Working through Boundaries: Behind-the-Scenes Interdisciplinary Collaboration from a Dutch-Indonesian Consortium[1]

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Abstract

It is commonly assumed that multidisciplinary and interdisciplinary research collaborations involve various values, knowledge, and practices, thereby existing between science and policy. This study argues, oppositely, that multidisciplinary and interdisciplinary research collaborations are socially constructed and not to be taken for granted. To support its argument, this article uses the concept of boundary work to see how the interaction between science and policy is constructed. Taking as its case study the Ground Up consortium, a collaborative water management research programme involving the Netherlands and Indonesia, this study finds that boundary work generated and formed boundaries between science and policy through a joint call for proposal documents, research proposals, and three people operating at boundaries. Furthermore, this article shows that the collaborative research in the Ground Up consortium was a social process evidenced through three mediums: text, object, and person. This qualitative research thus uses a single-case study to explore boundary work in a consortium setting. Data were collected through a review of documents (meeting notes, research proposals, and calls for proposals) as well as in-depth interviews with three members of the Ground Up consortium.

Keywords: *boundary work, consortium, water management, Indonesia*

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Introduction

Numerous multi-dimensional problems have emerged (such as climate change) in the current era, and the resolution of these issues requires collaborative international research that incorporates multi-disciplinary and intra-disciplinary knowledge (Gonsalves, 2014; Fitzgerald, et al., 2018). This can be seen in many cases. For instance, several international research collaborations have been established in Indonesia, particularly in Semarang City, in the past five years to investigate the issue of water management.[3] Data collected by the Ground Up consortium (PowerPoint, 29–30 April 2019) showed that ten collaborative research programmes have been established between Dutch and Indonesian universities to investigate the subject of water management and propose solutions to contemporary issues. The current study contributes new explanations on boundary work[4], consortia, and knowledge of water management in Southeast Asia.

Establishing international research collaborations such as those mentioned above involves various documents, including those specifying honoraria and participants' obligations. Collaboration is established

3 For example, the WaterWorX programme—established in 2019—is a joint project between the Semarang City-owned Tirta Moedal Water Company and the Dutch Water Operators (VEI). The partnership is oriented toward improving groundwater access, ameliorating inefficient operations, low utility coverage, and land subsidence problems (including urban floods) in Semarang. This project thus mitigate the negative effects of water usage. See also: Jong, T.D., (2019). *WaterWorX project: WOP Semarang Indonesia*. https://www.vei.nl/projects/waterworx-project-wop-semarang

4 Boundary work is a concept developed by Thomas F. Gieryn to examine the relationship between science and policy. For Gieryn (1983), the ideology of the scientist limits the action of science in policy activities. Meanwhile, for Halffman (2003), the action of science is implied through the texts, objects, and persons of policy activities. Further explanation is provided below.

through negotiations between members, which continue until an agreement is reached (Perkmann & Schildt, 2015; Kirchhoff & Esselman, 2015). Unfortunately, the topic of how the different disciplines, values, and practices of consortium members influence the collaboration process has received limited attention in academic literature.

To fill this gap, the current article focuses on the establishment of the Ground Up consortium. This consortium was selected based on three considerations. First, it involves a multitude of partners from diverse backgrounds, writ, two universities in the Netherlands (the University of Amsterdam [UvA] and IHE Delft Institute for Water Education), two universities in Indonesia (Gadjah Mada University [UGM] and Diponegoro University [Undip]) and two NGOs in Indonesia (the Amrta Institute for Water Literacy and the People's Coalition for The Rights to Water [KRuHA]) (Ground Up Document, 2018). As such, Ground Up consists of members with various backgrounds and involves collaborative research from more than one institution.[5]

Second, this article explains the boundary work between science (universities) and policy (NGOs). This explanation is important, as universities and NGOs are commonly viewed as having different values, knowledge, and practices, which leads to contestation. This study, conversely, seeks to understand how these entities can coordinate and finally "work together". Although the

5 This is distinguishes the Ground Up consortium from other projects, which involve collaboration between only two institutions active in the same field. The aforementioned WaterworkX project, for instance, involved the Utrecht-based Dutch Water Operators and the Semarang City-based Tirta Moedal Water Company, in a co-funded scheme from the Dutch Ministry of Foreign Affairs (Jong, 2019).

investigation of collaboration between universities and NGOs is not unique, the research collaborations between them have always been taken for granted. This study, thus, investigates research collaboration as a social process that may include (but does require) contestation.

Lastly, this study deals with the contestation of knowledge, values, and practices amongst members of the consortium. The Netherlands are well known for their knowledge of water management, through which the country has developed its canal system (Colven, 2020). Such knowledge is particularly prominent in Dutch universities, given their positions as institutions with the competence to combine scientific disciplines—for instance, history and urban studies (Colven, 2020). On the other hand, knowledge of water governance in Indonesia is different due to the country's emphasis on a regulatory-based approach (SI, interview, 7 June 2021). Such a difference is interesting, especially given their decision to collaborate.

As the topic of international research collaboration and consortia is already established (e.g.: Perkmann & Schildt, 2015), this article focuses on using Southeast Asian experiences to provide a new explanation for how demarcation and collaboration are formed in such projects. Most consortium studies, such as Perkmann and Schildt (2015) and Kirchhoff and Esselman (2015), have relied on experiences from the Global North in their investigation of the main factors underpinning consortium work. Such a situation has contributed to the strong demarcation between universities and NGOs and, following McNiel et al. (2008), between science and

policy. Little has been done to understand how science and policy can collaborate to achieve shared goals.

