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A Review of the State-of-the-Art for Stakeholder Analysis with Regard to Environmental Management and Regulation

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Abstract

Stakeholder analysis (SA) is a widely used decision-support tool. This paper reviews the state-of-the-art of SA within environmental management and regulation. In total, 48 SA studies from the peer-reviewed literature were investigated according to 7 aspects: Topic and purpose; Elements included; Geographical area; Definition of key terms; Methods used; Authors self-evaluation and Inclusion. We find that the SAs conducted cover a broad spectrum of environmental issues. The most applied data-collection methods are snowball-sampling (26 studies, 54%), interviews (30 studies, 63%) and literature reviews (26 studies, 54%). The most examined stakeholder attributes were interests (41 studies, 85%) and influence (34 studies, 71%). We find that there is a lack of clear definitions of key-terms such as “Stakeholder” (19 studies, 40%) and “Influence” (14 studies, 29%). SAs are often conducted by authors from other geographical areas than the case study, which could explain why marginalized stakeholders are only considered in 21 of the studies (44%). In only half of the studies (24 studies, 50%), the authors reflect upon limitations and biases of their own analysis. Among others, three important lessons learned from our study are: 1) Transparency with regard to methodology, results and decisions made is of paramount importance as it otherwise undermines the credibility of SA; 2) Definition of key-terms such as “stakeholder” and “influence” need to be provided in future SAs to avoid misunderstandings; and finally, 3) Clear guidelines on how to perform SA are needed, including how to determine interests and power, and how to document and report findings.

1 Introduction

Including civil society stakeholders is a fundamental part of democracy and is often used to ensure accountability and transparency of governance (Reed, 2008). When done correctly it can be beneficial for decision-making, citizenship and inclusion (Quick and Bryson, 2016). For this reason, it has also
been part of environmental governance for decades, and in the Rio declaration from 1992 it is stated “Environmental issues are best handled with the participation of all concerned citizens, at the relevant level.” (Ebbeson et al., 2014). This principle was further implemented with the Aarhus convention from 2001, which concludes, that humans have a right to live in a healthy environment and an obligation to protect the environment. To assert this right and meet the obligation citizens must have access to information, participation in decision-making and justice in environmental matters (Ebbeson et al., 2014). Inclusion of civil society stakeholders is also an important part of decision-making in the European Union (EU) (Brande, 2017; Reed, 2008) and since 2006 the Aarhus convention has been an integral part of the EU legal order (Milieu Consulting Sprl, 2019). In the Treaty of the European Union article 10 it is stated that: "Every citizen shall have the right to participate in the democratic life of the Union. Decisions shall be taken as openly and as closely as possible to the citizen", and in article 11: "The European Commission shall carry out broad consultations with parties concerned in order to ensure that the Union's actions are coherent and transparent." (European Union, 2008). One way to facilitate consultations and involvement of concerned parties (stakeholders) is through stakeholder analysis (SA) (Evans, 2012). In SA, individuals or groups of individuals who are affected, have interest in or can affect a decision, are identified and their roles, relations and/or interests are analysed systematically (Varvasovszky and Brugha, 2000; Brugha and Varvasovszky, 2000). This is typically done by project managers, a working group (of analysts and interviewers) or researchers (Schmeer, 2000; Jepsen and Eskerod, 2009; Reed and Oughton, 2018). Throughout this paper, all of these will be referred to as researchers. Originally, SA started out as a business tool for management of stakeholders in the 30ties, ensuring they did not cause problems for the firm or organisation in focus or to utilise the opportunities of the stakeholders (Brugha and Varvasovszky, 2000). Freeman published in the mid 80ties a key piece of literature, establishing a guideline for strategic management of stakeholders (Freeman, 1984). Since
then, many new approaches has been proposed and in 2009, Reed and co-authors published a thorough and accredited review of SA, which is still widely used today. Reed et al. (2009) discuss how and why SA should be conducted for natural resource management and propose a SA typology. They conclude that SA is hard to define, and there are numerous methods for performing SA, all with different challenges and limitations.

