



Evaluation Report

Sanitation in the Niger Delta Project

**An Outcome Evaluation of a Royal Roads
University Graduate Student Research Project**

Prepared by: Stephanie Jones, Brian Belcher,
Rachel Claus, and Rachel Davel



SSHRC  CRSH

Cover photo: Typical better quality hanging toilet. Niger Delta, Nigeria. Photo: Nancy Gilbert

Any views expressed in this publication are those of the authors. They do not necessarily represent the views of Royal Roads University, the principal investigator, the principal investigator's institution, or financial sponsors.

Acknowledgements

The Sustainability Research Effectiveness Program is supported by Ashoka Canada, the Canada Research Chairs Program, and the Canadian Social Sciences and Humanities Research Council (SSHRC). We thank the principal investigator for their contributions to the Theory of Change and sense-making workshops, interviews, and feedback on the report. Finally, we extend thanks to all interview and survey informants who participated in the evaluation.

Produced by

Sustainability Research Effectiveness Program
Royal Roads University
2005 Sooke Road
Victoria, British Columbia
V9B 5Y2
Canada

Telephone: +1-250-391-2600 ext.4407

Email: brian.belcher@royalroads.ca

Website: researcheffectiveness.ca

© SRE 2020



This research was carried out by the Sustainability Research Effectiveness Program at Royal Roads University as part of a series of case studies of completed Royal Roads University graduate student research projects.

Table of Contents

Table of Contents	ii
List of Tables	iii
List of Figures	iii
List of Acronyms	iv
Executive Summary	v
Introduction	1
Case Study Overview	2
Evaluation Methodology	3
Data Collection	4
Analysis	5
SNDP Theory of Change	6
Results	10
SNDP Outputs	10
Outcome Evaluation	10
<i>To what extent and how were outcomes realized?</i>	10
<i>Were there any positive or negative unexpected outcomes from this project?</i>	20
<i>Could the outcomes have been realized in the absence of the project?</i>	21
<i>Are the higher-level changes likely to be realized?</i>	29
Research Project Assessment	34
<i>What elements of the research design and implementation supported outcome realization, and how?</i>	34
<i>To what extent and how did the project engage effectively with relevant stakeholders?</i>	40
<i>To what extent were the findings sufficiently relevant to achieve the stated objectives?</i>	42
<i>To what extent and how are target audiences aware of and using the project outputs?</i>	42
<i>How does Royal Roads support student success in research?</i>	44
<i>What lessons about effective research practice can be learned from this case study?</i>	45
Recommendations	48
Appendix 1. Invitation to Participate in Interview	50
Appendix 2. Evidence Sources	51
Appendix 3. Semi-structured Interview Guide	52
Appendix 4. Survey Tool	57
Appendix 5. Codebooks	61
Outcomes Codebook	61
QAF Codebook	65
Appendix 6. Quality Assessment Framework	71
Appendix 7. QAF Scores and Justifications	75
Appendix 8. Evidence of Outcome Realization	78
Appendix 9. References	96

List of Tables

Table 1. Summary of outcome realization and SNDP contributions	ix
Table 2. Informant and interview details	4
Table 3. Summary of the SNDP outcome assessment	11
Table 4. Mechanisms of outcome realization by pathway leveraged by the SNDP	17
Table 5. To what extent have the following factors contributed to changes in the Nigerian WASH sector?.....	20
Table 6. Project assumptions assessment.....	23
Table 7. Higher-level outcome assessments	30
Table 8. Individual evaluator and average scores for all QAF criteria	75
Table 9. Expanded outcome assessment	78

List of Figures

Figure 1. Simplified SNDP Theory of Change	vii
Figure 2. Length of survey respondents' experience in WASH	5
Figure 3. Elaborated SNDP Theory of Change.....	9
Figure 4. SNDP Theory of Change, with outcomes colour-coded to reflect extent of outcome realization	16
Figure 5. Scoring of the SNDP against QAF principles	34
Figure 6. Project satisfaction of relevance criteria.....	35
Figure 7. Project satisfaction of credibility criteria.....	36
Figure 8. Project satisfaction of legitimacy criteria	38
Figure 9. Project satisfaction of effectiveness criteria.	39
Figure 10. Survey respondents' familiarity with the SNDP and its outputs	43
Figure 11. Survey responses to the question: 'The PI's research has influenced or contributed to my work on WASH'	44

List of Acronyms

ATED	Appropriate Technology Enabled Development
CIHR	Canadian Institute of Health Research
CLTS	Community-led Total Sanitation
CSO	Civil Society Organization
COMASSOC	The Commonwealth Association
DEWT	Delivering Effective WASH Training
DSocSci	Doctor of Social Science
EoP	End-of-project
INGO	International Non-governmental Organization
KASR	Knowledge, Attitudes, Skills, and Relationships
LGA	Local Government Area
MDG	Millennium Development Goal
NEWSAN	The Society of Water and Sanitation
NGO	Non-governmental Organization
NSERC	National Sciences and Engineering Research Council of Canada
ODF	Open Defecation Free
PI	Principal Investigator
PIND	Partnership Initiatives in the Niger Delta
QAF	Quality Assessment Framework
RFP	Request for Proposal
RRU	Royal Roads University
RUWASSA	Rural Water Supply and Sanitation Agency
SDG	Sustainable Development Goal
SNDP	Sanitation in the Niger Delta Project
SRE	Sustainability Research Effectiveness
SSHRC	Social Sciences and Humanities Research Council
TDR	Transdisciplinary Research
TI	Transform International
ToC	Theory of Change
WASH	Water, Sanitation, and Hygiene
WEDEC	Water, Engineering and Development Centre

Executive Summary

Introduction

This report presents an outcome evaluation of a research project undertaken by a Royal Roads University (RRU) Doctoral of Social Sciences (DSocSci) student. RRU has a mission to teach and create research that contributes to transformation, both in its students and the world. RRU's focus on interdisciplinarity, blending academic and professional experience, and solution-oriented research situates RRU well to address real-world problems. The Sanitation in the Niger Delta Project (SNDP) intended to contribute to improved sanitation in the riverine communities of the Niger Delta by: identifying current water, sanitation, and hygiene (WASH) practices, attitudes, and beliefs; assessing sanitation technologies employed in riverine communities; assessing the appropriateness of technologies for the delta's geography; and identifying opportunities to sustainably improve sanitation. Approximately 50 million people currently practice open defecation in Nigeria, with little progress being made in addressing WASH in the Niger Delta (Gilbert, 2017). Unsafe WASH has significant implications for social and economic development, as poor management of water resources leads to pollution and destruction of ecosystems that in turn affect livelihoods and health. Although previous literature has focused on various aspects of the WASH sector, little to no research has examined the conditions specific to the Niger Delta. The SNDP intended to support developments within the Niger Delta's WASH sector and for its riverine communities; contribute to improved government policy and practice; and contribute to the professional development of the principal investigator (PI). The SNDP investigated current WASH practices, attitudes, and beliefs; sanitation technologies employed in riverine communities; appropriateness of technologies for the delta's geography; and elements needed to sustainably improve sanitation. This outcome evaluation assesses whether and how the SNDP contributed to the improvement of sanitation in the Niger Delta.

Methodology

The evaluation investigates whether and how the SNDP generated new knowledge, attitudes, skills, and relationships among key actors to improve sanitation in the Niger Delta region. The objective is to critically assess the SNDP by collecting and analyzing information about its activities, outputs, and outcomes to support learning for research effectiveness.

The Outcome Evaluation approach used within this evaluation is explicitly intended for application to transdisciplinary research projects (Belcher et al., 2020). The approach uses concepts from Outcome Mapping (OM), such as declining relative influence, presented as spheres of control, influence, and interest; actor-specific outcomes defined as behaviour change; and specific indicators defined per outcome (Belcher et al., 2020). The approach assesses whether and how a research project contributed to the realization of outcomes, using a theory of change (ToC) as the main analytical framework. The ToC is also used to define data needed and identify potential data sources to deductively test each change hypothesis (Belcher et al., 2020). A ToC provides a detailed description and model of why a change is expected to occur within a specific problem context. It models the causal relationships between a project's activities and results, and how these are expected to manifest in outcomes, giving particular attention to the impact pathways, actors, and steps involved in the change process. The underlying mechanisms of behaviour change are conceptualized as changes in knowledge, attitudes, skills, and/or relationships (KASR).

The evaluation team led a participatory workshop in March 2019 to define the scope of the evaluation, retrospectively document (i.e., make explicit) the implicit ToC for the SNDP (Figure 1), and identify possible sources of evidence to empirically test the ToC. The Outcome Evaluation method collects participant and stakeholder perspectives to identify and assess the contribution of factors within a change process (Belcher et al., 2020). To gather these perspectives, we conducted fifteen interviews, an online survey, and reviewed a series of relevant documents to answer the following questions for the outcome assessment:

1. Research Outcome Evaluation:

- a. *To what extent and how were outcomes realized?*

- b. Were there any positive or negative unexpected outcomes from this project?*
- c. Could the outcomes have been realized in the absence of the project?*
- d. Were the assumptions pertaining to why these changes were expected sustained?*
- e. Are the higher-level changes likely to be realized?*

Project design and implementation were characterized using Belcher et al.'s (2016) Transdisciplinary Research Quality Assessment Framework (QAF). The QAF was used to highlight elements of research design and implementation that contributed to the realization of outcomes. This assessed the degree to which the SNDP incorporated recognized quality criteria of transdisciplinary research¹, organized under the principles of *Relevance*, *Credibility*, *Legitimacy*, and *Effectiveness*. The project assessment was guided by the following questions:

2. Research Project Assessment:

- a. What elements of the research design and implementation supported outcome realization, and how?*
- b. To what extent and how did the project engage effectively with relevant stakeholders?*
- c. To what extent were the research findings sufficiently relevant to achieve the stated objectives?*
- d. To what extent and how are target audiences aware of and using the project outputs?*
- e. How does RRU support student success in research?*
- f. What lessons about effective research practice can be learned from this case study?*

Results were analyzed and grounded in the context of social change theories, including stakeholder theory and social capital theory, to explain the implications of outcome realization.