This article, thus, seeks to explain how the universities and NGOs within the Ground Up Consortium negotiated science and policy boundaries. In so doing, it seeks to answer three questions, namely: 1) How did members of the Ground Up consortium divide and coordinate work between science and policy?; 2) What were the consortium members' views on the relationship between science and policy?; 3) How did consortium members manage to find common ground to work together when dealing with the issue of land subsidence?

To answer those questions, this study uses the boundary work concept offered by Willem Halffman (2003), which emphasises demarcation and coordination between science and policy. For this research, document analysis was conducted by using the consortium's meeting notes from January 2019 to April 2021. Interviews were also conducted with three members of the Ground Up consortium to provide additional information for analysis. What was discussed at the coordination meetings? On what aspects did they agree on definitions, knowledge, and the need for research? What is relevant knowledge? How did they view the roles of science and policy? What were the problems and what could be solutions? Such questions guided this study's effort to reconstruct our understanding of what is seen as science or policy (Halffman, 2003, p. 416).

Literature Review

The study of collaborative research, including consortia between universities (science)

and non-government organisations (policy), has drawn special attention. Perkmann and Schildt (2015) argue that any consortium consists of stakeholders with different goals, interests, and benefits. This argument is supported by Gonsalves (2014), who writes that a relationship between science and policy exists within any research consortium. Such collaborative projects create public spaces wherein science may interact with policy and vice versa. Therefore, reconstructing our understanding of how research collaboration occurs in the context of consortia invites attention to further study.

Most scholars have observed the role of consortia as bridges between science and policy. A study from Perkmann and Schildt (2015), for instance, investigated the role of consortia in the topic of open data using the example of the Structural Genomics Consortium. They show that the Structural Genomics Consortium played a role as a boundary organisation[6] in encouraging collaboration between universities and industry to increase the quantity of Research and Development (R&D) in open data projects (Perkmann & Schildt, 2015). The consortium was therefore successful in stimulating collaboration and regulating the demarcation between science and policy. They found that substance in the research agenda contributes positively to institutional coordination. If the object (writ, research agenda) disappears, interactions between science and policy will never materialise and thus the collaborative open data project will fail (Perkmann & Schildt, 2015).

6 Guston (2001, 2003) identifies the institutions that operate in communicating science and policy as boundary organisations. The main task of these institutions is to serve as science and policy communicators.

In a different case, Kirchhoff and Esselman (2015) examined the Great Lakes Integrated Sciences and Assessment (GLISA), a consortium of climate science producers and brokers. They investigated how GLISA collaborated with the Hudson River Watershed Council (HRWC), an NGO, and argued that GLISA—as a boundary organisation—had a role in transmitting scientific climate information, whereas HRWC acted as a facilitator (Kirchhoff & Esselman, 2015). As a boundary organisation, GLISA was identified as an important 'tool' for bridging science and policy.

As discussed above, two main points should be highlighted. First, most studies of the interactions between science and policy take the context of the Global North.[7] The aforementioned study by Perkmann and Schildt (2015), for instance, took a consortium involving the University of Oxford (United Kingdom), University of Toronto (Canada), and the Karolinska Institute (Sweden) to see research collaboration contributed to encouraging universities and industry actors to improve research and development. In contrast, this study focuses on a different context, taking its example from Southeast Asia—specifically, Indonesia, cases in Indonesia have been understudied.

Secondly, most studies use an institutionalist analysis to see the interactions between science and policy. They argue that consortia act as boundary organisations that mediate between the two. In the context of water governance, the boundaries between science and policy have also focused

7 Research on boundary work construction within consortia that focus on water management has been conducted by several scholars, with emphasis on water scarcity and knowledge contestation between experts and laypersons (White, et al., 2008), as well as the negotiation of knowledge between experts and laypersons (Leimona, et al., 2015).

their analysis on the institutional setting, with organisations acting as mediators (White et al., 2008; White, 2010; Parker & Crona, 2012; Boezeman et al., 2013). Meanwhile, this study uses the SSK perspective to explore how collaborative research was initiated by different institutions in a consortium.

Theoretical Framework

1. Boundary Work

The concept of boundary work was introduced by the sociologist Thomas F. Gieryn in 1983 to describe how the different knowledge between science and non-science is negotiated (Gieryn, 1983; Zeiss & Groenewegen, 2009). Early studies by Gieryn (1983) reviewed the demarcation of "what is science" and "what is non-science", arguing that ideology is the main factor limiting scientists' ability to be objective in seeing phenomena. Gieryn's studies contributed significantly to the shift from an essentialist[8] to a constructivist[9] paradigm of scientific authority (Ramírez-i-Ollé, 2015). The constructivist paradigm is used by scholars to explain, understand, and discuss the boundaries between science and policy, which have long been considered to be different worlds (Ramírez-i-Ollé, 2015).

Early studies using the boundary work concept emphasised the discursive and defensive nature of the demarcations between science and non-science (Gieryn, 1983). Scientists build boundaries to protect their territories, and the contestation and defence of these

8 The knowledge produced by the scientific community has some fundamental and unique qualities, including certain values, norms and methods. This uniqueness provides a strong foundation for the creation of science (Ramírez-i-Ollé, 2015).

9 The SSK paradigm was used by Gieryn (1983), who provides an alternative argument about the formation of science by emphasising that science is formed based on social constructions (i.e., social interactions or activities).

boundaries (Langley, 2019) are encouraged by the social interest to claim, expand, and protect the authority of cognitive science (Jasanoff, 1987). In addition, earlier studies on boundary work tended to explain the way science does not contribute to policy, and vice versa (Ramírez-i-Ollé, 2015; Langley et al., 2019).