In our study, we wish to explore the state-of-the-art of how SA has been used in environmental management and regulation, more than ten years after the review by Reed and co-authors. The specific aims are to: (1) Examine how SA is and has been conducted for use in environmental decision-making; (2) Extract key lessons learned from case studies reported in the scientific literature and finally, 3) Provide recommendations to environmental decision-makers and researchers for future uses of SA.

2 Methodology

To examine how SA is used as a decision-support tool within the field of environmental management and regulation, we performed a systematic literature review, as described by Briner and Denyer (2012). Only scientific peer-reviewed papers reporting on SA studies were included in the review. They were identified and retrieved using Web of Scienc (WoS) and Scopus.

Two literature searches were performed on WoS. One with the search words “stakeholder analysis” in addition to “environmental” and a second with the search “stakeholder analysis” combined with selected keywords (an option in “refine results”): environmental sciences OR environmental studies OR water resources OR ecology OR engineering environmental OR biodiversity. Lastly, a literature search was performed using Scopus, again using the search "stakeholder analysis" combined with the selected keywords: Environmental management OR environmental policy OR environmental
planning OR environmental protection OR climate change OR waste management. The following two search criteria were additionally applied: Because many studies only perform elements of SA, the first search criteria used was, that the term "stakeholder analysis" must be included in the title. The second search criteria was, that they had to have either an environmental-science or -regulatory perspective with regard to the study performed. We understand environmental sciences to revolve around the following core elements: atmospheric sciences, ecology, environmental chemistry and geo-sciences. Further, we understand environmental regulation to be regulation of environmentally challenging aspects such as pollution, solid waste, water resources or biodiversity. As a consequence, studies with a main focus on health, technology, economy or business were excluded from the review.

2.1 Evaluation criteria

After identification of the published peer-reviewed papers, all studies were investigated with respect to 7 aspects:

1. **Topic and purpose:** We examined which fields were most explored within the published SA studies published, and what aims the researchers had with their SA. Reed et al. (2009) and Grimble and Wellard (1997) noted that SA is a tool often used for prioritization of stakeholder involvement in decision-making processes, or to identify the consequences of a course of action, to ensure the most favourable outcome. Others argue that SA should be performed to integrate the interests of the disadvantaged and less powerful stakeholders (Bryson, 2004; Mushove and Vogel, 2005). SA can also be used as a descriptive tool with the aim of describing the relation between a system and its stakeholders (Reed et al., 2009). Which of these aims, researchers of a given SA studies have is important to understand as it might affect how the SA is performed and the subsequent interpretation of the findings.
2. **Elements included:** Because the term "Stakeholder analysis" is hard to define, we reviewed which elements were commonly included in the SAs (Reed et al., 2009). There seems to be disagreement on what elements are necessary for SA. Vogler et al. (2017) states that "The most basic stakeholder analysis simply involves the identification of people, groups, and institutions that have some interest in a project or will be affected by it", while Brugha and Varvasovszky (2000) point out that "This use of the term [stakeholder analysis] for studies which have often included only one or two features or steps of a stakeholder analysis risks causing confusion". Overall, there seems to be an agreement that the aim of SA is to gain understanding of the analysed system, and that this is done by identification of the key stakeholders and their viewpoints (Grimble and Wallard, 1997; Varvasocszky and Brugha, 2000; Mushove and Vogel, 2005; Reed et al., 2009; Prell et al., 2016; Vogler et al., 2017).

3. **Geographical area:** We explored where the SAs were performed and if researchers from the same geographical area performed the SAs. Local understanding and in-depth appreciation of the cultural circumstances of the given issue, which is subject to the SA, is often a prerequisite for a meaningful interpretation and consideration of stakeholders, their interests, values and internal connections. Having multiple performers of the SA reduces the risk of biases, potentially yielding more reliable data interpretation (Schmeer, 2000).