Project Overview

Open defecation in Nigeria remains a substantial issue with little progress having been made in addressing WASH in the Niger Delta (Gilbert, 2017). Nigeria was listed among countries 'not on track' to fulfill the sanitation objectives of the seventh Millennium Development Goal (MDG). As well as having a significant impact on health (e.g., improved access to WASH is effective in combatting diarrheal disease), unsafe WASH has a significant impact on economic development as poor management of water resources leads to pollution and destruction of ecosystems that in turn impact livelihoods. The Niger Delta region, with its low altitude coastal geography, high annual rainfall, high-water table, and frequent flooding, presents special challenges which require tailored technology options to address the WASH gap. The region also has challenging social conditions, including low levels of education, income, a general lack of resources, and cultural norms and attitudes that impede adoption of improved WASH practices. By gaining insights into the cultural, social, and economic context, the SNDP aimed to guide and inform approaches within the ASH sector, including technological options for sustainable sanitation in the riverine communities of the Niger Delta. The SNDP used an exploratory case study method with a quantitative survey of habits in two riverine communities (257 households participated), and a qualitative study including twenty-one in-depth semi-structured interviews with individuals working in WASH or living in this environment, as well as direct observation, participant observation, and field notes. The key outputs of the SNDP included: the WASH sector WhatsApp group; government and WASH actors low-level of WASH knowledge; knowledge of Niger Delta contexts (e.g., environment, hydrology, culture, communities, etc.); low level of WASH knowledge and current cultural practices in communities (including risks and challenges associated with poor WASH); the appropriateness of WASH technologies for communities' specific context including lack of available technology; evidence based recommendations and guidance for exploring safe sanitation options and ensuring their adoption into policy and practice; and, identified the need for capacity-building and consistency of WASH workers. The SNDP aimed to contribute to key intended outcomes such as: enhancing local government capacity for improved policy and practice; enhancing capacity for knowledge sharing and learning within Nigeria's WASH sector and supporting the implementation of SNDP recommendations; enabling Niger Delta

¹ The QAF is not meant to be a measure of excellence, but rather characterizes the project design and implementation in terms of the degree of its transdisciplinarity.

communities to have access to appropriate, affordable and safe technologies to address WASH; and, supporting the PI to continue work in the WASH sector and beyond. Further detail regarding the SNDP ToC is included below.

Project Theory of Change

The overall purpose of the SNDP was to improve the health, social, and economic development of communities living in the Niger Delta. The research aimed to contribute to this aim through three interconnected pathways: a *WASH sector and community development* pathway, a *government policy and practice* pathway and a *professional development* pathway. The key steps in these pathways are illustrated in Figure 1. Each impact pathway intersects and complements the others to support the realization of outcomes. When the PI began the SNDP, there were no technological options available for safe sanitation practices appropriate for the high-water tables and frequent flooding experienced in the Niger Delta region. This led the PI to explore technological options for the context, along with an investigation of current WASH practices, attitudes, and beliefs, to identify potential solutions. The PI conducted a literature review of current sanitation technologies implemented in the Niger Delta, identified available WASH technologies and their suitability to riverine environments, and examined sanitation behaviour change approaches. Other activities included field observation, surveys, and interviews with stakeholders. The PI engaged relevant government, practitioner, and community actors in the research by leveraging the PI's existing professional connections in the region. The PI shared knowledge and SNDP findings back to these groups to influence thinking, policy, and practice.

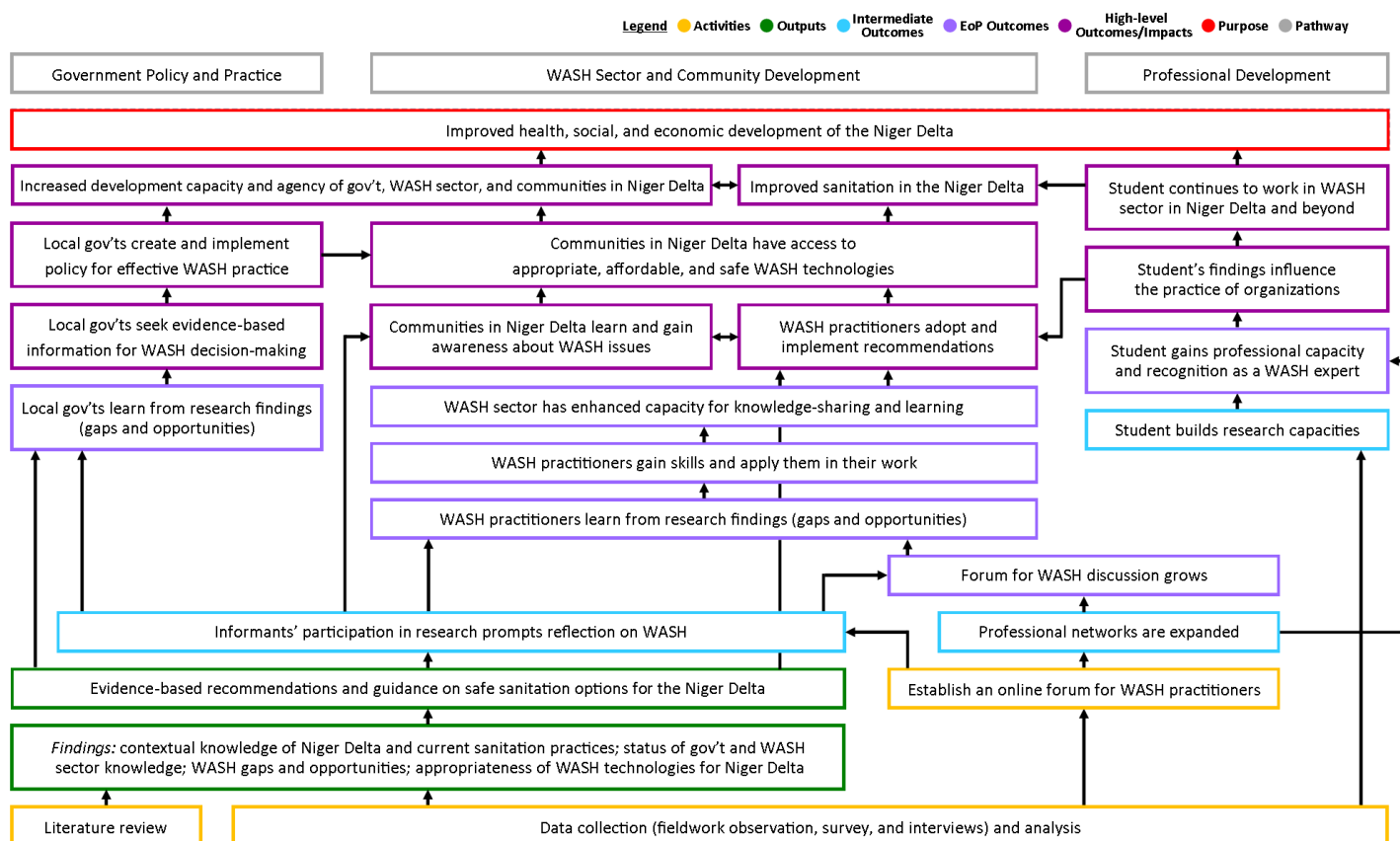


Figure 1. Simplified SNDP Theory of Change

The *WASH sector and community development* pathway was the main avenue of influence for the project. To support engagement activities with local WASH practitioners, the PI created an online forum for discussion, which also functioned as a community of practice, via a WhatsApp group. By participating in the research, it was expected that new reflections about the Niger Delta's WASH situation would emerge. WASH practitioners were expected to critically reflect on their own ways of working, learn from the research findings, gain skills via

training sessions, and subsequently implement the recommendations. With a greater local awareness of WASH issues and as WASH practitioners implement recommendations, communities in the Niger Delta would have greater access to appropriate, affordable, and safe WASH technologies in the long-term.

Influencing *government policy and practice* was not a main focal point of the research. However, by including WASH representatives from the government (including the Rural Water Supply and Sanitation Agency (RUWASSA)) within the data collection process, it was expected that these informants would reflect on their own ways of working and improve their WASH knowledge through the research findings. Moreover, it was expected that exposure through the SNDP would encourage government actors to seek evidence-based information and contextually appropriate solutions. With an improved knowledge base and awareness of WASH gaps, issues and solutions, it was expected that local government capacity to develop and implement effective WASH policy would be improved. Better informed policies and practices alongside access to appropriate technologies would lead to improved sanitation in the Niger Delta.

In addition, the research intended to provide a *professional development* experience for the PI to expand their expertise as a WASH practitioner and earn their doctorate. As a result, the PI would gain recognition as an expert in WASH. The PI was expected to apply learning from the research experience in the organizations they work with in the future to influence practice. By sharing and applying WASH knowledge to other contexts around the world, the PI was expected to contribute to the development capacity and agency of the WASH sector both in the Niger Delta and beyond. Overall, all activities, outputs, and outcomes were expected to support improved health, social, and economic development in the Niger Delta.