Several scholars, such as Langley et al. (2019); Orsini et al. (2017); Sheldow (2017), and Halffman (2003), have a different perspective on that statement. Langley et al. (2019: 705) define boundary work as involving individual and collective efforts to influence social, symbolic, material, and temporal boundaries; demarcation; and differences affecting groups, occupations, and organisations. In other words, Langley et al. (2019) emphasise the coercive power of individuals and collectives to re-construct the demarcation between science and policy.[10]

Orsini et al. (2017) have a different emphasis, defining boundary work as involving the achievement of mutual understanding between agencies while maintaining the necessary boundaries and clarifying each agency's respective role. In line with that, Shedlow (2017: 831) said that boundary work is an attempt to build or break down the barriers between different practices or activities. To

10 According to Langley et al. (2019), categories of boundary work include: 1) competitive boundary work; 2) collaborative boundary work; and 3) configurational boundary work. Competitive boundary work can be seen as the initial conception of boundary work, one which emphasizes the efforts of scientists to build boundaries and protect their privileged status. Gieryn explained this as a 'credibility contest', wherein knowledge is contested between scientists and policymakers. Collaborative boundary work, meanwhile, is characterised by an effort to negotiate boundaries and 'work' at them. Finally, configurational boundary work is explained as a shift in meaning, wherein working on building boundaries turns into working on boundaries. Orsini et al., (2017) argue that boundary work has to explain more than demarcation, and include also the effects on collaboration.

summarise, Orsini et al. (2017) highlight the need to appreciate the respective roles of science and policy, while Shedlow (2017) emphasizes developmental aspects and breaks down boundaries between science and policy.

Most definitions of boundary work emphasize either the demarcation of science and non-science or the 'negotiation' between science and policy. In this, Halffman (2003) revealed the key variables in the interaction of science and policy. He emphasised that boundary work is institutionalized in boundary devices, which include coordination, and that practice through boundaries is a key part of boundary work. The interaction between science and non-science is not only a matter of demarcation but also coordination (Halffman, 2003: 4)., both of which are embedded within practices. As Halffman writes, boundary work is

> *"...a practice, in contrast with other practices, protects it from unwanted participants and interference, while attempting to prescribe proper ways of behaviour for participants and non-participants (demarcation); simultaneously, boundary work defines proper ways for interaction between these practices and makes such interaction possible and conceivable (coordination)" (Halffman, 2003: 116).*

Furthermore, Halffman (2003: 63–71) argued that boundary work uses and produces boundary devices where textual, material, or social sources serve to demarcate and coordinate practices between the

boundaries of science and policy. These boundaries can be realized by text, objects, and people (abbreviated TOP), which form the boundary configurational.[11] This means that the boundaries between science and policy use and produce and configure new boundaries through texts, objects, and people. This TOP framework will be used in this article, which will identify the texts, objects, and people in the Ground Up consortium.

2. Text, Object, and Person (TOP Model)

To identify the construction of boundary work involving the Ground Up consortium, I use the TOP framework developed by Halffman (2003). This framework emphasises that texts, objects, and people can be identified through several documents, such as programmatic journal articles and polemics between members of research institutions (Halffman, 2003: 120). This approach provides useful guidance on what data is required to look at science and policy boundary work.

Firstly, text refers to boundary work marked by rhetoric, language, and literary tools (Halffman, 2003: 60). It refers to people or actors that separate science and policy through speech or writing to emphasise their respective roles. Take, for example, the terms "risk assessment" and "risk management"; the former was produced through boundary work by the National Research Council of the United States with a specific purpose, while the latter places risk within the context of

11 Halffman (2003) argues that boundary configuration is a combination of text, object, and person (TOP) that is mobilised together and produces an effect on the demarcation of science and non-science. In this article, I use the TOP framework to examine how the configurational boundary is formed.

the policy world (Halffman, 2003: 60). The differences between these terms affect various activities (Halffman, 2003: 66).

Secondly, objects are the material boundary devices used to mark boundaries (Halffman, 2003: 60). The term "boundary object" was introduced by Star and Griesemer in 1989. This concept explains various actors' different understandings of objects to which all refer. Take, for example, heart and lung specialists. Both will refer to this object. However, the cardiologist will examine the pulsations of the heart to ascertain its condition. In contrast, the pulmonologist will focus more on the patient's breathing to determine the quality of the lungs. From this example, we can conclude that boundary objects function to coordinate different social worlds and ensure communication between them. At the same time, however, they provide space for their social worlds to remain separate and stable (Goksu, 2014: 12-13).

A study by Cutts et al. (2011) offers an excellent example of the logic of boundary objects. Studying a socioecological model that projects water consumption and availability in central Arizona in scenarios of growth, urbanisation, climate uncertainty, and policy choices, they found that the object (i.e., simulation) facilitated the negotiation of specific issues related to water consumption between scientists and stakeholders. This is not surprising, as the model was produced by scientists to communicate knowledge products for use by policymakers.

From this case, we can that objects do not only coordinate boundaries but provide space for scientists to produce knowledge as well as for stakeholders to use for policymaking. In other

words, an object can be used by two different actors, who remain separate and stable in the two different social worlds. Continuing from the previous example, the water model could be moulded into a standardised package[12] (Franks, 2010, p. 286-287; Halffman, 2003, p. 64) and create a new, stable definition for both scientists and policymakers.

Lastly, the term 'people' or boundary person describes an agent that stands in two social worlds, a figure that represents a link between science and policy or one who operates on the boundaries between different worlds (Halffman, 2003: 61). These people are defined variously as gatekeepers[13] and knowledge brokers[14] (Halffman, 2003: 61). For instance, a study from White et al. (2008) looked at the role of water managers as knowledge brokers representing the Decision Center for Desert City (DCDC), Arizona State University (ASU), in the distribution of knowledge about climate change uncertainty to stakeholders. These water managers received the title "people" because they had the authority to represent the DCDC and its decisions.