4. **Definition of key terms:** We explored how many SAs that define the typical SA-terms which are ambiguous such as "stakeholder", "influence/power" and types of non-governmental organisations (NGO). For instance, it is not simple to define who stakeholders are (Reed et al., 2009), but doing so is important as it defines the boundary conditions of the analysis performed and affect who and what is emphasised in the analysis (Bryson, 2004). Furthermore, we examined how many studies, that acknowledge that stakeholders’ positions might change with time or as a consequence of changes in the system.
5. **Methods used:** We examined if it was clear, which methods were used for the different elements of the SA, and which SA methods that were most commonly applied, for instance, with regard to stakeholder identification. Including all relevant stakeholders is important because it can lead to higher quality decisions and is important from a democratic perspective (Vogler et al., 2017).

6. **Researcher’s self-evaluation:** It was investigated how many of the studies that included the researchers own reflections on the limitations of their analyses, and how many SAs that included feedback from stakeholders. Methods used for SA all have limitations, which are important to have in mind when interpreting the findings (Reed et al., 2009; Clausen et al., 2020).

7. **Inclusion:** Lastly, we examined at how many studies that included marginalised stakeholders. By “included” we mean stakeholders that were considered in the analysis but not necessarily included through participation. In addition, we investigated at how many SAs that included interviews with stakeholders that did not hold a high position (e.g. managers, experts, NGO-representatives or politicians) in the system. For practical reasons, researchers must often choose who to include or exclude from their SA, and both Bryson (2004) and Mushove and Vogel (2005) emphasize the need of integrating the interests of disadvantaged and less powerful groups in order for decisions to be compatible with the typical practise of democracy and social justice. In our analysis, we furthermore examined if the SAs conducted included nature as a stakeholder, which is something that has been subject to much debate and controversy (Williamson, 2018; Benör and Lynch, 2018).

Apart from these aspects we also noted the context of the SA, how big the sample size was, how many stakeholders were identified, the response rates of participatory SAs, how many stakeholders they ended up including for interviews and which challenges the researchers
encountered while performing the analysis. All data is available as supplementary information in Appendix A.

3 Results and discussion

The literature search for "stakeholder analysis" in the paper title and "environmental" as a topic gave 68 results on WoS. After an initial screening of the paper titles and abstracts, 30 papers were deemed relevant for more substantial review. The second search approach in WoS with "stakeholder analysis" combined with the selected keywords gave a result of 62 articles, many of which overlapped with the previous search. Lastly, Scopus yielded 32 results. Once all papers had been screened, a total of 48 studies were identified as relevant for the scope of this review. All reviewed papers are listed in appendix A in addition to the notes taken during the review for each study.

As shown in Figure 1, the publication of SA studies matching the review criteria has increased in recent years. In fact, more than 50% of the reviewed articles were published after 2016. This might be a reflection of the increased focus on participatory aspects of regulatory and environmental management globally (Brande, 2017; Wamsler, 2017; Djomo et al., 2018).
3.1 Topic and purpose

The topics explored within the reviewed SA were relatively evenly distributed, as seen on Figure 2A. The most explored topics were the energy industry (8 studies, 17%), wetland management (8 studies, 17%), protected areas and/or species (7 studies, 15%) and marine governance (7 studies, 15%), covering both regulatory and environmental management issues. Other topics included the regulation of chemicals within the EU, infra-structure planning and non-market valuation of environmental assets. According to the aim of the reviewed papers most of the SAs had the purpose of identifying the stakeholders in a system (9 studies, 19%), describing stakeholder relations (11 studies, 23%) and investigating stakeholder interests (13 studies, 27%) (see Figure 2B).

We found, that only 8 studies (17%) were conducted with the aim of identifying obstacles and 8 studies (17%) aimed to support decision-making (see Figure 2B). This finding is contradictory to the reflections made by Reed et al. (2009) and Grimble and Wellard (1997), who noted that SA is a tool often used for prioritization of stakeholders, or to identify the consequences of a course of action. Even fewer performed SAs with the aim of integrating the interests of the disadvantaged or less powerful stakeholders, like proposed by Bryson (2004) and Mushove and Vogel (2005). Only 2 studies (4%) had the aim of including marginalised stakeholders, and 5 studies (10%) aimed to describe the roles stakeholders had in the system.
Figure 2: A) The overall topics of the evaluated stakeholder analyses. Protected areas include stakeholder analyses about protected species. *mgmt.: management. B) The purpose of the evaluated stakeholder analyses as described by the authors' aims. Each stakeholder analysis can have more than one purpose. *stkhs: stakeholders; †ES: existing system; ‡DM: decision making; ◊marg: marginalised stakeholders.