Results

Outcome Evaluation: *To what extent and how were outcomes realized?*

Table 1 summarizes the extent to which outcomes were realized. The SNDP leveraged multiple impact pathways and mechanisms to realize outcomes. Outcomes in the *WASH sector and community development* pathway were realized through the involvement of key stakeholders in the data collection process and by co-producing knowledge. As an exploratory piece of research, the SNDP identified key knowledge gaps and helped stakeholders become aware of WASH gaps, issues, and opportunities through targeted dissemination of the findings (e.g., including stakeholders in meetings and discussions). By leveraging the PI's professional position at WASH organizations (including Partnership Initiatives in the Niger Delta (PIND) Foundation), knowledge gained through the SNDP was transferred to the PI's colleagues to support staff effectiveness and increase capacities. The creation of a WhatsApp group comprised of 179 local WASH sector actors (e.g., RUWASSA, WASH practitioners, etc.) at the time of the evaluation contributed to increased knowledge and sharing of best practices across the Niger Delta WASH sector. *Government policy and practice* outcomes were partially realized and supported by outcomes in the *WASH sector and community development* pathway. For example, involving government actors in the data collection phase influenced their knowledge and capacities through participation, encouraging them to reflect on current WASH policy and practice. By inviting government actors to join the WASH sector WhatsApp group, the SNDP facilitated enhanced capacity for knowledge sharing and learning. Outcomes in the *professional development* pathway were realized as the SNDP provided an opportunity for the PI to develop their research capacities through the research process, and through new knowledge, skills, and understanding for future work on the topic. Other mechanisms include strengthening existing networks and coalitions by exposing the PI to new networks; leveraging and enhancing the PI's reputation; and supporting the PI's interest and motivation to continue working on the topic of WASH.

There were some unexpected outcomes that arose in connection to the SNDP, such as the establishment of a knowledge network of scholars and practitioners to share development knowledge and facilitate knowledge-to-practice in the form of Transform International (TI); further exploration of the topic in other parts of Africa; and the opportunity to support the revision of a national government protocol to establish communities as open defecation free (ODF). The logic of the SNDP and its underlying assumptions appear to be sustained. However,

the need for appropriate infrastructure appears to have not been fulfilled owing to corruption, the challenging landscape, embedded cultural norms, and a weak governance.

Table 1. Summary of outcome realization and SNDP contributions

<i>Outcome</i>	<i>Assessment</i>
Informants' participation in research prompts reflection on WASH [<i>intermediate outcome</i>]	Realized, clear project contribution
PIND staff gain knowledge and capacities and apply them in related work [<i>intermediate outcome</i>]	Realized, clear project contribution
Forum for WASH discussion grows [<i>end-of-project outcome</i>]	Realized, clear project contribution
WASH sector recognizes WASH gaps, issues and opportunities [<i>end-of-project outcome</i>]	Realized, clear project contribution
Nigeria's WASH sector has enhanced capacity for knowledge sharing and learning [<i>end-of-project outcome</i>]	Realized, unclear project contribution
WASH sector explores technologies in high water table contexts [<i>end-of-project outcome</i>]	Partially realized, unclear project contribution
Local governments have enhanced capacity for improved policy and effective WASH practice [<i>end-of-project outcome</i>]	Partially realized, unclear project contribution
PI's professional development enhanced by research experiences [<i>intermediate outcome</i>]	Realized, clear project contribution
The PI has deeper understanding of issues in WASH and how to approach working in challenging contexts [<i>end-of-project outcome</i>]	Realized, clear project contribution
Knowledge network of scholars and practitioners share development knowledge and facilitate knowledge-to-practice transformation (TI) [<i>end-of-project outcome</i>]	Realized, clear project contribution

Alternative Explanations of Outcome Realization

Some evidence indicates alternative explanations (i.e., processes external to the SNDP) for outcome realization. For example, national government initiatives such as declaring a state of emergency in WASH, the implementation of the National Action Plan for the Revitalization of the WASH sector (2018), and the recent prioritization to end open defecation have raised the importance of appropriate sanitation technology development and provision to achieve an open defecation free (ODF) Nigeria by 2025. This increased support by national government has led to the implementation of policy for effective WASH practice. Community-Led Total Sanitation (CLTS) has also been embraced by the Nigerian government and is part of the National Action Plan. For example, evidence suggests that CLTS has been implemented in some riverine communities of the Niger Delta which has supported communities to take ownership of local WASH initiatives. Local governments also have enhanced commitment to action on WASH through establishing WASH policies, laws, ODF road maps, and implementation guidelines as a result of national initiatives. The above initiatives have contributed to the biggest improvements in the Nigerian WASH sector over the past three years. The efforts by national and local government highlight the alignment of the SNDP with current initiatives and its social relevance as a research problem. However, contextual factors including corruption have proven a barrier to progress. Organizations such as USAID and UNICEF have also focused efforts on improving WASH with capacity-building programs and communities of practice. Increased communication and knowledge sharing within the WASH sector has begun to influence safe sanitation practices within the Niger Delta. UNICEF has focused attention on strengthening government efforts to end open defecation, as well as supporting governments to implement WASH policies, strategies and guidelines (UNICEF, 2019). Similar to the SNDP which focuses on sanitation value chains, the private sector is also a key element to UNICEF's work as they aim to ensure sufficient engagement and support to enhance commitment to action on WASH. Other individual research projects have engaged with communities

in the Niger Delta to understand persisting sanitation challenges and why communities may not currently be using improved sanitation options that are available. Lastly, media campaigns, including through radio and television, have been used to contribute to the gradual change in social norms around safe WASH. Overall, the SNDP reinforces and works towards similar goals as many initiatives also underway in the sector. However, few of these are discussed or built upon within SNDP documentation.

Project Assessment: *What elements of the research design and implementation supported outcome realizations, and how?*

The QAF assessment reveals that the SNDP's design and implementation aligns with some principles and criteria of relevant, credible, legitimate and effective research, and produced knowledge that is useful and used (see Appendix 7 for QAF results and justifications for the project assessment). However, in comparison to other TDR projects, the SNDP scored relatively low across all principles.

Under the relevance principle, the PI's previous experience and knowledge of the context was a key factor in supporting the completion of research in a sensitive topic. The research design was appropriate due to the little prior research on the topic of sanitation in the Niger Delta which enabled the SNDP to provide a base of understanding. The SNDP addressed a socially relevant research problem and effectively engaged with the problem context. Informants reflected on the relevance and value of the SNDP, and the practical application of the findings have been considered and discussed by system actors, particularly those who continue to work at PIND. However, the singular objective and lack of discussion of the communication process was a weakness under the QAF analysis; a set of objectives to support the research purpose and explicit discussion of communications would further situate the research within the social problem and contribute to transparency.

Regarding credibility, the PI had the adequate competencies to support the completion of the SNDP and collect a variety of perspectives. The exploratory design is appropriate to address the stated objective with a clear discussion on the inclusion of chosen methodologies and the collection of data from Niger Delta communities. However, the SNDP does not draw correlations between the qualitative and quantitative data to support findings and strengthen the argument. Further transparency regarding relationships and bias would have further supported the trustworthiness of SNDP findings (Belcher et al., 2016).

Under legitimacy, the SNDP maintained the anonymity of participants and highlighted the importance of reflexivity to ensure it was an ethical project. There was scope for the project to be more collaborative with informants and those not directly involved in the project to improve the uptake and use of findings and recommendations. Transparency could have been improved with more detailed discussions of relationships, biases, and positionality to build trust among possible users of the findings and recommendations.

Lastly, the SNDP clearly contributed to the partial or full realization of seven of the ten intermediate and end-of-project outcomes. The PI's capacity was developed with the successful expansion of their knowledge base to support their future work on the topic in the Niger Delta and beyond. Since completing the SNDP, the PI has continued to work with NGOs, governments, and communities to develop safe, contextually appropriate, and environmentally suitable toilets for the Niger Delta, as well as bring practitioners together to improve and share knowledge about best practices. Informants suggested that the SNDP was effective at bringing knowledge into action. Practitioners working in the sector were encouraged to focus their work on developing appropriate technology solutions for the contexts, with a number of the recommendations having been implemented on a regional scale. However, it is unclear to what extent the SNDP directly contributed to this. Most actors within the project's sphere of influence were aware of the project findings, benefitted from the process, and are using some learnings from the project. However, most survey respondents stated that they were unaware of the SNDP. The final thesis, a summary article, presentations at WEDEC, and a magazine article disseminated SNDP findings. More targeted dissemination and engagement would have supported further outcome realization in the *WASH sector and community development* pathway and the *government policy and practice* pathway to share knowledge of the SNDP beyond those directly involved in the project.

RRU programming supported the realization of SNDP outcomes in the *professional development* and *WASH sector and community development* pathways by supporting the PI to complete research that was relevant to their role as a WASH practitioner with the interdisciplinary environment supporting the SNDP to implement change. The nature of the DSocSci program at RRU is broad enough to allow flexibility for student-practitioners to undertake research that will inform their professional work. Key informants suggest that the interdisciplinary nature of the program was a key aspect to the project's success. The program structure, with a combination of on-campus residencies and distance learning, worked well with the PI's schedule while also allowing the PI to build collegial relationships with other students from a range of backgrounds, ages, and ideas. This subsequently fostered new professional relationships for the PI to continue working on the topic, and the PI has since established the non-profit organization, Transform International (TI), with a fellow RRU student.