To conclude, Halffman (2003) emphasized that text, objects, and people operate together and form the boundary configuration. Through these three instruments, boundaries are bound to each other to distribute meanings, values, and participants to construct interactions

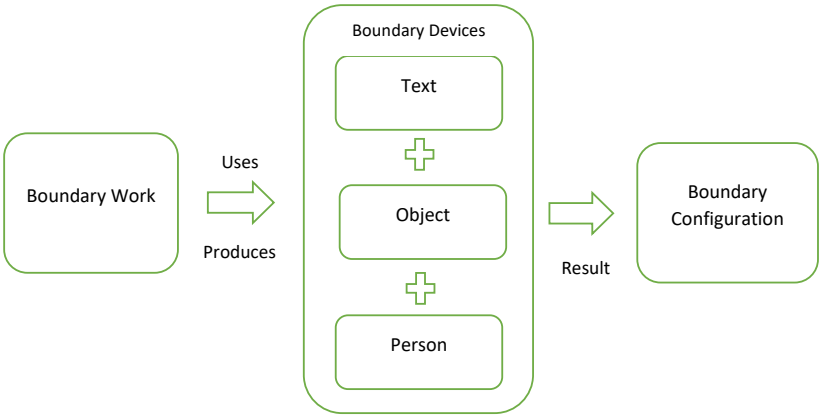
12 This term coined by Fujimura (1992: 168), who explains that negotiation between boundary objects can lead to a standardised package that functions to stabilize the facts and boundaries of the boundary object.

13 As Halffman (2003: 61) illustrates, gatekeepers could be exemplified by journal editors as persons representing a journal. Editors have the right to decide the topic, who can contribute to the journal, etc. (p. 61).

14 Kimble et al. (2010), in Halffman (2003), define a knowledge broker as a person who has a role in mediating expertise.

(and provide boundaries) between science and policy (Halffman, 2003). This article aims to develop this concept within an Asian context through the example of the Ground Up consortium.

Figure 1 Conceptual Framework



Source: Author's Analysis (2021)

Methodology

This qualitative research offers a case study of the Ground Up consortium. It relies on primary documents, in the form of meeting notes, calls for proposals, initial proposals, and meeting/workshop PowerPoint presentations (Laswell: 2007: p. 73) prepared by Gadjah Mada University (UGM) for the Ground Up consortium. The documents produced by UGM have been chosen due to the university's status as the coordinator of the research team in Indonesia and the recorder of consortium

meeting notes (Ground Up document, 2019). Data were collected between January 2019 and April 2021, during which time the objects, ideas, negotiations, and discussions shaping the collaborative work of the Ground Up consortium were investigated. For research and publication purposes, this article disguises the names of informants and consortium members.

This article uses the Sociology of Scientific Knowledge (SSK)[15] approach, a tradition that emphasises that knowledge and technology are not "natural"[16] but socially constructed to form "new" knowledge of agency (Sismondo, 2010; Bijker, 1997). This approach traces its roots to academics at the University of Bath and Edinburgh School, particularly Steven Shapin, Trevor Pinch, and Harry Collins. Since then, the SSK approach has been extended to several theoretical and methodological frameworks, one of the famous being Bruno Latour's Actor-Network Theory.[17]

In this study, and following the tradition of the SSK approach, the concept of boundary work in knowledge collaboration is not taken for granted. Rather, it emphasises that non-human actors (such as documents) contribute to the formation of collaborations (Zeiss & Groenewegen, 2009; Halffman, 2003). Therefore, this study tries to uncover why the Ground Up consortium was

15 The SSK approach is embedded with a constructivist logic.

16 The SSK approach was develop to criticise technological determinism, an understanding which emphasises technological growth based on actor knowledge and leads to one goal, either good or bad (Bimber, 1994).

17 Using a laboratory study, Latour (1987) emphasised the role of non-human actors (such as electricity networks, documents, and scientific experimentation tools) in the formation of social networks in society. Both are termed "actants".

ultimately established despite the differences in consortium members' cultural/social practices and knowledge.

Analysis: Boundary Work in a Consortium

The analysis section is divided into three subsections, each of which deals with one aspect of the TOP (text, objects, people) model used for analysis. Based on document analysis and interviews with consortium members, this article argues that the research collaboration represented by the Ground Up Consortium was constructed by calls for proposal documents, research proposals, and the presence of people who acted within the boundaries of science and policy.

1. Boundary Text: Calls for Proposals and Division of Labour in Research Proposals

The Ground Up consortium was initiated through a call for proposals issued in conjunction with two donor agencies, the Dutch Research Council (NOW) and the Ministry of Research and Higher Education of Indonesia (RISTEKDIKTI). According to the widely distributed call for proposals, several prerequisites had to be met. One was that the Dutch research organisation had to act as the main applicant; the Indonesian research organisation as a member; and one or more private/public partners had to be involved to enhance the social impact of the research. It was also stated that including one or more awardees of a current-year RISTEKDIKTI grant on the research team would increase

the chances of the proposal being accepted. However, this was not a mandatory requirement (NWO Document, 2018: 9).