3.2 Elements of stakeholder analysis

In our review, we did not come across any studies that only focus on identifying the stakeholders of the system as described by Vogler et al. (2017). This might be due to the fact, that we only reviewed scientific studies published in peer-reviewed papers and that the ambition and aim of the SA studies go beyond merely stakeholder identification as a consequence of this. Instead we found that a vast majority of the SAs examined the interests of the stakeholders (41 studies, 85%) (see Figure 3).
Figure 3: Number of papers discussing different core elements of stakeholder analysis. Perception includes studying the degree of knowledge stakeholders have. *stkh=stakeholder

Furthermore, many studies used SA to determine stakeholder influence, and their potential to affect the project or regulation either positively or negatively. Through our review, we saw that 34 studies (71%) discussed or analysed the influence of stakeholders. Fewer studies were concerned with the relations between stakeholders (22 studies, 46%) and the roles of the individual stakeholders in the system (11 studies, 23%). SA is important because it helps provide a broader perspective of the issues and solutions. Wisdom is not limited to scientists and public officials, and including a wide range of stakeholders can lead to higher quality decisions by incorporating more sources of information, and perhaps bring knowledge that is otherwise unknown to the researchers (Rietbergen-McCrackeen and Narayan, 1998; Evans 2012; Vogler et al., 2017). 14 studies (29%) investigated conflicts among stakeholders, and 12 studies (25%) looked at the perceptions stakeholders had of aspects in the systems scrutinized, including the policies or project in focus. Most studies (42 studies, 89%) included participation of stakeholders by interviews or questionnaires as a minimum and 9 studies (19%) provided suggestions for how stakeholders could be further involved in the decision-process.
Performing SA can also make environmental regulations and projects more viable (Mushove and Vogel, 2005). Lack of attention to interests of and information held by key stakeholders is a big cause for poor performance or failure of projects or regulations, and stakeholder support is fundamental for successful coalitions and long-time viability for policies and organisations (Bryson, 2004). By simply providing stakeholders an opportunity to learn about a problem and the corresponding decision-making, the likelihood that stakeholders will support the final decision increases even if it goes against them and their primary interests (Stern and Fineberg, 1996; Mushove and Vogel, 2005).

3.3 Geographical area

Many of the reviewed papers studied EU-countries or the UK, which is a previous EU-country (14 studies, 29%) (see Figure 4) emphasizing that stakeholder involvement is an integrated part of the decision-making in the EU (Brande, 2017). Note that the United Kingdom (UK) is separated from the European Union (EU), since the UK left the EU on January 31st 2020 (European Commission, 2020), but it is worth noting that all articles were published in or before 2018. Many studies also concerned projects within South-East Asia and China (in total 15 studies, 31%). For studies examining South-East Asia, 7 of the papers were written by main authors from other geographical areas. The majority of the SAs were published with main authors being from the EU (15 studies, 31%), USA (7 studies, 15%) and Australia (7 studies, 15%). It is, however, worth noting that 14 of the articles had authors from multiple geographical areas. We found that 6 papers (12%) were written without any authors from the examined geographical region. In total, 8 (17%) papers had main authors from other regions than the one examined. In general, it is preferable to have knowledge of the cultural context of the area, where data is collected. Spangenberg et al. (2018) mention that external translators used during the data collection process may result in modified questions or results, and Pennell et al. (2010) state that, researchers must be aware, which data collection methods are most suitable for the
culture or region, where the data is collected. It seems logical that conducting a SA without local knowledge might lead to wrong interpretations of data collected or even collection of wrong or biased data. From this perspective, it is recommended to include at least one researcher from the region examined. This will not only help with language issues and cultural practices of the region, but also with understanding and revealing, for outsiders, hidden cultural contexts. Of course, our analysis does not capture, if the non-local authors have worked intensively with the study regions for many years and thus have acquired substantial local knowledge. One study did not examine a geographical area, but rather islands in general (Kougias et al., 2020). The main author of this study was from EU. Detailed information on each study can be found in Appendix A.

