeneration of brownfields as a "public good", and thus placing mere economic benefits in a secondary position. Analysing the answers to the open-ended questions, however, provides a more nuanced picture of stakeholder attitudes. On one hand, it is generally recognised that environmental and social benefits can generate, as a consequence, economic benefits in the long term. On the other hand, it is often noted that economic dynamics cannot be avoided and should be always considered. In addition, a consistent number of respondents pointed out the necessity to identify the financial sources that should cover the economic costs of the regeneration of a brownfield when this will not generate profits in the short term. Figure 7 suggests an interesting inter-country difference. Whereas for the Czech Republic, Germany, Italy and Poland most responses cluster around option C, with lower proportions of respondents selecting B or D, for Romania the pattern is skewed towards option D. Corroborating this with the fact that brownfield redevelopment is in its initial stages in Romania (Cobârzan 2007), we suggest that Romanian stakeholders might lack adequate knowledge on a

realistic balance between social and environmental benefits on the one hand and economic costs on the other, in regeneration.

4.4. Stakeholders' information needs and feedbacks to the proposed categorisation system for the collection of information on brownfield regeneration

Based on stakeholder exchanges during workshops and focus groups, a categorisation system for the collected information was created. The information categories, encompassing all phases of brownfield regeneration process, were shared and agreed by participating stakeholders (see Figure 2). This section addresses the range of information needs of the consulted stakeholders. One of the main findings is that they have settled on a number of 13 information categories, which suggests that this is the range of information that they deem useful. Even if they were offered the opportunity to expand this number, the resulting categories appear to capture the information needs of a relatively diverse set of users of brownfield information. The sections below show, for a selection of stakeholder groups, what categories of information figure as their top choices.

4.4.1. Stakeholder groups and information ranking

In order to obtain relevance rankings with a low dispersion of data, the categories of stakeholders have been rearranged into five groups of stakeholders with similar characteristics, as described below. The original categories included in the questionnaire are given in brackets:

- Group 1: Site owners (Site owners);
- Group 2: Authorities (Local authorities; Region and sub-regional government; Regional and national regulators);
- Group 3: Problem holders (Site neighbours; Local community groups; Public interest groups; End-users);
- Group 4: Services providers (Developer/investors; Technology providers; Consultants; Financiers; Contractors; Insurers; Media);
- Group 5: Scientific community and research (Scientific community and research).

From the most popular relevance ranking for each of the five groups of stakeholders, we notice that the information categories "Strategic planning" and "Investigation" are always ranked in the *top five* information categories (see Table 3). This answers the second question outlined in the introduction section, suggesting that distinct groups of stakeholder have specific information needs.

The observed range of *first choices* (highest number of choices) is, however, limited to three information categories out of five possible (strategic planning, investigation and remediation strategies and options). In terms of first choices, for example, both site owners and problem holders choose strategic planning, while authorities and service providers value information on brownfield investigation. For the scientific and research community the most valuable is information on remediation strategies and options.

Table 3 Relevance rankings for the five groups of stakeholders. The 5 most relevant information categories for each group of stakeholders are highlighted in grey.

Group 1 site owners	Group 2 authorities	Group 3 problem holders	Group 4 services providers	Group 5 Scientific community and research