Lessons Learned

Project Lessons

- Leveraging the PI's professional networks and social capital were effective strategies to collect data and to ensure knowledge-into-practice through dissemination.
- A transdisciplinary approach supported the blending of the corporate and community and practitioner worlds to ensure the usefulness of SNDP recommendations.
- To further support outcome achievement through research design and implementation, a discussion of project limitations is needed within the SNDP, and data collected should be fully leveraged (e.g., drawing correlations between qualitative and quantitative data). The research project assessment using the QAF revealed that theoretically, the appropriate project methodology is needed to support the transfer of findings to inform or design solutions to the research problem.
- Establishing respectful and positive relationships is necessary to increase trust in the PI, the research project, and the SNDP outputs.
- Further intentional collaboration and knowledge dissemination with system actors and organizations not directly involved in the SNDP would support the implementation of recommendations within the sector.

Contextual Lessons

- Further leveraging the PI's knowledge and experience of the Niger Delta WASH context would identify alignments with other projects underway in the sector, avoiding duplication, to ensure the research fills existing knowledge gaps.
- Engaging a cross-section of actors (including community members, experts in the field, and government actors) within the conversation supported research and progress around a 'taboo' and sensitive topic.
- Completing an in-depth review of current WASH policies and practices currently implemented in the Niger Delta provided useful insights for recommendations and supported the SNDP in influencing policy.
- Building further connections with and leveraging government informants who can champion the SNDP and solutions would support the SNDP in fostering political will for implementing the SNDP recommendations.

Evaluation Lessons

Limitations of the analytical framework: Retrospective documentation of the ToC can make the distinction between intended and unintended outcomes unclear. Subsequently, some outcomes that were identified in ToC workshop were not expected at project inception (e.g., *knowledge network of scholars and practitioners share development knowledge and facilitate knowledge-to-practice transformation (TI)*). In addition, having the PI identify informants to test the outcomes can also increase the risk of introducing bias into data collection as informants may be selected for their likelihood to reflect positively on the project's results and outcomes. To address this limitation, snowballing for additional perspectives and sources of information was undertaken. A survey of the WASH sector WhatsApp group was also completed to gather data more widely than the PI's direct sphere of influence which helped to reduce bias within data collection.

Limitations of the data and results: Assessments rely on informant perspectives. Interviews were conducted a few years after the project concluded, making recall of project details and processes difficult for informants. There was also some confusion in separating outcomes related to the SNDP from the PI's extensive work in the sector prior to and following the completion of the SNDP. This led to several outcomes being identified with unclear project contribution. However, it was observed that those closest to and more involved the project could recall more details of the project and its contributions. These individuals also perceived the project's influence to be higher than those more distant from the project. Despite efforts to reach government officials, community members, and WASH trainers (e.g., Delivering Effective WASH Training, DEWT), these informants were not interviewed. As a result, many of the outcomes in the *government policy and practice* pathway could have had richer data and analysis expanding on survey data.

Recommendations

Considering the results of the case study evaluation, we propose the following recommendations for the design and implementation of future research projects on sanitation issues in developing countries:

1. Be strategic in partnerships to leverage social networks and optimize opportunities for mutual learning, dissemination, and outreach.
2. Identify suitable boundary partners to support intended outcome realization.

We also recommend the following for research projects in *general*:

1. Use a ToC to plan and monitor progress and identify boundary partners that will support intended outcome realization.
2. Develop a clear problem statement, research question, and set of objectives to guide and support the purpose of the research project.
3. Fully leverage data collected to strengthen the argument and support the robustness of the research.

Introduction

This report presents an outcome evaluation of a research project undertaken by a Royal Roads University (RRU) Doctoral of Social Sciences (DSocSci) student. The focus of the Sanitation in the Niger Delta Project (SNDP) was to improve sanitation in the riverine communities of the Niger Delta by analyzing: current water, sanitation, and hygiene (WASH) practices, attitudes, and beliefs; sanitation technologies employed in riverine communities; appropriateness of technologies for the delta's geography; and elements needed to sustainably improve sanitation. The SNDP intended to contribute to improved knowledge and capacities within the Niger Delta's WASH sector and communities to support access to appropriate, affordable, and safe technologies to address WASH; contribute to improved government policy and practice; and contribute to the professional development of the principal investigator (PI). This evaluation investigates the extent to which and how the SNDP contributed to outcomes among key actors to inform the improvement of sanitation practices in the Niger Delta. The purpose of this evaluation is to critically assess project design, implementation, and contributions to outcomes to elicit lessons from the project's overall effectiveness.

RRU has an explicit mission to teach and generate research that contributes to transformation in students and the world (RRU, 2019a). The DSocSci program encourages the study of complex real-world problems using interdisciplinary and applied approaches to problem-solving for organizations, communities, and society (RRU, 2019b). In order to uphold the University's mission and support continuous learning, it is critical to analyze the extent to which and how student research contributes to change and how programming facilitates those contributions. The Sustainability Research Effectiveness (SRE) program at RRU is dedicated to understanding how research contributes to social change, and how those contributions can be improved through research design, implementation, and adaptive management. The SRE program conducts a series of participatory outcome evaluations to support learning for research effectiveness.

The project was selected for its likelihood to make contributions to social change. It fulfilled certain criteria in a document review of the abstract and thesis. The SNDP had a clearly stated problem and a socially relevant research question; used contextually appropriate research design and methodology; included stakeholders or community members in the research process; and its conclusions demonstrated potential for outcomes.

The evaluation follows a participatory theory-based evaluation approach, using a Theory of Change (ToC) as the analytical framework. The ToC articulates the theoretical relationships and sequences of steps through which the research project intended to realize outcomes and impacts. The evaluation is an empirical test to assess the extent to which and how the intended outcomes modelled in the ToC were realized. Research design, implementation, and outputs are assessed using Belcher et al.'s (2016) transdisciplinary research quality assessment framework (QAF). The QAF is used to highlight elements of the transdisciplinary research process that were sufficiently implemented by the SNDP to support the realization outcomes, and to elicit learnings of where future considerations should be made when designing and implementing transdisciplinary research (Belcher et al., 2016). The findings of the evaluation are grounded in broader theories of social change processes to explain how and why the project contributed to change.

The evaluation has three main objectives, to:

1. Assess the project's influence, by;
 - i. Documenting and testing intended outcome realizations and pathways;
 - ii. Drawing conclusions about the extent to which intended outcomes were realized and mechanisms of realization, with specific attention given to research project design and implementation;
2. Provide an opportunity for learning and reflection for researchers pertaining to promising research design and implementation practices, and lessons to guide future graduate research; and
3. Critically reflect on the evaluation methodology for future research project evaluations.

Outcome evaluations aim to assess two components of a research project: i) whether or not outcomes are realized; and ii) the extent of the project's contribution to outcome realization. The second component of assessing the

project's contribution is especially challenging (Mayne, 2001; 2012; Forss, Marra, & Schwartz, 2011). When projects are situated in complex systems, with multiple actors and processes that affect outcomes in some way, the attribution to any one cause is not possible (Mayne, 2001; 2012). This evaluation acknowledges these challenges by explicitly considering alternative explanations for the documented results, seeking stakeholder perspectives, and applying expert judgement to assess the project's contribution.

Research contributions are typically framed in terms of new knowledge production, such as testing and improving theory and methods, conceptual framework development, and theoretical and empirical analysis, among others (Belcher, 2020). Increasingly, research-based knowledge contributions are solutions-oriented, providing information and options to improve policy and practice. In addition to knowledge, research activities can facilitate and support social processes of change, such as building social and scientific capacities, influencing public discourse and research agendas, and creating new fora or facilitating solution negotiations as ways to influence policy and practice (Belcher, 2020).

The report begins with a brief overview of the SNDP. The methodology section explains in detail the analytical framework used and how data were collected and analyzed to respond to the evaluation questions. The results section answers the evaluation questions using evidence collected from interviews, survey, and document review. The lessons learned section discusses the implications of the findings and what was learned from the case study evaluation. The recommendations section outlines considerations for future research in light of the evaluation findings. The appendices provide supplemental information pertaining to the evaluation methods and results.

Case Study Overview

Approximately 50 million people currently practice open defecation in Nigeria, with little progress being made to improve water, sanitation, and hygiene (WASH) in the Niger Delta (Gilbert, 2017). With a population of 35 million people, it is estimated that between 50 and 65 percent of people in the Niger Delta live below the poverty line (National Bureau of Statistics, 2012). Nigeria is listed among countries 'not on track' to fulfill the sanitation objectives within the seventh Millennium Development Goal (MDG). Elsewhere, improving access to adequate WASH has proven to be effective at combatting diarrhea, one of the main causes of death in the developing world, particularly amongst children. There are significant negative social and developmental (e.g., health, economic) implications of poor WASH practices. Although previous literature has focused on various aspects of the WASH sector, little to no research has examined the conditions specific to the Niger Delta. The low-altitude coastal geography of the Niger Delta region, high annual rainfall, and high-water table presents particular challenges that need tailored technological solutions. The Niger Delta region also has social challenges including low levels of education, income, and a general lack of resources. Cultural norms also affect the development crisis – these norms include current WASH practices (e.g., disposal of human waste), attitudes toward WASH (e.g., cleanliness, acceptance of waste reuse, etc.), and the need to create a sense of agency and ownership. There are many factors needed to be in place to bring change within WASH; it is a long-term sequential process requiring antecedent changes and factors including infrastructure and political change. The challenge remains in how to bring sustainable change over time using a multitude of pathways. This context reveals the need for research in and understanding of a complex and difficult environment (Gilbert, 2017).