SAs conducted by multiple performers reduce the risk of biases and mistakes in data interpretation (Schmeer, 2000; Lienert et al., 2013) and in general, the reviewed papers had multiple authors, which indicate there were multiple performers behind the SAs. It is noteworthy that 4 papers (8%) were solo authored.

Figure 4: Geographical area examined in the stakeholder analyses and the geographical area of the main author of the stakeholder analyses. 14 articles had authors from multiple regions, and in total 6 articles were
written by no authors from the examined region. The United Kingdom (UK) has been separated from the European Union (EU), since the UK left the EU on January 31st 2020 (European Commission, 2020), but it is worth noting that all articles were published in or before 2018. One study did not examine a geographical area, but rather islands in general (Kougias et al., 2020). The main author of this study was from EU.

*SA=stakeholder analysis.

3.4 Definition of key terms

Environmental SAs has multiple terms, which can be ambiguous, and when these terms are used it is important to define them in order to avoid misinterpretations or misapplications of the results. Among others, these include “stakeholder”, “influence”, and types of NGO’s.

Before relevant stakeholders can be identified, the researchers need to determine, what they understand by the term "stakeholder". This is important as it defines the boundary conditions of the analysis and affects what is emphasised (Bryson, 2004; Colvin et al., 2016). In 19 (40%) of the reviewed papers the term was not defined, leaving much unclarity and confusion (see Figure 5A). Also, in 16 (33%) of the reviewed studies, it was unclear who the identified stakeholders were and why they were included in the analysis. Such lack of transparency makes it difficult to assess the reliability, quality and meticulousness of the studies and hamper their usefulness. To address these issues, we call for clear guidance on how to conduct SA and how to document and report findings.

SA is a snapshot of a present situation, which may be rapidly changing. Positions and influence are subjects to constant changes. This means that if the timeframe of the analysis or the gap between SA and implementation is too long, it may no longer be relevant (Varvasovszky and Brugha, 2000). Only 6 reviewed studies (13%) discussed how stakeholders’ positions might change in the system (see Figure 5B). An additional 4 studies (8%) acknowledged that it may happen, but did not this explore it further. In total, 37 studies (77%) did not mention how the position of stakeholders might change.
There is a lack of an unequivocal definition of influence, partly due to the many ways influence can be achieved (Dür, 2009). Different methods of determining influence will often either over- or underestimate the attribute (Dür, 2009). When reviewing the papers we combined the terms "power" and "influence", due to the lack of a clear distinction. For the rest of the text we will refer to both terms as "influence". In total, 35 (72%) of the reviewed papers included influence in their studies (see Figure 5C). Of these, 14 did not define the term (40% of the papers including influence). For 5 studies (10%) the methodology for measuring stakeholder influence was unclear. 11 studies (23%) used "attributed or perceived influence" and in 4 studies (8%) influence was determined by expert judgement.

If the system has many different stakeholders, these are often grouped according to their characteristics or interests. One group of stakeholders that are often important stakeholders in environmental projects and regulations are NGOs. NGOs exists in a variety of fields, and their interests might therefore be conflicting. An example of this can be found in Clausen et al. (2020), where some NGOs were in favour of a European restriction proposal of microplastics, while others were against. In total, 16 of the reviewed studies (33%) had grouped NGOs without specifying, which types were included or addressing similarities and dissimilarities of the included NGOs (see Figure 5D).
3.5 Methods used

There are a vast number of methods that can be used for SA, and multiple well-accredited papers and literature reviews on methods are available for SA and how they should be performed. These papers include, but are not limited to Montgomery (1995), Varvasovszky and Brugha (2000), Bryson (2004) and Reed et al. (2009). It, therefore, should come as no surprise that the methods used in the reviewed papers vary greatly. For this review, the methods used in SA can be divided into three overall categories: Methods for identifying stakeholders, methods for collecting data and methods for data interpretation.
As observed in Figure 6A, the most used method for identification of the stakeholders in the reviewed studies was snowball-sampling (26 studies, 54%), where researchers ask stakeholders to nominate other stakeholders. Apart from revealing stakeholders that might otherwise have been unknown to the researchers, it may also help revealing connections between stakeholders (Bryman, 2016).