Strategic planning	**Investigation (preliminary/detailed)**	**Strategic planning**	**Investigation (preliminary/detailed)**	Remediation strategies and options
Funding and financing	**Strategic planning**	Funding and financing	Risk assessment (qualitative/quantitative)	Socio-economic assessment
Socio-economic assessment	Risk assessment (qualitative/quantitative)	**Investigation (preliminary/detailed)**	**Strategic planning**	**Investigation (preliminary/detailed)**
Investigation (preliminary/detailed)	Remediation strategies and options	Socio-economic assessment	Funding and financing	Decision-making and communication
Risk assessment (qualitative/quantitative)	Funding and financing	Remediation strategies and options	Remediation technologies evaluation and selection	**Strategic planning**
Remediation technologies evaluation and selection	Decision-making and communication	Risk assessment (qualitative/quantitative)	Building and infrastructure documents	Funding and financing
Implementation, control, monitoring (land back to market)	Socio-economic assessment	Decision-making and communication	Remediation strategies and options	Risk assessment (qualitative/quantitative)
Building and infrastructure documents	Remediation technologies evaluation and selection	Remediation technologies evaluation and selection	Decision-making and communication	Remediation technologies evaluation and selection
Remediation strategies and options	Requalification plan development	Building and infrastructure documents	Socio-economic assessment	Deconstruction/re-use of structures materials
Decision-making and communication	Building and infrastructure documents	Requalification plan development	Requalification plan development	Implementation, control, monitoring (land back to market)
Requalification plan development	Deconstruction/re-use of structures materials	Deconstruction/re-use of structures materials	Implementation, control, monitoring (land back to market)	Building and infrastructure documents
Deconstruction/re-use of structures materials	Waste management	Waste management	Waste management	Waste management
Waste management	Implementation, control, monitoring (land back to market)	Implementation, control, monitoring (land back to market)	Deconstruction/re-use of structures materials	Requalification plan development

Considering the data in Table 3, a selection of the top five information categories for each group of stakeholders has been analysed further. To this end, for each group of stakeholders, a score from 1 to 5 has been assigned to each information category of the selection (where 1 represents low relevance and five represents high relevance). The obtained histogram is reported in Figure 8.