The SNDP investigated current WASH practices, attitudes, and beliefs in a sample of communities in the Niger Delta, as well as what sanitation technologies are already employed, and which technologies would be appropriate for the delta's geography. As a practitioner working in the Niger Delta WASH sector, the PI observed the lack of progress in WASH as community leaders were unaware of how to improve or where to seek WASH assistance. Owing to the PI's position at the Partnership Initiatives in the Niger Delta (PIND) Foundation, the PI had an opportunity to inform PIND programming, particularly in their role as the manager of the ATED program which sought to learn how technology can help improve development.

There has been limited previous research in the region on this topic. Moreover, at the time of the SNDP, the Niger Delta's WASH sector comprised only a small number of organizations. This included NGOs, inter-governmental organizations (e.g., UNICEF), and local government agencies (e.g., Rural Water Supply and Sanitation Agency

(RUWASSA) who is responsible for sub-national interventions in WASH). Following the influx of oil companies to the Niger Delta region in the 1950s, and subsequent environmental (e.g., oil spills) and social (e.g., armed conflict) emergencies from this influx, companies such as Chevron developed various Corporate Social Responsibility (CSR) and community support strategies. For example, in 2005, Chevron led the Global Memorandum of Understanding (GMoU) established between communities within the Niger Delta, whereby communities formed Regional Development Committees (RDCs) to assume responsibility over funding provided by Chevron to manage health, education, jobs and infrastructure (Chevron, 2017). To assist the RDC program, Chevron decided to set up an arms-length development organization in the region. PIND was established in 2010 as a regional strategy to address deep-rooted socio-economic problems in the Niger Delta by growing networks of international and local partners to collaborate in the development and implementation of new solutions and reducing dependence on oil revenue in the region (PIND, 2019).

By gaining insights into the cultural, social, and economic factors of the problem context, the SNDP aimed to guide and inform approaches for sustainable sanitation in the riverine communities of the Niger Delta. In addition to improved policy and practice, the SNDP intended to increase communities' and WASH practitioners' development capacities and agency as well as improving health, social and economic development. Overall, this was expected to help transform the negative feedback loop of poor sanitation and low development prospects into a positive development feedback loop for improved health alongside social and economic development.

Evaluation Methodology

A series of RRU Doctoral and Masters research projects were selected for evaluation through a systematic review process from the online repository. Seven selection criteria were applied including: (1) a clearly stated problem/issue; (2) a socially relevant research question; (3) inclusion of community or other stakeholders; (4) an articulation of how the project would lead to expected outcomes (implicit or explicit ToC); (5) appropriate research design and application of methods; (6) conclusions with demonstrated potential for outcomes (e.g., provides applicable recommendations); and (7) completed within five years of primary data collection. The SNDP was selected for its likelihood to contribute to social change. It fulfilled a number of the above criteria in a document review of the abstract and thesis. For example, the SNDP had a clearly stated problem and a socially relevant research question; used contextually appropriate research design and methodology; included stakeholders or community members in the research process; and its conclusions demonstrated potential for outcomes.

This evaluation examines whether and how the project contributed to development practice change that would influence social and environmental change in the study area and beyond. It uses a theory-based evaluation approach to model the intended outputs, outcomes, and impacts, test whether those results were realized, and analyze the mechanisms of change.

The analysis was guided by the following questions:

1. Research Outcome Evaluation:

- a. To what extent and how were outcomes realized?*
- b. Were there any positive or negative unexpected outcomes from this project?*
- c. Could the outcomes have been realized in the absence of the project?*
- d. Did the assumptions pertaining to why changes were expected sustained?*
- e. Are the higher-level changes likely to be realized?*

2. Research Project Assessment:

- a. What elements of the research design and implementation supported outcome realization, and how?*
- b. To what extent and how did the project engage effectively with relevant stakeholders?*
- c. To what extent were the research findings sufficiently relevant to achieve the stated objectives?*
- d. To what extent and how are target audiences aware of and using the project outputs?*
- e. How does RRU support student success in research?*
- f. What lessons about effective research practice can be learned from this case study?*

The evaluation follows the Outcome Evaluation approach described in Belcher et al. (2020), a participatory theory-based evaluation method which uses a ToC as the analytical framework (Figure 1). The method draws on the Payback Framework, Contribution Analysis (CA) and Outcome Mapping (OM), among other approaches, to assess research contributions in complex socio-ecological systems (Belcher et al., 2020). It takes a systems perspective, acknowledging that any project operates simultaneously with other actors and social processes, and recognizes that causal processes are often non-linear (Belcher et al., 2020). The ToC models the theoretical relationships and sequences of steps through which the research project intended to realize outcomes and impacts. It describes the causal relationships between a project's activities and results, and how these were expected to manifest in outcomes, focusing on the associated impact pathways, actors, and steps involved in the change process (Belcher et al., 2020). The model works backward from long-term goals to identify the conditions that theoretically must be in place for the intended high-level results to occur. The framework is also used to identify indicators and evidence needed to assess actual changes against expected outcomes at each stage.

The approach draws on OM's explicit recognition that the relative influence of a project or program declines the further it moves from the project boundary (Belcher et al., 2020). For example, a project's influence declines as the project moves from its activities (sphere of control) and who they work with (sphere of influence), to the improved conditions it hopes to realize (sphere of interest) (Belcher et al., 2020). Another key concept borrowed from OM is the focus on outcomes that are proximate to the intervention and occur within the sphere of influence (Belcher et al., 2020). We conceptualise outcomes as changes in knowledge, attitude, skills and relationships (KASR). However, a key element of the Outcome Evaluation approach is the explicit distinction of end-of-project outcomes defined as ambitious but reasonable to expect within the timeframe and resources of the project (Belcher et al., 2020). By modelling the ToC developed, the Outcome Evaluation method makes relationships between what the project does (activities and outputs) and its aims (outcomes and impacts) explicit. Assumptions are also documented to explain why a change is expected to occur in a particular circumstance. These explicit assumptions allow for testing to inform learning about how a particular change occurs under the conditions of the project and context within which it is situated (Belcher et al., 2020). The Outcome Evaluation method also builds on the RAPID approach by gathering participant and stakeholder perspectives to assess the contribution of various factors, activities, and outputs within a change process. The method also follows the CA approach of articulating and testing alternative hypothesis that can explain key changes (Belcher et al., 2020).

ToC Documentation

The SNDP did not have an explicit ToC in place. Therefore, as a first step, a participatory ToC workshop was held with the PI in March 2019. During the workshop, the SRE team worked with the PI to retrospectively document (i.e., make explicit) the implicit ToC for the SNDP. The evidence required to empirically test whether or not the outcomes were realized was also identified during the workshop. Data needed to assess each outcome and potential data sources were organized in an evidence table.

Data Collection

Data were collected through a review of relevant documents (including project proposals, magazine articles, and government documents), an online survey (42 complete responses), and semi-structured interviews with fifteen informants from two different informant categories (Table 2) (see Appendix 2 for a full list of data sources).

Table 2. Informant and interview details

<i>Informant Group</i>	<i>Number of Interviews Conducted</i>
Researcher	4
Practitioner	11
Total	15

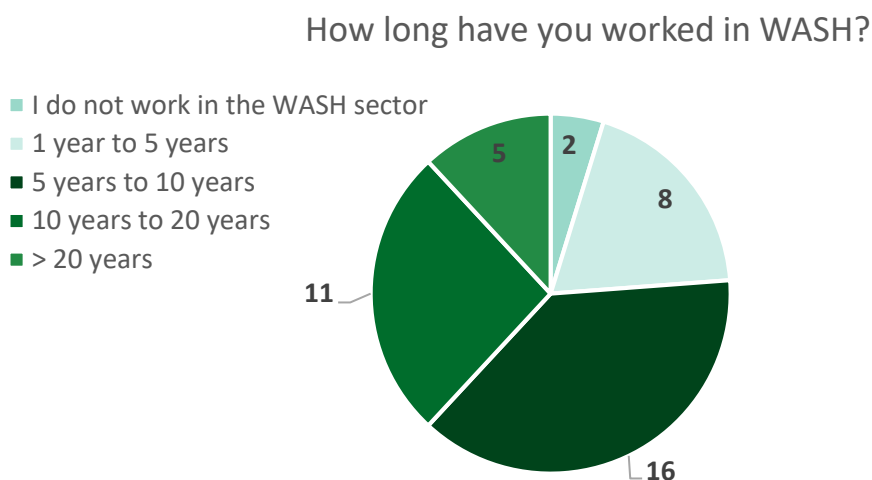
Interview and survey questions were formulated to ascertain informant perceptions of the problem context, key challenges and developments, decision-making, and the project's approach and its contributions (see Appendices 3 and 4 for the interview guide and survey tool, respectively). In consideration of the PI's commitment to the anonymity of project participants, invitations to participate in the interviews were sent to original project

participants through the PI (Appendix 1). Former project participants who were willing to participate were then connected to the evaluation team. Snowballing from former project participants for additional perspectives and sources of information was undertaken. Survey respondents were contacted through the PI's WASH Sector WhatsApp group comprised of practitioners and key stakeholders working in the Niger Delta WASH sector. The evaluation team maintains commitment to the anonymity of these and all evaluation informants by removing identifying information from interview transcripts and ensuring the survey was anonymous. Interviews were recorded with informants' permission and transcribed.