Another commonly used method is to follow a predetermined list (14 studies, 29%). In this paper, we have classified all approaches, where researchers include stakeholders mentioned in relevant literature or governmental documents as "following a predetermined list", along with more classical definitions of lists such as the one presented by Peoc’h and UN Environment Civil Society Unit (2018) or the checklist included in Montgomery (1995). Often, studies also used expert nomination for stakeholder identification (10 studies, 21%), where researchers ask experts within the studied field to nominate relevant stakeholders. Dür (2008) point out, that the use of experts will rarely lead to new and surprising suggestions. However, it is a reliable technique if sufficient amounts of experts are included to address potential biases. Further, in 9 (19%) of the identified studies, it was unclear how stakeholders were identified and in 16 (33%) of the studies it was unclear who the identified stakeholders were. This lack of transparency is problematic, as it makes it difficult to assess if all relevant stakeholders were identified and/or included.

Figure 6: A) Methods used for stakeholder identification. Some SAs used more than one method. Following a list includes looking through documents, governmental plans and websites. *nom: nomination. B) The most
frequently used approaches for SA. *sth: stakeholder; †int: interview; ‡SNA: social-network analysis; 345 ◊ALM: actor-linkage matrix. 346

As observed in Figure 6B, the most used methods for gaining information and data collection were interviews (30, 63%), questionnaires (16, 33%), focus groups (8, 17%) and secondary literature (26, 54%). Interviews, questionnaires and focus-groups are all bottom-up approaches, where stakeholders are given the opportunity to contribute to the research. When using interviews, it is important to establish trust between interviewer and interviewee and avoid a mismatch between the two. If this is not achieved the answers may be coloured by interviewees dislike for the interviewer (Schødt et al., 2020). One study from Malaysia found that women were less willing to participate in their study (Hashim et al., 2017), while another study in South East Asia made sure interviewees and interviewer had the same gender (Spangenberg et al., 2018). In 12 (25%) of the reviewed studies the type of interview was unspecified. Again, dawdling with respect to reporting requirements might undermine the credibility of SA.

Participants in focus-groups might not want to voice unpopular opinions or let competitors know their interests (Lüthi et al. 2011). In one SA, stakeholders were unwilling to score other stakeholders, especially those considered their close partners (Caniato et al., 2014). In another study, one group of villagers refused to participate due to fear of creating conflicts (Kontogianni et al. 2001). With respect to the use of questionnaires, interestingly we found that studies using these often had response-rates of less than 50%. In total, 5 studies (10%) commented on their low response rates of less that 50% and in an additional 10 studies (21%) the response rates were unclear or not reported. Few respondents or respondents representing a majority of certain groups may result in biased data.
Secondary literature is a good way to gain information on a large number of stakeholders. This is also reflected by the fact that more than half of the SAs included in this study (26 studies, 54%) used some type of literature review to collect data on stakeholders. Such a top-down approach is less time- and resource-consuming than many bottom-up approaches and is therefore appropriate for initial stakeholder screening (Clausen et al., 2020). An issue with using previously conducted studies is, that the positions, biases and limitations of the research may be passed on and that there is less chance of finding new stakeholder opinions or interests (Dür, 2008).

Bottom-up approaches require more experience and time of the researchers, but if done correctly it may give valuable insights not obtainable by top-down approaches. We found that only a few studies (6 studies, 13%) solely relied on top-down approaches. All other SAs included participation of stakeholders by interviews or questionnaires as a minimum.