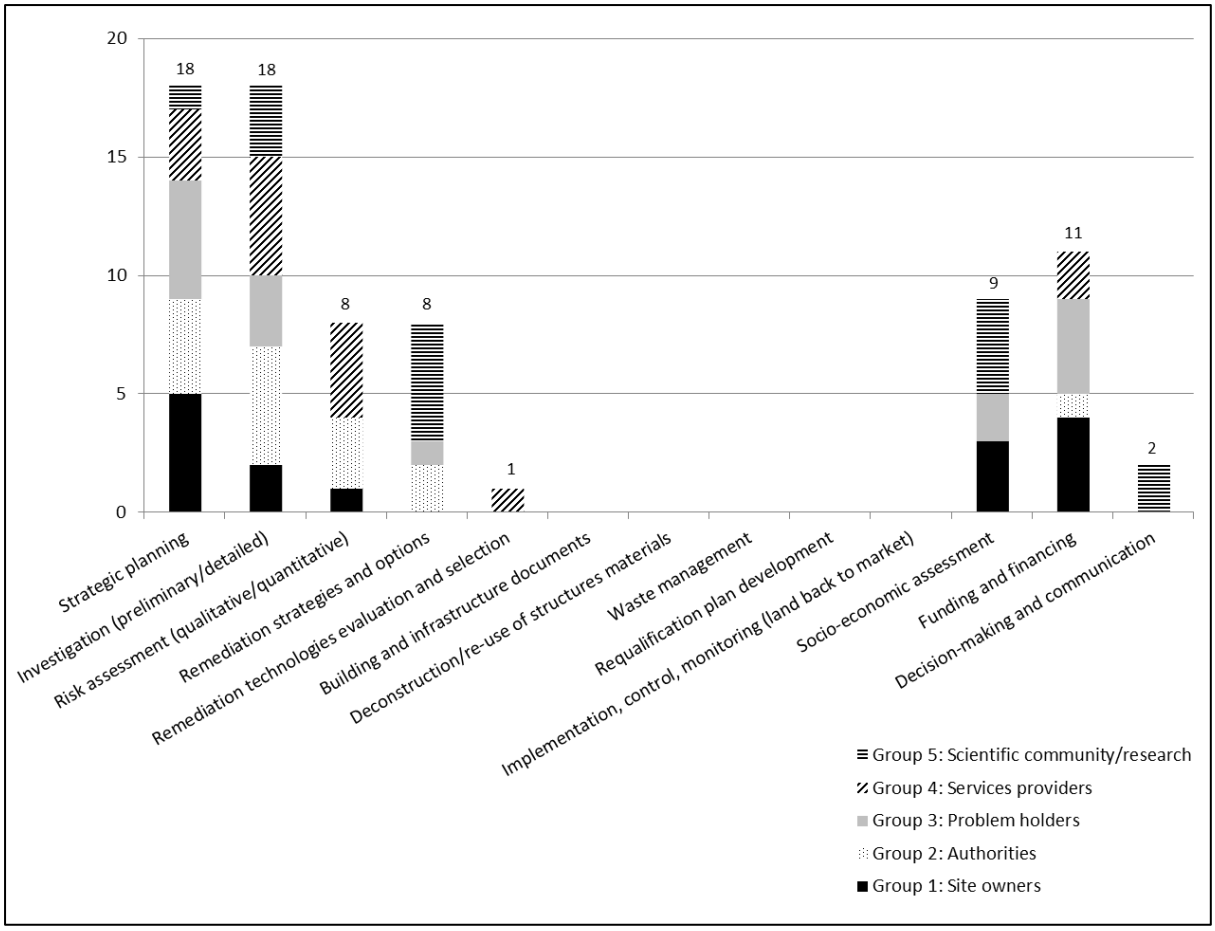

Figure 8 Histogram representing the distribution of scores achieved by the information categories according to the preferences provided by the five groups of stakeholders. The values have been computed by assigning the first ranked information category 5 points, the second one 4 points and so on up to the fifth category, which received 1 point.

Table 3 and Figure 8 show that *site owners* and *problem holders* are primarily interested in gaining information about strategic planning and funding and financing, which is reasonable considering the role they play in brownfield regeneration.

Authorities, listing investigation, strategic planning and risk assessment in the first top three positions, present a strong similarity with *services providers*, which keep investigation in first position and simply switch strategic planning and risk assessment.

Finally, the *scientific community and research group* interestingly lists in the two first positions remediation strategies and options and socio-economic assessment.

4.4.2. Stakeholder concerns and information categories

One expects that the relevance of the information categories will vary not only in relation to the group of stakeholders, but also depending on the level of concern with specific brownfield problems. In order to address the third research question of this article, we have investigated the relationships between the selected relevant information categories and the identified concerns (see Table 4) considering only the categories of information ranked in first position for relevance. In the contingency Table 4, we only included those responses that indicated a high or very high level of concern with the different problems generated by the presence of brownfields. This allows making tentative inferences on the

kinds of concerns that stakeholders interested in specific information categories might have. In what follows, the choice of information categories for each of the five stakeholder groups will be discussed, adding where appropriate insights from the cross-tabulation between information categories and brownfield concerns. Given that the information categories discussed in 4.4.1 are based on the top five choices and the information categories analysed in 4.4.2 relate to the top first choice, the results in the two sections are not directly comparable, but can provide a wider picture of the analysed problem. Moreover, our aim here is to establish possible hypotheses that could be explored in future research.

635 *Table 4 Number of times a specific information category has been selected as the most relevant (i.e. first position for relevance) by a stakeholder who identified a specific concern as "High".*
636 *Cells with values above 5 have been coloured in grey.*