> *"In the call for proposals, there was an obligation to cooperate with existing Indonesian academics recommended by RISTEKDIKTI. There was a list in the call for proposals document. Approximately 50 scientists based at universities in Indonesia were recommended by RISTEKDIKTI. This call for proposals was a collaboration between NWO-RISTEKDIKTI, so it included two different funding schemes" (BA, interview, 7 June 2021).*

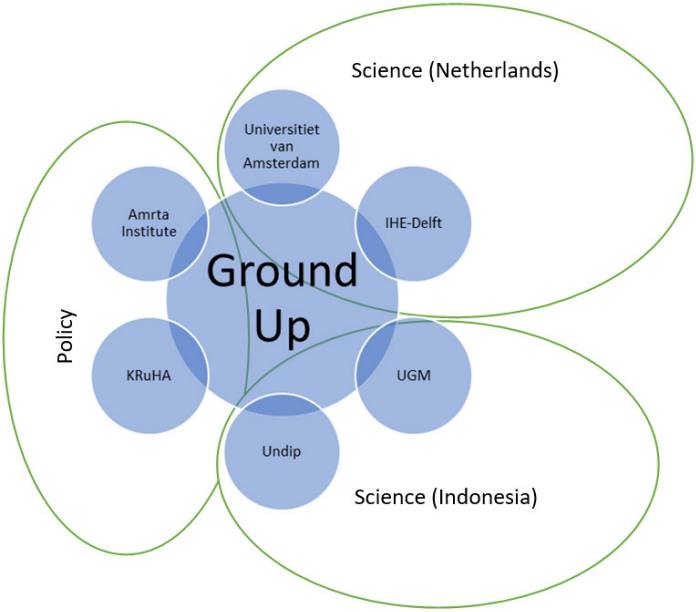
Another prerequisite was implicit: advancing the goals of the NWO-RISTEKDIKTI research grant. In the call for proposals, three main objectives were identified. First, strengthening cooperation in the fields of science and innovation. Second, addressing the current problems of society by creating collaboration between scientists and scholars at institutions in Indonesia and the Netherlands. Third, promoting interdisciplinary research (NWO Document, 2018: 3). This had implications for the involvement of experts in the Ground Up consortium.

Also stipulated was the focus of the research. Three research focuses were listed in the NWO-RISTEKDIKTI call for proposals. First, food security and agriculture. Second, regional planning (including water management and hydrology). Third, governance and rule of law (NWO Document, 2018: 5–6). To accommodate the requirement to promote interdisciplinary research, the Ground Up consortium chose to focus on two elements: Regional Planning (Water Management and Hydrology) and Governance and

Rule of Law (Ground Up proposal, 2018). These were translated as land subsidence, which was chosen because it incorporated both technical dimensions (regional planning) and matters of governance (SI, interview, 7 June 2021).

To address these prerequisites, the Ground Up consortium was assembled as a combination of universities, institutions that produce science, and NGOs, as institutions that focus on advocacy (policy). In the Netherlands, UvA and IHE-Delft acted as the main university applicants for this proposal. These universities brought with them a tradition of socio-technical knowledge that sees social conditions and technical aspects as mutually influential. UGM and UNDIP acted as the university applicants from Indonesia. UGM dealt with the governance aspects of water management, particularly the power dimensions involved in water management. Meanwhile, UNDIP brought with it knowledge of urban spatial planning. Finally, two NGOs—the Amrta Institute and KRuHA—were concerned with citizens' right to water without exception. Both were tasked with distributing the findings of the Ground Up consortium and conducting public advocacy activities. Once the Ground Up proposal was accepted, UvA and Undip were rarely involved in consortium activities; their inclusion in the consortium was primarily to meet administrative requirements for their applications to be considered by NWO-RISTEKDIKTI. In short, every member of the consortium agreed to be involved because it was relevant to its particular expertise (SI, interview, 7 June 2021).

Figure 2 Actors in the Ground Up Consortium



Source: Author's Analysis

Challenges arose because the call for proposals required the involvement of universities (science) in the Netherlands, universities (science) in Indonesia, and NGOs (policy) in Indonesia. The main challenge was bridging the different values, knowledge, and practices of the Ground Up consortium's members. Such differences arose naturally due to the differences in culture, interaction, and environment that affected the way institutions work (McNie, 2008). The contestation of expertise, therefore, was unavoidable.

From these facts, it is evident that the formation of the Ground Up consortium was influenced by the requirements set within

the NWO-RISTEKDIKTI call for proposals, such as collaboration of knowledge, values, and practices. This requirement entered the basic logic of each consortium member, and thus the urgency to collaborate was undeniable. Collaboration was carried out by dividing tasks among members, with certain research questions entrusted to certain members. At the same time, the boundary work between science and policy was formed through this process.

The Ground Up consortium thereby created a division of labour in answering the research questions. IHE-Delft, as the main applicant, had an important role in drafting the research questions and honing the ideas to be brought by the Ground Up consortium. UGM also played a role as a discussion peer in brainstorming ideas. However, IHE-Delft was the sole institution with the authority to decide the final research questions (SI, 7 June 2021).

> *"Initially it was IE, EL, and BA, who from the beginning identified research problems. Finally, the research questions themselves were made by EL, after we discussed them. It takes skill to make solid research questions, and EL was more expert in doing so, but together we identified the big direction of this research" (IE, interview, 12 June 2021).*

The results of the brainstorming were then communicated with the Amrta Institute so that it could provide input on the research questions. The Amrta Institute agreed, as the research questions had been arranged to coincide with its agenda—

which is heavily intertwined with water management issues (SI, interview, 7 June 2021; IE, interview, 12 June 2021). The results of the brainstorming were also communicated to KRuHA, which did not have any specific point to address. UNDIP, as a consortium member, did not contribute to the shaping of the research questions considering their focus on a "strategy". Therefore, the research questions included in the proposal were the responsibility of IHE-Delft.

> *"That was like EL's prerogative. BA did not seem to have much involvement. There were three research questions for this project, so we just accepted them; nothing happened" – (IE, interview, 12 June 2021).*

Discussions ultimately led to a decision on the three research questions included in the proposal, namely: 1) How do ecological and socio-technical relations between below-ground and surface water distributions shape uneven outcomes for water access and risk?; 2) How are groundwater governance practices shaped by formal and informal institutions?; 3) How can civic innovation influence groundwater governance practices to realise more equitable distributions of flood risk and water access?