Visual presentation of the data collected is both a good way for readers to understand the findings of the SA and a help for researchers to identify relationships among stakeholders. Also, it serves as a mean to map and rank stakeholder attributes such as their respective importance (Bryson, 2004; Reed et al. 2009; Vogler et al., 2017). The most used methods for presenting the information was different type of stakeholder grids, SNA (social network analysis) and - to a lesser extend - actor-linkage matrix (see Figure 6B). The grids can be used for elucidating stakeholder alliances or to prioritize involvement of stakeholders (Durham et al., 2014; Vogler et al., 2017). Categorisation of stakeholders by stakeholder grids are popular among the studies included in this review (16 studies, 33%) but might marginalise certain groups. Also, it assumes that the respective stakeholder attributes, e.g. influence and interest, are important parameters for stakeholder inclusion (Reed et al., 2009). Durham et al. (2014) states that low levels of influence held by some stakeholders often is used as justification for excluding these from the research.
Another common method, used to identify the relationships between stakeholders, is SNA (8 studies, 17%). Here all communication ties between stakeholders and their strength are quantitatively analysed, presented graphically and categorised as either strong or weak (Prell et al., 2016). According to SNA-theory, stakeholders with strong ties are more likely to influence one another. Thus, stakeholders with many (strong) ties are more influential than stakeholders with few (or weaker) ties (Prell et al., 2009). Critiques of this method is that the types of ties, and what flows through them, are not distinguished (Borgatti et al., 2014). Furthermore, performing SNA is a time-consuming process, that requires specialists (Reed et al., 2009), and all the information needed might not be available in complex local situations (Wang and Aenis, 2019).

Two other methods used for determining the influence of stakeholders were “attributed influence” and using interpretation of various factors as a way to determine influence as proposed by Montgomery (1995). “Attributed influence” was the most used method for determining the influence of stakeholders (11 studies, 23%). Here stakeholders or experts are asked to evaluate the influence of stakeholders in the system. The critique of this method is that stakeholders often have good reason to either over- or underestimate their and others' influence (Dür, 2009). Montgomery (1995) lists 10 factors of influence, of which we have observed researchers focusing on "social, economic and political status", "control of strategic resources" and "influence through links with other stakeholders". This method is based purely on the perceptions of researchers, which increases the risk of biases. Perhaps for this reason the method was used in only 4 studies (8%) and indicate that methods for objective unbiased assessment of stakeholder attributes, such as stakeholder influence, is needed.
3.6 Author self-evaluation

Researchers may present initial findings to stakeholders in order to collect feedback but also as a mean to avoid misunderstandings or misinterpretation of the data collected. Also, it allow stakeholders to give more considered and well-reflected answers. However, feedback is not always beneficial, as it may alter the stakeholder’s position and thereby reduce the utility of the analysis, or influential stakeholders might control the outcome if the initial assessment is not favourable for them (Varvasovszky and Brugha 2000). Such considerations are vital for SAs, but seldom included. We found that 15 studies (31%) included feedback from stakeholders, additionally 2 studies (4%) mentioned, that feedback would have been preferable, but was not possible in their research (see Figure 7A).

Further, we found that only 24 (50%) of the reviewed papers mention limitations and biases to their research (see Figure 7B). This is problematic, because readers with limited knowledge of SA theory may be unaware of the limitations to the research. Further, if we, the scientific community, is not open and vocal about the limitations of our methodologies, it hampers transparency and lastly credibility of our work.

![Figure 7: A) Number of SAs including feedback from stakeholders regarding the research findings. B) Number of SAs mentioning and discussing limitations to their studies.](image)
3.7 Inclusion