	Strategic planning	Investigation (preliminary/ detailed)	Risk assessment (qualitative/ quantitative)	Remediation strategies and options	Remediation technologies evaluation and selection	Building and infrastructure documents	Deconstruction/ re-use of structures materials	Waste management	Requalification plan development	Implementation, control, monitoring (land back to market)	Socio-economic assessment	Funding and financing	Decision-making and communication	TOTAL (Mean = 18.5)
Environmental pollution	6	7	2	2			1			1	3	2		24
Loss of property value	7	10	1	1	1		1				2	2	1	26
Health risks	6	5		2			1			1	4	2		21
Land consumption	5	5		1		1	1			1	3	1		18
Housing abandonment	4	4	1			1					4	1		15
Keeping out potential investors	3	6	1	1			1			1		2		15
Economic loss of the community	1	6	1	2			1			1	2	2		16
Urban blight	2	2	1	1		1	1			1	2	1	1	13
Reduced local employment opportunities	1	3	1								2	2		9
TOTAL (Mean = 14.3)	35	48	8	10	1	3	7			6	22	15	2	

637

638 The breakdown of the results by the five stakeholder groups reveals some noteworthy patterns. The *site*
639 *owners* appear to be mostly concerned about strategic planning, followed by funding and financing. While
640 this is not surprising, as the presence of brownfields poses both planning and financial challenges, the third
641 selected category – that of socio-economic assessment – is unexpected and invites potentially new
642 interpretations. It suggests that site owners pay attention to the wider social and economic implications of
643 the presence of brownfields, which makes them similar to researchers and members of the scientific
644 community and to problem holders. Notwithstanding, their rationale behind putting emphasis on these latter
645 categories might also be driven by an assumption that they need to consider these elements to convince
646 actors necessary to approve their investment projects. Whatever motivation, it appears that all stakeholders,
647 who deal with specific sites or are interested in a grounded approach to brownfield regeneration, require
648 information on the local economic and social context. This unexpected finding elevates the importance of
649 collecting and making available socio-economic information for site owners. This finding shows site owners'
650 interest for issues related to the social pillar, supporting recent discussions about sustainable remediation.

651 If considered from the point of view of stakeholder concerns, it emerges that those interested in the socio-
652 economic conditions of brownfields also have a high level of concern and attention with regard to health
653 risks and housing abandonment, followed by environmental pollution and land consumption and by different
654 forms of economic losses (see column 12 in Table 4). A potential area for future research would thus be the
655 specific content of environmental, social and economic risks, which site owners see as important in their
656 work.

657 *Authorities* are mostly interested in information pertaining to investigation and strategic planning, followed
658 by risk assessment and remediation strategies and options (see Table 3). One would expect strategic planning
659 to be of pivotal interest also for authorities, but instead it appears to be chosen mostly by site owners and
660 problem holders. The interest of authorities in risk assessment can be explained by the fact that authorities
661 are usually responsible to protect the general public from perils and therefore to affect and supervise
662 measures of hazard defence, hence the results of risk assessment usually identify the need to intervene to
663 determine an acceptable level of contamination. The choice of the more technical information on strategies
664 and options for remediation might be interpreted in line with this remediation focus, where authorities can
665 also determine remediation technologies. Nevertheless, it could perhaps also be linked to the professional
666 interests of individual respondents who work as authorities. Future research could perhaps elucidate if there
667 are differences between the countries involved. Based on preliminary interviews in Romania, it appears that
668 Romanian authorities are eager to learn about remediation options, perhaps because this information is
669 largely missing in the Romanian public sector.

670 Apart from sharing in the general interest for strategic planning, *problem holders* were interested in
671 information on funding and financing, on the same par with site owners. They were also interested in
672 investigation, socio-economic assessment and remediation strategies and options. As the problem holders
673 group might bring together quite varied interests, such as those of organised public interest groups and of
674 individual site neighbours, it would be worthwhile to investigate if there are distinct profiles of information-
675 seekers to be identified.