Survey Respondent Demographics

The majority of survey respondents (38%; n=16) have worked in WASH for five to ten years. Some respondents had more experience, from ten to twenty years (26.2%; n=11) to upwards of twenty years in the sector (11.9%; n=5); while others were still relatively new to WASH with one to five years of experience (19.0%; n=8). Only two respondents (4.8%) stated that they do not work in the WASH sector. This suggests that most survey respondents have a good knowledge of the WASH sector and its related issues.

Figure 2. Length of survey respondents' experience in WASH



Analysis

The transcripts were coded thematically and analyzed using NVivo to systematically organize data corresponding to the evaluation questions. Deductive coding was employed using codes adapted from previous evaluation experiences and new codes framed by the specific outcomes of the project (see Table 9 in Appendix 8 for a complete list of project outcomes). The coding process organizes objective and subjective data from a variety of sources to help understand contextual factors, project contributions, and how outcomes were realized. Two codebooks were used: one to analyze outcome realization; and one to assess elements of research design and implementation (both codebooks can be found in Appendix 5).

The evaluation team supplemented the research design and implementation assessment by scoring the SNDP according to Belcher et al.'s (2016) transdisciplinary research quality assessment framework (QAF) to assess the degree to which the project employed transdisciplinary characteristics. The QAF organizes criteria for assessing research design and implementation under the four principles of *Relevance*, *Credibility*, *Legitimacy*, and *Effectiveness*. *Relevance* refers to the appropriateness of the problem positioning, objectives, and approach to the research for intended users. *Credibility* pertains to rigour of the design and research process to produce dependable and defensible conclusions. *Legitimacy* refers to the perceived fairness and representativeness of the research process. *Effectiveness* refers to the utility and actionability of the research's knowledge and social process contributions. Full definitions of the criteria can be found in Appendix 6. Four evaluators reviewed project documentation and interviews prior to scoring. Each evaluator scored the criteria independently on a Likert scale (0 = the criterion was not satisfied; 1 = the criterion was partially satisfied; 2 = the criterion was completely

satisfied); and averages were calculated for final scores. The scores indicate characteristics that were strong, present but incomplete, or absent in the project.

Results of the analysis are grounded in theories of social change processes to better understand the theoretical explanations of why changes did or did not occur. We applied theoretical principles from social capital theory (Putnam, 2000), stakeholder theory (Freeman, 1984), multiple-streams theory (Kingdon, 1984) and agenda-setting theory (McCombs & Shaw, 1972).

SNDP Theory of Change

The SNDP ToC that was developed collaboratively with the PI (Figure 3) illustrates how the PI hypothesized the project's contributions to change at the time of the evaluation (n.b., this is the most up-to-date ToC, which includes outcomes not originally intended by the SNDP at project inception). While the project could not anticipate how outcomes would manifest, there were deliberate aspects of the research design and implementation that allowed the project to be responsive to and generate opportunities to support outcome realization.

SNDP Activities and Outputs

The PI conducted a literature review of available WASH technologies, assessed the suitability of these technologies for the riverine environment, and conducted fieldwork to investigate current sanitation technologies implemented in the Niger Delta. In addition, the PI examined past approaches to sanitation behaviour change, reviewing the successes and criticisms of each behaviour change framework. As part of the fieldwork, two communities' WASH habits were surveyed to gather quantitative data on current WASH practices. Qualitative data were collected from direct and participant observation, in addition to twenty-one in-depth semi-structured interviews with local WASH practitioners, community-based organizations (CBO), sub-national and local government WASH actors, and communities to gather a deeper understanding of WASH knowledge and perceptions. Owing to the identified need for a mechanism to enable the WASH sector to discuss and share knowledge, the PI also created an online forum to engage local WASH practitioners through a WhatsApp group.

SNDP's analysis of academic literature, grey literature, and primary data aimed to generate contextual knowledge of the Niger Delta (e.g., environment, communities, culture, etc.), the status of local knowledge on WASH and WASH practices in communities, and the risks and challenges associated with poor WASH. Based on this knowledge, the PI aimed to assess the appropriateness of WASH technologies for the communities' specific contexts and generated evidence-based recommendations and guidance to inform WASH policies and practice in the Niger Delta for target audiences such as the PIND, RUWASSA, and UNICEF. The PI also identified the need for capacity-building and consistency in training of WASH workers.

Intended Outcomes

The SNDP aimed to contribute to outcomes and impacts through three interconnected pathways: a *WASH sector and community development* pathway, a *government policy and practice* pathway, and a *professional development* pathway. Each impact pathway intersects and complements one another to realize outcomes.

WASH Sector and Community Development

The first impact pathway relates to *WASH sector and community development*. Engagement with both PIND staff and wider WASH sector actors (e.g., UNICEF, RUWASSA, etc.) through interviews and the WhatsApp group, was expected to stimulate reflection. Engagement with other WASH actors in the WhatsApp group would expose them to different perspectives and ways of thinking. It was expected that organizational development at PIND in particular would be enhanced for PIND staff working alongside the PI (who was working on their doctoral research simultaneously during their time at PIND) and as a result of the creation of the WASH training curriculum. These engagements laid the foundations for findings from the research to be transferred to the wider WASH sector and practitioner community.

In addition, by sharing findings and recommendations with local WASH practitioners, organizations (e.g., PIND, UNICEF, etc.), and local governmental departments (e.g., RUWASSA), it was expected that these actors would

reflect on WASH and recognize existing gaps, issues, and opportunities to pursue by the end of the project. For example, the PI's position at PIND would enable coaching of PIND staff and facilitate the sharing of findings through the updated WASH training curriculum developed for the ATED training programs. This was expected to result in PIND staff gaining new WASH knowledge and capacities to share and apply this knowledge and related skills in relevant WASH projects. As ATED trainers learn from this WASH training and aim to make their training more effective, it was expected that master trainers would adapt the training and improve their WASH training skills. Subsequently, it was expected that trainees would be better equipped and become more effective trainers themselves, creating a cascading training effect. By disseminating and sharing the findings to their participants and through PIND, ATED's training programs, workshop presentations, the WhatsApp group, and conference presentations, it was expected that local practitioners would gain capacity for enhanced knowledge sharing and learning.

Influenced by both the findings relating to the appropriateness of WASH technologies for the riverine context and the enhanced knowledge sharing and learning between local WASH practitioners, by the end of the project, the WASH sector was expected to explore the practicality of technologies compatible with the high-water table context such as composting toilets and biodigesters. It was expected that this exploration of the practicality of solutions would lead to the piloting of sanitation technology and new innovations for the context. As a result, communities in the Niger Delta would have access to appropriate, affordable, and safe WASH technologies in the long-term, which was expected to stimulate local thinking around social norms (including the propensity of open defecation) and encourage behaviour change within local communities to eradicate open defecation. Cultural norms in the region include concerns about human waste being reused for fertiliser, falling into the hands of those with 'evil-intent', and the view of the compost toilet being too similar to the night soil system of colonial times (i.e., fear of regression). By encouraging a shift in cultural norms that currently inhibit good sanitation through changed thinking, education, technology, and practice, it was expected that a transformation of the negative feedback loop of unsafe sanitation practices to a positive development feedback loop would occur. With improved sanitation practices in the Niger Delta through the adoption of appropriate technologies, the region was expected to experience better health alongside greater opportunities for social and economic development in the long-term.

As one of the dissemination strategies, information gathered during the research was displayed at the Appropriate Technology Enabled Development (ATED) Demonstration Centre which is accessible to the public. As visitors become interested in the exhibit, it was expected that ATED visitors would learn and gain more awareness about WASH issues and seek additional information on WASH. As more visitors engage with the exhibit over time, it was expected that the public would become aware of local WASH challenges and contextually appropriate solutions. With better awareness, local communities were expected to adapt their WASH practices, which overtime would influence cultural norms around sanitation.

Government Policy and Practice

Although influencing government policy and practice was not a main focal point of the research, by including WASH representatives from the government as key informants, such as sub-national RUWASSA, local government area (LGA) WASH departments, and community WASH committees, it was expected that engagement in the research would prompt reflection on WASH. Reflecting on their prior experience within the Niger Delta WASH sector, the PI identified a need for a mechanism to enable the WASH sector to discuss and share knowledge with one another and created the WASH sector WhatsApp group to fill this niche. Subsequently, it was expected that WASH practitioners would see the benefit to participate in the WhatsApp group community of practice. At the end of the project, this was expected to lead to the growth of the forum for WASH discussion. The growing community of practice was expected to contribute to enhanced local government and NGO capacity for knowledge sharing, learning, and improving policy and practice by the end of the project.

With this enhanced capacity to improve existing policy and WASH practices, local governments were expected to recognize existing WASH gaps, issues, and opportunities and develop an enhanced commitment to action on WASH. This commitment would take the form of increased WASH budget and resource allocation, coordination,

community capacity development, supply chain support, and openness to other approaches, among others. Subsequently, it was expected that local governments would seek evidence-based information and contextually appropriate solutions for WASH decision-making, which would enhance local government actors' capacity to take up and implement improved policy for effective WASH practice. Better informed policies and practices, alongside access to appropriate technologies, would lead to improved sanitation in the Niger Delta and support the negative to positive development feedback loop transformation.