Chevalier and Buckles (2008) criticise SA for being too descriptive and schematic, tending to neglect issues of stakeholder domination, empowerment of marginalised groups and representation of the common good. No SAs included future generation as a stakeholder and only 1 study (2%) included nature as a stakeholder (Mir and Rahaman, 2011). An additional paper discuss nature as a stakeholder, but it was not included in the analysis (Hansen and Baun, 2015). From an ethical perspective, these marginalized stakeholders require little effort to include. However, the issue most likely originates from failing to identify and recognize them as stakeholders in the first place. Furthermore, Civil society stakeholders have a right to meaningfully participate in the public decision-making process and be informed on the bases for decisions made by their government (Stern and Fineberg, 1996). By involving communities in the environmental governance, the decision-making will be more fair to those affected (Evans 2012). Of the reviewed studies, 11 (23%) included marginalised stakeholders. An additional 10 studies (21%) made some effort to ensure a broad perspective. Examples of this could be Spangenberg et al., (2018), who ensured, that interviewees and interviewer had same gender or Romanelli et al. (2011), who included school children in their interviews. One article both indirectly included marginalised stakeholders and recommended inclusion as further research. We considered this as indirectly included. 25 studies (53%) did not mention marginalised stakeholders (see Figure 8A). Convincing stakeholders to participate in the decision-making process is not always an easy task. Focusing on what stakeholders might gain from participating could increase the number of stakeholders interested in participating (Borisova et al., 2012).
As mentioned, it is important to include all relevant stakeholders when conducting a SA. However, it is also important not to include too many. For bottom-up approaches like focus-groups and stakeholder workshops, this may result in stakeholders competing for their voices to be heard and stakeholder's influence might be diluted as a consequence (Suárez de Vevero et al., 2008). Furthermore, Chevalier and Buckles (2008) points out, that too many stakeholders can result in poorer results and create unachievable expectations among the many participating stakeholders. Also, inclusion of too many stakeholders make the SA a tedious and resource demanding process (Jepsen and Eskerod, 2009). One way to avoid this is to include only selected strategical stakeholders (such as experts, managers or NGO-representatives) in the analysis. This was the case for 14 (29%) of the reviewed studies (see Figure 8B). For 5 studies (10%), it was unclear if stakeholders, apart from high-position stakeholders, were included. An issue with this is a greater risk of marginalised stakeholders,
and an extra effort to consider these is therefore be necessary. Selecting specific stakeholders for further analysis may introduce a potential bias, which is important to reflect upon. In any case, the choice between experts, non-experts and other stakeholders should be well documented and explained.

4 Lessons Learned

Based on our review of the 48 papers identified conducting SAs within environmental sciences and regulation, a range of lessons can be learned be:

1. Transparency with regard to methodology, results and decisions made is of paramount importance as lack of transparency otherwise undermines the credibility of SA.

2. There is a need for clear guidance on how to perform SA and how to document and report findings to address the lack of transparency.

3. Also related to transparency, there is a lack of definition of key-terms and stakeholder attributes, leading to possible misinterpretations or misapplications of results.

4. Limitations and potential biases of own work should have increased attention. Often, such issues are not addressed hampering transparency and credibility.

5. There is a need of unbiased and objective approaches for determining stakeholder attributes.

6. Stakeholders’ position and perceptions might change with time or as the system changes. This have had little attention in the past but should be considered in future SA.

7. SAs should be conducted by or with people holding local knowledge. Researchers from the geographical region of interest should take part in the analysis, to ensure proper data collection and to avoid misinterpretation of data.
8. Consideration and inclusion of marginalised stakeholders have only received little attention. This includes consideration of nature as a stakeholder and the consequences of decisions made for nature.

9. Convincing stakeholders to engage and participate in interviews, questionnaires or focus groups can prove difficult often resulting in low response rates potentially introducing misleading data and biases.

10. Within environmental management and regulation, the three most frequent uses of SA, besides stakeholder identification, are analysis of stakeholder interests, influence and mutual relations.

5 Conclusions

By reviewing 48 peer-reviewed papers concerning SAs with an environmental science or regulatory perspective, we found that SA is mostly used to describe and understand specific stakeholder settings and as an instrumental tool for managing stakeholders or related obstacles. Among others, three important lessons learned from our study are: 1) Transparency with regard to methodology, results and decisions made is of paramount importance as lack of transparency otherwise undermines the credibility of SA; 2) Definition of key terms, such as stakeholder and influence, need to be provided in future SA studies to avoid misunderstandings; and finally, 3) Clear guidelines on how to perform SA are needed, including how to determine interests and power, and how to document and report findings.

Based on our review we conclude and recommend that conductors of SA ensure that all terms risking misinterpretations are clearly defined prior to the analysis, and that all choices made during the analysis are clearly stated. We further recommend using multiple methods both for data collection
and for data interpretation to circumvent the limitations of the individual methods. In general, researchers conducting SA should more actively address the limitations of their own studies. Lastly, we recommend that researchers and decision-makers put more effort into consideration and inclusion of marginalised stakeholders. Also, nature and future generations are marginalized in most SAs but should from an ethical point of view be included.

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**References**


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