> *"EL was heavily involved in research question number one and two because she is a practitioner. Question number three, I think it was SI and IE who dealt with civic innovation" (BA, interview, 5 June 2021).*

These three research questions were formed and each member of the consortium took into account each institution's expertise in the study of water management. Boundaries

were therefore constructed (see Table 1). The creation of the research questions involved three members of the consortium, namely EL, BA and SI (SI, interview, 7 June 2021), who brainstormed to develop the questions and coordinated to identify problems. However, in the end, BA and SI had limited ability to make final decisions. Such authority fell to EL, because of her experience formulating research questions. In other words, the scientific approach was emphasised over the policy approach when designing the research questions.

Boundaries had to be created through the research questions due to expertise considerations. For example, SI had extensive knowledge of urban spatial issues and saw the dimensions of governance that impacted urban development. Therefore, she was responsible for the research questions related to governance issues (BA, interview, 5 June 2021). On that basis, we can see that the demarcation factor is due to the belief within the consortium that everyone had certain skills.

Table 1 Division of Labour in Ground Up Consortium

No	Research Question	Institution
1	How do ecological and socio-technical relations between below-ground and surface water distributions shape uneven outcomes for water access and risk?	IHE-Delft, UvA
2	How are groundwater governance practices shaped by formal and informal institutions?	IHE-Delft, UGM, Amrta Institute

3	How can civic innovation influence groundwater governance practices to realise more equitable distributions of flood risk and water access?	IHE-Delft, UGM, Amrta Institute, KruHA

Source: Author's Analysis (2021)

This division of labour was based on the knowledge and expertise of each institution. IHE-Delft had a deep understanding of the interdisciplinary approach and understood water management through a combination of its technical and governance aspects (SI, interview, 7 June 2021). They were able to speak well with other actors because of their expertise and existing track record with previous collaboration projects (IE, interview, 12 June 2021).

In contrast, UGM viewed the inability to solve water problems in Semarang as stemming from water management policies that emphasised an institutionalist approach, even as there existed disharmony between the executive, legislative and judicial branches (SI, interview, 7 June 2021). Amrta Institute and KRuHA had developed similar beliefs through their emphasis on communities' right to water.

As discussed above, the boundary text was identified through the substance of the NWO-RISTEKDIKTI call for proposals. This document provided an "area" for science and policy collaboration between Dutch and Indonesian institutions. At the same time, however, it created limitations on the research topic and the involved parties. Another boundary text was the research questions compiled by the Ground Up consortium. The division of labour in developing

research questions placed "boundaries" between UGM and IHE-Delft as well as between IHE-Delft and the two NGOs (Amrta Institute/KRuHA). At the same time, the research questions also created "coordination" between consortium members when answering the research questions (see Table 1).

Boundary work in the Ground Up consortium was constructed through a call for proposals from NWO-RISTEKDIKTI, research questions, and methodologies. This condition shifted after the project started. For the call for proposals, applicants planned transdisciplinary research with a focus on food and water management and rule of law (NWO Document, 2018). This impacted the form of the Ground Up consortium, which shared the common goal of producing transdisciplinary knowledge on the rule of law and water management (Ground Up proposal, 2018). Therefore, the Ground Up consortium was formed by various agencies, but they had a shared interest in investigating water management.

At the same time, the division of labour in the consortium was constructed through the research questions in the proposal. Every member of the consortium had an obligation to answer the research questions. Likewise, through the methodological aspects—the decision to use a survey—the demarcation between science and policy was shaped. These boundaries shifted over the course of the year.

2. Boundary Object: Research Proposal

Discussing the boundary objects of the Ground Up consortium brings our discussion to the research proposal, which functioned to set boundaries between science and policy, expertise and non-expertise, and

(more generally) the Netherlands and Indonesia. The research proposal contained, among other things, a timeline of the activities to be carried out by the Ground Up consortium. Specific budgeting and research questions were arranged, distinguishing specifically between science-based and policy-based activities. Boundary work thus became more prominent.

Reconstruction of this process can begin with explaining the research proposal as a boundary object. Three components of the research proposal can be said to be boundary objects. Firstly, the timeline of Ground Up consortium activities contained in the research proposal. The Ground Up project ran for three years. In the first year, the Ground Up consortium focused on collecting data to answer the research questions detailed in the proposal. It also produced knowledge through the book *Maleh Dadi Segoro* (MDS), which emphasised land subsidence in northern Semarang.

Entering the second year, the distribution of knowledge to water stakeholders in Semarang was carried out through a workshop in late December 2019 and early January 2020. Targeted stakeholders included the Regional Revenue Agency (Bappenda) of Semarang City, the Regional Planning Agency (Bappeda) of Semarang City, the Department of Energy and Mineral Resources (ESDM) of Central Java Province, the Public Works Department (PU) of Semarang City, and local politicians. In this workshop, the Ground Up consortium explained the results of data collection and initial analysis through PowerPoint presentations. Focus was given to land subsidence in several parts of Semarang City (such as Tambak Lorok), local

innovations from residents who made and distributed water tanks, and potential solutions for each stakeholder (Ground Up meeting notes, 19 January 2020).

In the third year, the consortium focused on the production of knowledge in the form of journal articles, according to the main interests of each member of the consortium. For example, UGM wrote about how local (material) policy relates to water issues. The local election in Semarang showed that the materiality of policy is shaped by patronage. Furthermore, this article related to the momentum of local elections and looked at how the issue of water was being interpreted in public discourse. On the other hand, Amrta Institute and KRuHA developed an open course about "socio-ecological crises and direct democracy". BA was involved in this open course as an individual, as he assumed that it would be a way to share knowledge. He discussed "degrowth", knowledge of which he gained through his involvement in Ground Up (BA, interview, 5 June 2021).