Professional Development

By engaging in the research experience from both a research and practitioner lens, the PI's professional development would be enhanced. As a result, the PI would be recognized and sought out for their expertise in WASH through invitations to present at WASH conferences and support WASH evaluations in other contexts. By the end of the project, the research experience would enable the PI to develop a deeper understanding of WASH sector issues and ideas of how to approach working in challenging contexts. With this deeper understanding, the PI was expected to apply this learning in the organizations they work with in the future and their continued work in the Niger Delta WASH sector and beyond. One example of transferred learning is at Transform International (TI)², a learning and demand-driven organization founded by the PI. As the founder, the PI would be well-positioned to support the organization to expand its reach and promote learning that would come out of the PI's (and other) research through its networks by facilitating knowledge-to-practice. At the end of the project, the expansion of TI's reach was expected to allow WASH knowledge identified in the PI's doctoral research to be transferred and applied in other contexts, develop capacities and agency through TI's learning centres, and ultimately support improved health, social, and economic development in the developing world. By sharing and applying WASH knowledge to other contexts around the world, the PI expected this information to contribute to the development capacity and agency of the WASH sector both in the Niger Delta and globally.

Assumptions

Assumptions were documented for each outcome and then aggregated to the project level on the basis of common themes. The ToC rests on the following eight assumptions:

1. There is a need for more appropriate sanitation technologies to improve policy and practice for the challenging context of the Niger Delta (e.g., environmental conditions, etc.)
2. The SNDP creates an opportunity for informants to engage on the topic through an interdisciplinary perspective
3. There is an identified need and benefit to participate in a community of practice/forum to share WASH information and knowledge
4. The recommendations are useful, practical, and accessible for implementation, and were sufficiently rigorous to be taken seriously
5. Partners are receptive to and develop an interest in evidence-based information and innovation around appropriate sanitation technologies to address WASH issues
6. There is the appropriate infrastructure, market, community demand (e.g., change in cultural norms), and capacity for maintenance of WASH technologies in the Niger Delta region
7. The PI's experience working with PIND positions the PI well to influence the Niger Delta's WASH sector
8. A doctorate holds universal recognition and provides the opportunity to expand on research capacities and expertise (professional networks, etc.)

² While this specific example was not originally intended at project inception (re: unexpected outcome), it clearly demonstrates the logic regarding how professional learning through the doctoral experience was expected to be transferred to other organizations.

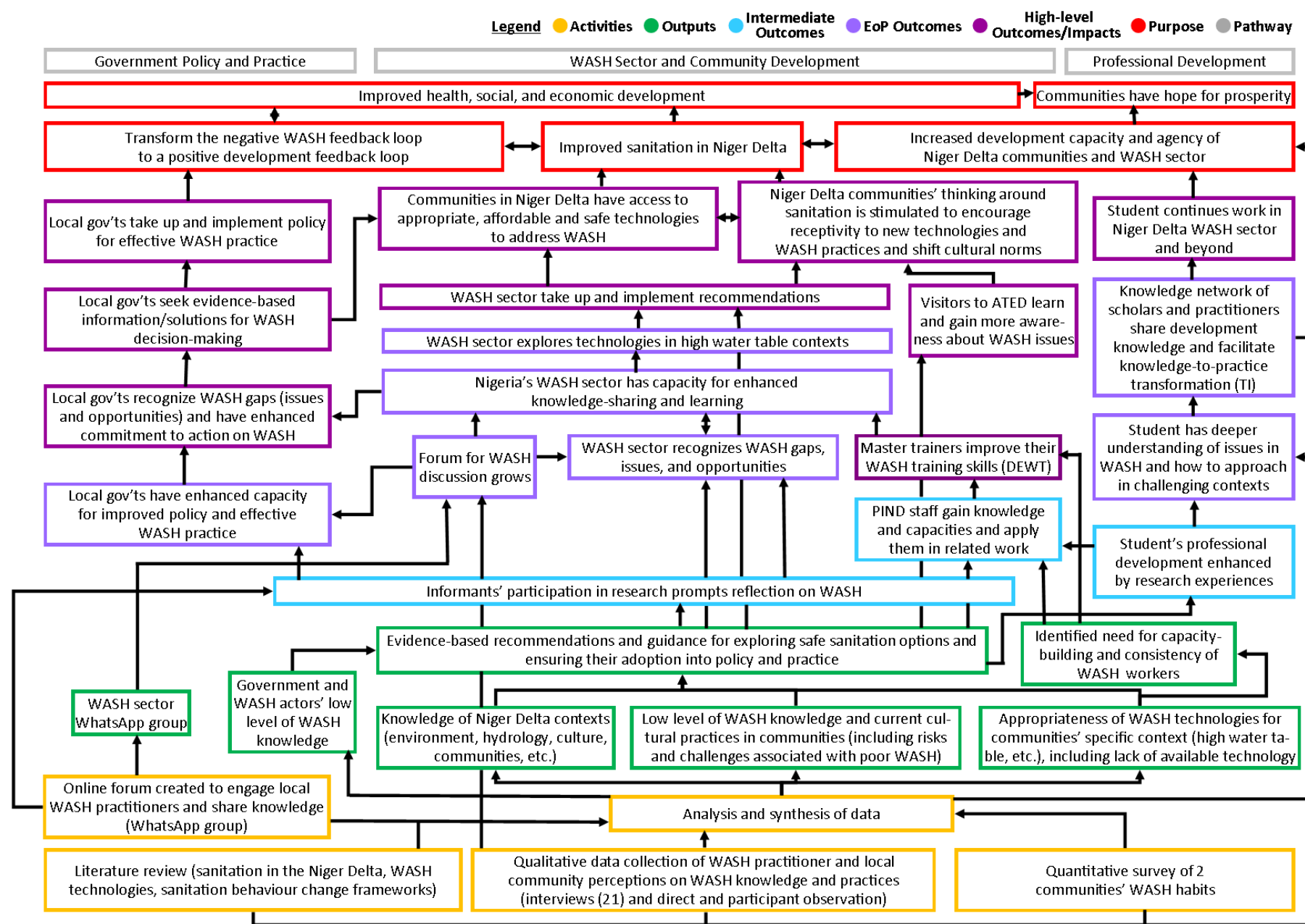


Figure 3. Elaborated SNDP Theory of Change

Results

SNDP Outputs

The SNDP contributed to a number of outputs including knowledge contributions and tailored products. For example, by engaging local communities in the research process, the SNDP identified the status of WASH knowledge and practices within the communities, and contextual knowledge of the Niger Delta including the high-water table and community culture. Similarly, by involving WASH actors and government informants within data collection, the SNDP identified their level of WASH knowledge. These knowledge contributions, coupled with exploring the appropriateness of available technologies in the region, supported the creation of evidence-based recommendations and guidance to inform WASH policies and practice in the Niger Delta (e.g., PIND, RUWASSA, UNICEF). Due to the PI's working relationship with PIND staff, the SNDP supported the capacity building of these individuals through knowledge sharing and learning. The SNDP also identified a network of key actors connected to WASH in the Niger Delta and the low level of knowledge sharing across the sector. As a result, the PI created the WASH sector WhatsApp group to encourage discussion and collaboration among key actors. As well as these knowledge contributions, tailored products were also produced such as the thesis, (which is available online via the RRU VIURRSpace), presentations at WEDEC with a supporting paper, and magazine articles to share the SNDP findings. No process contributions were identified as a result of the SNDP.

Outcome Evaluation

To what extent and how were outcomes realized?

Extent of Outcome Realization

Detailed results and supporting evidence of outcomes are provided in Appendix 8. The SNDP clearly contributed to the partial or full realization of seven of the ten intermediate and end-of-project outcomes. Most outcomes related to the increased knowledge and capacities of WASH sector actors (e.g., SNDP participants, NGOs, WASH consultants) to enable the continuation of work on the topic of appropriate sanitation technologies. Intermediate and end-of-project outcomes relating to the PI's professional development were realized and focused on the PI's development of knowledge, skills, and networks to support the PI's future work in the WASH sector and on community development. However, direct SNDP contributions to the improvement of sanitation in the Niger Delta were questioned by some informants. For example, one informant felt the research questions were too broad, which is why the project only succeeded in providing a summary of the WASH sector in the Niger Delta but did not effectively contribute to solutions development for the sanitation problem in riverine communities (Prac11).

Informants' ideas for project improvement focused on the *government policy and practice* and *WASH sector and community development* pathways, with suggestions that the project should feed into broader discussions at multiple scales to reach actors outside of the project's sphere of influence and government (Prac4, Prac5, Prac11). This would require further targeted dissemination efforts by the SNDP to boundary partners. Owing to limited previous research on the topic in the Niger Delta context, some informants felt that the SNDP provided a basis for further exploration on the topic (Prac4, Prac9). However, others suggested that the SNDP provided more of a context summary, documenting what was already known in the sector, which did not contribute to new solutions for WASH in the Niger Delta (Prac11).

Changes in government and policy have not yet been fully observed as it is too early in the process to expect these outcomes. Government informants were not available to interview for this evaluation, so evidence related to these outcomes is limited to survey data. We summarize the findings of the outcome evaluation in Table 3. Figure 4 illustrates the assessment of outcome realizations using the ToC.

Table 3. Summary of the SNDP outcome assessment, supporting evidence, and consideration of contextual factors and causal mechanisms affecting outcome realization (see Appendix 8 for a more detailed assessment).