676 *Service providers* stand out through their high interest in investigation, on a comparable level with
677 authorities. If considered from the point of view of brownfield concerns, investigation seems to be relevant
678 for all those who attach a high score to the problem of losing property value. This result can indicate that
679 these individuals are mostly aware of the need for sound investigation measures to generate knowledge and
680 reduce uncertainties about the site status, thus reducing the risks that impact the market value of a property
681 (cf. Bartke, 2011). As further evidence for the investigation – economic value relationships, those who are
682 concerned about keeping out potential investors or about economic losses for the community, are also likely
683 to choose investigation as a category of interest. On the other hand, given that the service provider category
684 includes investors, financiers and contractors, it appears logical that maintaining or enhancing property

values is important to them. However, investigation is relevant for a much broader range of concerns, apart from those related to economic value. Those highly concerned about environmental pollution or health risks also selected investigation as a primary category of interest. The specific aims that stakeholders might have in relation to investigation may be worth further exploration. A notable absence for the service providers is the category of remediation strategies and options, which is absent from the top five choices of relevant categories within this group. Without further evidence, this is difficult to explain.

Finally, the *scientific community* seems to be mostly interested in remediation strategies and options. This may seem counter-intuitive to those equating science with research lacking practical value. Apart from the already noted interest in socio-economic assessments, it is worth pointing out the limited interests of researchers among our respondents in the area of investigation. This might be due to the fact that investigation strategies are relatively well established. On the other hand, scientists appear to be the only ones interested in decision-making and communication. If we link this finding to the high interest in socio-economic assessments, we may hypothesise that researchers have developed a strong interest for the involvement of stakeholders in regeneration processes – at least those researchers who participated in our questionnaire (it could be argued that as a result of a self-selection process in all categories more of those stakeholders were ready to engage that have a higher propensity to participatory and trans-disciplinary processes). Future research could indicate if this finding is robust and, moreover, what would be the scientific reasons for striving for socially and economically relevant information.

It is also noteworthy that the information categories "Building and infrastructure documents", "Deconstruction/re-use of structures and materials", "Waste management", "Requalification plan development", and "Implementation, control, monitoring (land back to market)" are never ranked in the top five positions. This is not to say that they were not of importance per se – however, they seem neither to be as critical nor as demanding to be dealt with when compared to the top rated categories.

5. Conclusions

On average, we find stakeholder involvement to be a benefit for brownfield regeneration. Indeed, stakeholder involvement can contribute to identify more sustainable regeneration options. Moreover, through systematic engagement, ensuring that all groups are addressed and are given the opportunity to participate and their specific information needs are addressed, the acceptance of the decision-making process can be increased amongst these parties whose opposition could otherwise interfere with a regeneration project. Furthermore, stakeholder engagement can also be used by researchers, consultants and regulators to design more suitable policies and tools. This contribution has presented a structured approach to the collection of stakeholder needs. This methodology – consisting of the five steps of i) planning and preparatory work, ii) identification of potential stakeholder categories, iii) engagement activities (e.g. focus groups and workshops), iv) a questionnaire, and v) provision of feedback to the stakeholders involved – had been applied to stakeholders from five European countries. The proposed engagement methodology is an attempt to collect and analyse stakeholders' perceptions, concerns, attitudes and information needs when dealing with brownfield regeneration. It has been applied to experts belonging to a variety of different stakeholder categories, who have been preliminarily identified in order to have a wide representation of professionals dealing with brownfield regeneration. The information obtained allows drawing some interesting conclusions.

In general, a systematic approach for the collection of information needs, as proposed here, is important for the design or improvement of support tools that shall be tailored to actual stakeholder needs. These are supporting stakeholders in management of brownfield sites by reducing the various uncertainties linked to the rehabilitation process such as, for example, the unstructured overabundance of information for some specific aspects of the regeneration process or gaps of information for others. Our suggested methodology

731 lifts some of these uncertainties, by identifying categories of stakeholders and their perceptions, concerns,
732 attitudes and information needs. Enlightening what concerns stakeholders and what information they might
733 seek is of great help in supporting researchers to provide tailored answers to real questions.

734 Moreover, it is expected that not only researchers gain from the involvement by collecting useful information
735 necessary for the aims of their studies, in addition, stakeholders can gain extra knowledge about their role
736 within the brownfield regeneration process and their relations with other stakeholders.