Secondly, the research budget component also played a role as a boundary object. Each member of the consortium viewed it differently. For example, NGOs saw the budgeting component as focused on advocacy activities through the production of knowledge. For universities, the budget could be diverted to other things, such as strengthening the capacity of civil society by improving water education. The budget was part of the research proposal that regulated science and policy activities, identifying not only activities that would be carried out but also the means of carrying out these activities. Take, for example, survey activities. These limited the scope of the research, i.e., how many areas could be sampled for knowledge

production activities. The survey culminated in the production of knowledge. At another point, this produced advocacy to be carried out by the consortium (Ground Up Meeting Notes, 13 December 2019).

Another example can be seen when the Ground Up consortium sought to engage external partners in producing output. Per the research proposal, one of the outputs of the Ground Up consortium would be a video campaign (Ground Up Proposal, 2018). For NGOs, a video campaign would provide a means of supervising land subsidence. On the other hand, universities saw the video campaign as involving the dissemination of knowledge about land subsidence. These were transformed into an effort to deliver knowledge about water management through digital platforms. Such an output provided a blended science and policy activity because it combined knowledge production (in the form of documentary films) with advocacy (policy) activities. However, the budget was an obstacle to delivering science and policy activities. The two examples above show that the budget of research plays a role in maintaining the stability of practices and activities between science and policy.

> *"We need to decide what targets we want to achieve. Example: social justice and inequality. Alas, our budget is too small for [Watchdoc], as a Watchdoc could cost IDR 100 million" (Ground Up meeting notes, 12 January 2021).*

Furthermore, through the relationship and research management between consortium members, reciprocal relationships were created based on the research proposal. UGM and IHE-Delft played a

role in covering the research budget, while Amrta Institute and KRuHA focused on advocacy and knowledge transfer. This assignment of roles was evident throughout the entire project because KRuHA and the Amrta Institute were at the forefront of the advocacy process. In other words, each consortium member coordinated to ensure the continuation of research.

Thirdly, the research questions contained in the research proposal. Star and Griesemer (1989) argue that boundary objects involve standardised work and protocols. As such, research proposals—including research questions—can serve as important boundary objects that create demarcation and collaboration between consortium members (Ground Up consortium proposal, March 2018).

> *"If you look at the structure of the question, you can guess who will handle what, because, in the formulation of the problems we have designed, it is not actually designed from the beginning. Rather, there was pressure from each member of the consortium that shaped the research questions" (SI, interview, 7 June 2021).*

As noted previously, three key research questions were developed (see Table 1), with each consortium member having a role in providing answers. These questions thus served not only to divide members but also to ensure coordination. For instance, UGM was obliged to answer research questions number two and three. Thus, UGM conducted field research to answer these two questions. However, they did not restrict their interview guides to these two topics; they also

included more general questions so that other members of the consortium would be able to use their data.

Based on the above explanation, I argue that the research proposal played an important role as a boundary object in the Ground Up consortium. This is evidenced by three components, namely the timeline, budget, and research questions included in the research proposal. These functioned to demarcate and coordinate science and policy. For example, we can see that the demarcation of science and policy was constructed through the research timeline, which specified when scientific activities would be carried out and when policy activities would be carried out.

All consortium members' activities referred to the proposal. During meetings and discussions, they used the research proposal to remind them of the programmed direction of activities, both scientific and policy. For example, the production of scientific knowledge was to be carried out in the first year, while policy activities would be prioritised in the second year. In the third year, the consortium would be deeply engaged in advocacy activity through the production of knowledge, such as journal articles. Data collection was carried out in the first year, which then became the basis for the production of knowledge (in the form of journal articles) in the third year. Each member was involved in bridging their different values, knowledge, and practices. As such, the Ground Up consortium was able to realise their activities in practice.

> *"My role was to try to ascertain what was promised in the proposal. For example, the proposal promised to*

produce an article, and in my opinion, I think that conceptually it has been fulfilled." (BA, interview, 5 June 2021).

According to the previous discussion, we can assume that understandings of the research proposal differed. Universities interpreted research proposals as important parts of knowledge production that aimed to answer what previous studies had not. On the other hand, NGOs referred to research proposals to ascertain what kinds of activities could be done to increase public awareness about land subsidence. NGOs needed the knowledge produced by universities to be able to better understand the context of land subsidence. To conclude, universities and NGOs had different understandings of research proposals.

3. Boundary People: Shifting as Research Progressed

Identifying boundary people in the Ground Up consortium is tricky because almost all of the members acted as boundary people. Through document analysis and interviews, I discovered that members operated within different communities. EL operated on behalf of IHE-Delft, UvA, and the Ground Up consortium, as did BA. SI, meanwhile, acted on behalf of UGM and the Ground Up consortium itself, and held the title of coordinator.

Members' respective roles were also different. EL played a major role in bringing together experts to be involved in this study. BA, on the other hand, consolidated the expertise contributed by UGM, Undip and KRuHA within the consortium and explored the possibility of collaborating with the Legal Aid

Institute (LBH) of Semarang to deal with the issue of evictions in the coastal areas of Semarang. I argue that they acted as knowledge brokers because of their role to mediate experts and expertise within the Ground Up consortium.

The formation of the Ground Up consortium was inexorably linked to a meeting between EL and IE at a workshop on land subsidence in Jakarta, which was possible because IHE-Delft and Amrta Institute were asked to present the findings of their collaborative programme to the Governor of Jakarta. In this activity, Makara, a Dutch NGO engaged in water issues, was also involved.

The results of this workshop raised hopes that research activities could continue and provide policy input to the provincial government of Jakarta. Around this time, the call for proposals was announced by NWO-RISTEKDIKTI. EL conveyed this news to Amrta Institute and Makara and urged them to prepare a proposal.