737 Our empirical data interpretations contribute to a better understanding of who the stakeholders of
738 brownfield regeneration are and what they know and expect from this process. The engagement methods
739 revealed an understanding that stakeholders' perceptions on brownfields differ in the five analysed European
740 countries, while the concerns that the presence of a brownfield site can raise are similar and comparable in
741 the analysed countries. These results illustrated two variations. On the one hand there are differences
742 already in the scope of the conceptualisation of brownfields, which is viewed quite narrowly in Romania and
743 more comprehensively in Germany and Italy. Despite these differences, stakeholders are relatively
744 unanimous with regard to the two key categories of information which are important for them, that are
745 "Strategic planning" and "Investigation". This paper offers some first interpretation to the apparent
746 differences that can be observed between the countries' stakeholders and between the individual
747 stakeholder groups. Further research and analysis can be fruitful to investigate in more detail these contrasts
748 and extend the following preliminary assessment.

749 The collected data also supported the framing of the information needs which have been structured in a
750 categorisation system. The analysis of the developed categorisation system recognised that information
751 needs are concentrated in some specific aspects including the contamination characterisation, the
752 development of strategic plans, the identification of socio-economic benefit and constraints, the assessment
753 of the impacts on human health and the identification of suitable remediation technologies. Further studies
754 are needed to design how the necessary information can be provided and tailored according to stakeholders'
755 characteristics and requirements.

756 In order to further tailor brownfield information for different categories of stakeholders, some specific
757 suggestions for future research and action can be proposed. Site owners will likely benefit from information
758 on planning and funding opportunities, most likely by linking them to regional and national networks dealing
759 with brownfield regeneration. At the same time, further studies that detail the specific economic and social
760 circumstances and conditions in which owners have to act could help them mobilise other local actors in
761 regeneration. Such research is also interesting for researchers, therefore a synergy in the goals of these two
762 groups is apparent. Authorities could benefit from information on strategic planning but also from more
763 technical information on investigation, risk assessment and remediation. The desirability of a closer
764 relationship with service providers, especially for establishing best practices, could be explored in future
765 research. The problem holder category has not emerged as having a distinct profile in this research, but
766 future endeavours could aim to classify different categories of problem holders. Service providers are most
767 highly interested in investigation and from this point of view, the relationship between the brownfield
768 scientific community (universities or research centres) and practitioners could be explored for improved
769 knowledge transfers from the former to the latter.

770 Scientific community and researchers, showing a clear interest for remediation strategies and options and
771 for socio-economic aspects, seem they will likely benefit from information on the remediation options
772 appraisal process as well as on the way to integrate the three sustainability pillars, which represent the main
773 issues addressed by sustainable remediation. Moreover, this group would benefit from closer relationships
774 with all the above categories, but most importantly with site owners and problem holders, and especially in
775 improving communication with them.

There is, however, a broader implication of this endeavour. The methodology developed in this paper, which has been applied to five European countries, led to clarify which are the relevant stakeholders in brownfield decision-making processes and helped to attain a partial cross-EU overview of their perceptions, attitudes, concerns and information needs. These will vary because brownfield regeneration is managed differently in European countries, according to different legal frameworks. Therefore, this methodology, and the rationale it is based upon, can be informative for other research areas where a cross-EU perspective on stakeholders involved in decision-making processes is of interest.

Knowing who all the relevant actors are and knowing the information they need to better manage environmental issues are crucial factors, not to be taken for granted but to be investigated, for successful decision-making processes.

Land use policy development, integrated water resource management, integrated coastal zone management and major infrastructure projects could represent potential examples of areas of application of the methodology presented in this paper, since they are also characterised by complex decision-making processes, with multiple stakeholder's interests, which, according to different countries and legal frameworks, can be reflected in changes of perceptions, concerns, attitudes and information needs.

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ANNEX 1

Information categories

Strategic planning: legal requirements, regional/urban land use plans as well as the interests of local government, zoning boards, planning agencies and environmental regulatory agencies are identified in order to ensure that all the plans requisites and restrictions are respected and to foster the success of the rehabilitation process. In this contest the identification and involvement of the relevant stakeholders is a key point since it ensures that their needs, visions for the area and interests are properly analysed and taken into consideration.

Investigation (preliminary/detailed): determination of site characteristics and definition of the extent and magnitude of contamination at a site.

Preliminary investigation concerns the identification of potential contamination according to information on of site history (i.e. maps, plans, photographs, geological and hydrological data, past owners/occupiers, industrial or commercial uses, raw materials, disposal of waste and any mining activities) and available sampling data.

Detailed investigation focuses on confirming whether any contamination exists at a site, locating any contamination, characterizing the nature and extent of that contamination as well as defining the conceptual model of the site. It is essential to perform an appropriately detailed study of the site in order to identify the cause, nature, and extent of contamination and the possible threats to the environment or to any people living or working nearby.

Risk assessment (qualitative/quantitative): qualitative risk assessment allows the quick identification of potential risks, as well as assets and resources which are vulnerable to these risks. Qualitative risk assessment deals with the comparison of contaminant concentrations measured in soil, water or soil gas at a site with generic assessment criteria. Generic assessment criteria are typically conservative to ensure that they are applicable to the majority of sites and normally apply to only a limited number of pollutant linkages.

Quantitative risk assessment makes greater use of site-specific data to conduct a more accurate assessment of risks. Quantitative/detailed risk assessment involves the use of models to derive site-specific assessment criteria that are then compared with measured concentrations in soil, water or soil gas at the site to estimate risk.

Remediation strategies and options: review and analysis of clean up alternatives. It is a preparatory stage to the "Remediation technologies selection" because it aims to collect available information on possible strategies and options including the capability to meet specific clean up and redevelopment objectives, in accordance with legal requirements and regional/local planning and development goals.

Remediation technologies evaluation and selection: permits the evaluation of various technologies in order to identify those technologies with the capability to meet specific clean-up and redevelopment objectives taking into account also the economic aspects (i.e. the most suitable remediation technologies for the specific site according to a specific budget). The review, analysis and selection of clean-up alternatives relies on the data collected during the site assessment, the investigation phases and the cost-benefit analysis.

Building and infrastructure documents: collection of documents for building planning, drawings and specifications needed to obtain building permits and to support the BF rehabilitation. These documents are

used for tendering and to ensure that buildings are safe, healthy, accessible and sustainable from the environmental point of view.

Deconstruction/re-use of structures materials: deconstruction is the process of selectively and systematically disassembling buildings that would otherwise be demolished to generate a supply of materials suitable for reuse in the construction or rehabilitation of other structures.

Waste management: the collection, transport, processing or disposal, managing and monitoring of waste materials, mostly produced during the deconstruction of structures.

Requalification plan development: definition of a remediation technologies plan, which focuses on the application clean-up technologies to prepare the property for redevelopment and reuse. The design of the requalification plan and its implementation requires close coordination with all stakeholders.

Implementation, control, monitoring (land back to market): guarantee that the selected interventions are properly implemented, monitored and enforced in order to ensure the long-term durability, reliability and effectiveness of the interventions.

Socio-economic assessment: the socio-economic assessment aims at identifying the possible economic (business) implications of different alternatives for requalification of the site.

Funding and financing: the organization responsible for the remediation process has to consider several strategies in order to provide funding and financial support to all the other processes and phases.

Decision-making and communication: decision making is the process of evaluating and ranking different scenarios (i.e., suitable solutions for the rehabilitation of contaminated sites) on the basis of different criteria such as for example future land uses, socioeconomic benefits, remediation costs, time span, environmental impacts, technology set/s (including train technologies) and residual risk. These aspects are usually evaluated by means of suitable indices.