> *"At that time EL said that there was a chance to join the NWO call for proposals. Did we want to take it or not? In the end, we tried" (IE, interview, 12 June 2021).*

Discussions were carried and BA was involved in making the Ground Up proposal. When she wanted to involve BA, EL consulted IE, who also knew BA.

The inclusion of BA in the consortium helped EL gather experts for the Ground Up consortium. BA held a series of meeting with prospective members—UGM, KRuHA, and LBH Semarang—that could help their advocacy activities.

BA held a personal meeting in December 2018 with each member of the consortium and

potential external partners. BA met representatives from KRuHA, Amrta Institute, UGM, and LBH Semarang. The purpose of these meetings was to identify their expectations for this research, what roles they could play, and their main concerns when involved in this project (Ground Up Meeting Notes, 19 January 2019).

First, he met KRuHA representatives to initially discuss the Ground Up consortium's research objectives, especially as related to the issue of groundwater extraction and its effect on floods and land subsidence. KRuHA agreed that this was very important, as in their experience with the issue of land subsidence in Jakarta the public tended not to discuss the matter (Ground Up meeting notes, 19 January 2019). They found that the issue of land subsidence was not something that had a direct impact on the community. Therefore, the research objectives of the Ground Up consortium were in-line with the main goal of KRuHA (Ground Up meeting notes, 19 January 2019).

BA then met with representatives from the Amrta Institute, an organisation with a focus on research management and knowledge transfer. The meeting emphasised that research activities would continue for three years, starting from the consolidation of the Ground Up consortium to the release of research findings as a part of knowledge transfer. Representatives of the Amrta Institute argued that the Ground Up consortium needed a strong individual figure capable of channelling ideas of water governance in Semarang. Over time, the Amrta Institute hoped that there would be integrated data to facilitate advocacy activities in Tambak Lorok

(Ground Up meeting notes, 19 January 2019). The consortium owned the medium because one of its objectives was public advocacy.

The next meeting was with SI, as a representative of UGM. In the meeting, UGM expected that the Ground Up consortium would have a network of stakeholders to assist its advocacy actions and produce knowledge about land subsidence (Ground Up meeting notes, 19 January 2019). BA answered that the Ground Up consortium could invite LBH Semarang as one of its stakeholders. The involvement of LBH would improve knowledge of groundwater within the community.

Following this meeting with UGM, BA met with representatives of LBH Semarang to ascertain its potential as a medium for transferring knowledge to society and stakeholders. During the meeting, BA provided background information on this project, such as its objectives and duration. LBH positively welcomed this meeting and was willing to be involved in the groundwater crisis campaign (Ground Up meeting notes, 19 January 2019).

To summarise, EL and BA acted as knowledge brokers. EL played a major role in shaping ideas as well as connecting experts. She also distributed tasks and determined what data should be used, shaped the conceptual framework, and decided the main arguments.

On the other hand, BA acted to integrate the different knowledge and expectations of members. He was also involved in advocacy and, at the same time, contributed to the substance of the research. At one point, he demarked science and policy by playing a role in determining the members of the Ground Up consortium. At another point, he coordinated

science and policy relations by being involved in advocacy activities and maturating the research substance.

As research was underway, SI was made the main coordinator in Indonesia. This allowed her to stand between science and policy. She handled administrative matters, in the form of knowledge production activities through surveys and advocacy activities for residents affected by land subsidence. For instance, in preparing a book that contains knowledge and advocacy for residents affected by land subsidence, SI handled administrative issues such as the honorarium for the editor, the number of copies printed, etc. SI took care of these matters, and thus acted as a person who crossed the line between science and policy.

She was also involved in substantive processes. For instance, when the second survey was completed, she played a role in overseeing the analysis of the survey results. SI then played a role in distributing these results to stakeholders, especially politicians (SI, interview, 7 June 2021). SI had an agenda to raise awareness of the issue of land subsidence amongst politicians, thereby ensuring that the public was aware of the dangers of land subsidence. By using survey instruments, politicians could easily recognise that land subsidence was currently happening. Therefore, through the survey instrument, she was involved in both the production of knowledge and advocacy.

Further evidence of her role as a boundary crosser is the fact that SI represented the Ground

Up consortium in the press release of the project's findings (Ground Up meeting notes, 30 January 2020). On that basis, she acted not as a representative of UGM, but rather on behalf of the Ground Up consortium. She determined what research findings could be shared and what research findings should be kept. Therefore, if we define boundary people as gatekeepers, SI was the key figure. Through the discussion above, we can see that SI acted as a boundary person and played a role in bridging science and policy, such as by acting as a spokesperson. Therefore, SI was not involved only in the production of knowledge. She slowly became involved in advocacy (policy) activities.

Conclusion

Using the TOP model, this article shows that the negotiation between science and policy was constructed through the call for proposals, research proposals, and people operating at boundaries. As a boundary text, the call for proposals issued by NWO-RISTEKDIKTI shaped the formation of the Ground Up consortium. Its contents, such as the purpose of the call for proposals and the focus of research, pushed the Ground Up consortium to promote collaboration between science and policy and informed the focus of the research. At the same time, the call for proposals established a clear division of labour in answering the research questions.

As for boundary objects, the initial design of research collaboration demarcated science and policy in a particular manner. This was evidenced through a series of practices that were listed in the research proposal. However, the research proposal did not only function to

demarcate science and policy. It also functioned to coordinate science and policy by specifying the time for science activities and the time for policy-based activities. Finally, for boundary people, this study finds that three members of the consortium played a role to coordinate the boundaries. Furthermore, there was a shift as research progressed.

Through the example of the Ground Up consortium, this study finds that collaborative knowledge between the Global North and Global South is not taken for granted. Rather, collaboration was socially constructed through the call for proposals, boundary objects, and the involvement of people who are at the limits of science and policy.

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