Results	Illustrative Evidence	
Outcome Assessment	Summary of supporting evidence for the assessment	Contextual factors and causal mechanisms affecting how the outcome was realized
<p>Informants' participation in research prompts reflection on WASH <i>[intermediate outcome]</i></p> <p>Realized, clear project contribution</p>	<ul style="list-style-type: none"> Two interview informants directly involved in the SNDP note that their participation prompted reflection on WASH; these practitioners are involved in the Nigerian WASH sector within PIND and UNICEF <ul style="list-style-type: none"> Practitioners think more deeply on how to support the development of the WASH sector and how to handle negative sanitation practices in riverine communities (<i>interviews</i>) Practitioners are now exploring non-conventional and contextually appropriate solutions as a result (<i>interviews</i>) The interview process and opportunity to discuss personal experiences may have been affirming for SNDP research participants (<i>interviews</i>) 	<p>Facilitating factors:</p> <ul style="list-style-type: none"> The PI facilitated a process of reflection by involving stakeholders in data collection and asking them about their WASH knowledge and practices Engagement with the research questions and other system actors through the WASH sector WhatsApp group exposed informants to different perspectives and ways of thinking <p>Alternative explanations:</p> <ul style="list-style-type: none"> There are a number of other initiatives underway in the Nigerian WASH sector, such as those implemented by government and organizations such as UNICEF and USAID, that may have contributed to enhanced reflection on WASH by those working within the sector
<p>PIND staff gain knowledge and capacities and apply them in related work <i>[intermediate outcome]</i></p> <p>Realized, clear project contribution</p>	<ul style="list-style-type: none"> Four interview informants discussed how the SNDP supported PIND staff gaining knowledge and capacities and applying them in related work. Two of the informants are currently or were PIND staff at the time of the SNDP, with one now having moved to work in a similar role at UNICEF <ul style="list-style-type: none"> PIND staff are aware of the SNDP which coincides with their own work (<i>interviews</i>) PIND staff adopt new lenses to explore sanitation programming presented by the SNDP (<i>interviews</i>) Two survey respondents also discuss how the SNDP supported increased knowledge and capacities and the application of these within their work <ul style="list-style-type: none"> Practitioners, including those outside of PIND, have a better understanding of the topic (<i>survey</i>) Some practitioners are using the SNDP findings to improve their role as WASH community workers (<i>survey</i>) Other informants working in non-profit organizations suggest that successful transfer of knowledge to other staff through the SNDP has changed the way staff work on sanitation in riverine communities (e.g., added knowledge changed how staff interact and relate with communities, focus on a grass-roots level approaches) (<i>interviews</i>) 	<p>Facilitating factors:</p> <ul style="list-style-type: none"> Conducting the SNDP while working at PIND allowed the PI to leverage their managerial position and transfer knowledge gained to PIND colleagues working in WASH Learning from the PI as a colleague (e.g., mentor relationship) increased PIND staff effectiveness PIND staff are motivated to become better WASH practitioners <p>Barriers:</p> <ul style="list-style-type: none"> PIND could have leveraged SNDP contributions and recommendations further in order to be more impactful in improving sanitation in the Niger Delta

<p>Forum for WASH discussion grows [end-of-project outcome]</p> <p>Realized, clear project contribution</p>	<ul style="list-style-type: none"> • At the time of the evaluation, there was 179 members of the WASH sector WhatsApp group • One practitioner stated that they are aware of the WhatsApp group and note that the PI continues to engage in the forum (<i>interviews</i>) • Most survey respondents (83%) use the WhatsApp group more than once a week on average to connect with other WASH practitioners, use information shared in the group, share information to the group, ask questions to the group, and answer questions asked by the group (<i>survey</i>) • Respondents also share job opportunities to the WhatsApp group and learn from best practices of other organizations who are successful in improving WASH (e.g., PIND, United Purpose) (<i>survey</i>) • Practitioners continue to engage in and use the forum since its launch on August 20, 2015, suggesting the WhatsApp group continues to be a beneficial space for practitioners to participate (<i>survey</i>) 	<p>Facilitating factors:</p> <ul style="list-style-type: none"> • There was a need for a space to engage other WASH practitioners in the Niger Delta (previously low engagement and collaboration in the sector, duplication and inefficient use of resources) • The PI recognized the need for and helped establish the WASH sector WhatsApp group • The WhatsApp group functioned as a community of practice or coalition
<p>WASH sector recognizes WASH gaps, issues, and opportunities [end-of-project outcome]</p> <p>Realized, clear project contribution</p>	<ul style="list-style-type: none"> • Of the interview informants, five practitioners agree that the WASH sector recognizes WASH gaps, issues, and opportunities as a result of the SNDP. These practitioners work with PIND and international non-profit organizations. <ul style="list-style-type: none"> • Practitioners have begun to prioritise the needs of individuals in riverine communities, and the development of new projects stemmed from the recognition stimulated by the SNDP (<i>interviews</i>) • Practitioners' abilities to identify gaps and ensure there is no duplication across projects have improved, in part by increased information on the topic and the identified need to collate knowledge in the sector (<i>interviews</i>) • The SNDP provided a starting point for further work on this topic (<i>interviews</i>) • Over half of survey respondents (64%) believe that the Nigerian WASH sector is generally more aware of WASH gaps, issues, and/or opportunities than two years ago. However, most survey respondents were unsure as to whether the SNDP had directly contributed to this increased awareness (<i>survey</i>) 	<p>Facilitating factors:</p> <ul style="list-style-type: none"> • Practitioners look for information and direction to address WASH issues • The SNDP was an exploratory study that actively sought to identify gaps in the Niger Delta WASH sector • Knowledge gaps were filled by involving WASH sector actors and stakeholders in the SNDP and targeting findings to local WASH practitioners and organizations • SNDP's targeted recommendations are useful, practical, and accessible to fill this knowledge gap and influence the agenda <p>Alternative explanations:</p> <ul style="list-style-type: none"> • There are a number of other programs underway in the WASH sector, such as those implemented by government and organizations such as UNICEF and USAID, that may have contributed to enhanced reflection on WASH by those working within the sector
<p>Nigeria's WASH sector has enhanced capacity for knowledge sharing and learning [end-of-project outcome]</p> <p>Realized, unclear project contribution</p>	<ul style="list-style-type: none"> • Of the interview informants, four agreed that Nigeria's WASH sector has enhanced capacity for knowledge sharing and learning as a result of the SNDP. These practitioners work within PIND, and international non-profit organizations. However, one practitioner stated that there remains no effective collaboration or synergy between WASH programs working within Nigeria 	<p>Facilitating factors:</p> <ul style="list-style-type: none"> • WASH sector actors recognise the benefit of a WASH-oriented community of practice and are open to participating in one • By highlighting gaps, disseminating and sharing findings to participants, and presenting engagement options (e.g., WhatsApp group), the SNDP enhanced local capacity for knowledge sharing and learning

	<ul style="list-style-type: none"> • SNDP's facilitation of WASH sector engagement (via the WhatsApp group) has increased collaboration between WASH sector actors and minimized duplication (<i>interviews</i>) • Prior to the SNDP, the Nigerian WASH sector worked in silos (<i>interviews</i>) • The majority of survey respondents (61%) agree that WASH practitioners in Nigeria share information with and learn more from each other now than they did two years ago. However, half of the 61% of respondents were unsure if the SNDP contributed to greater information sharing (<i>survey</i>) 	<p>Barriers:</p> <ul style="list-style-type: none"> • Some practitioners remain sceptical of knowledge sharing practices as some organizations are unaware of work that is underway in the sector • One survey respondent suggested that there remains no strong synergy among WASH practitioners and other key players in the sector <p>Alternative explanations:</p> <ul style="list-style-type: none"> • The need for collective engagement across the relatively small WASH sector was an issue that was known before the start of the SNDP • The federal government has incentivised states to take action on the capacity-building of WASH actors • Other organizations such as USAID have implemented institutional capacity-building programs such as the WASH Coordination Project (2016-2018) • There has been increased and more efficient dialogue and knowledge sharing between NGOs and CSOs as access to and use of computer and communication technologies has improved
<p>WASH sector explores technologies in high-water table contexts [<i>end-of-project outcome</i>]</p> <p>Partially realized, unclear project contribution</p>	<ul style="list-style-type: none"> • Of the interview informants, three state that the SNDP influenced the WASH sector to explore technologies in high-water table contexts, with one informant and documentation highlighting the continual work on the issue by the PI. These informants work at PIND, and international non-profit organizations. However, one interview informant from an international development organization believes that there has yet to be local development of technologies or adoption of technologies. <ul style="list-style-type: none"> • The SNDP triggered creativity around innovation involving appropriate technologies for the Niger Delta region (<i>interviews</i>) • The SNDP illustrated the importance of understanding localized conditions and using technology appropriate options (<i>interviews</i>) • Half of survey respondents (50%) were neutral or unsure of whether the WASH sector is exploring technologies in high water table contexts (<i>survey</i>) <ul style="list-style-type: none"> • There is overall uncertainty regarding whether the SNDP had contributed to any changes in the WASH sector concerning the exploration of suitable technologies (<i>survey</i>) 	<p>Facilitating factors:</p> <ul style="list-style-type: none"> • The SNDP identified the need for follow-up action by raising the issue that there are currently no appropriate sanitation technologies for the challenging geographical context of the Niger Delta • Leveraging the PI's networks spread awareness of the lack of appropriate sanitation technologies to other WASH practitioners in the PI's sphere of influence <p>Barriers:</p> <ul style="list-style-type: none"> • Informants noted that appropriate technologies have not yet been identified as the sector is young and naïve – this remains a work in progress <p>Alternative explanations:</p> <ul style="list-style-type: none"> • In some cases, it is unclear to what extent the PI's work directly affected the initiation of external projects exploring appropriate technologies • The recent focus and prioritisation to achieve an ODF Nigeria by 2025 in the National Action Plan has raised the importance of appropriate sanitation technology development and provision • Governmental initiatives like ODF have encouraged the WASH sector to explore technologies in high water table contexts

<p>Local governments have enhanced capacity for improved policy and effective WASH practice <i>[end-of-project outcome]</i></p> <p>Partially realized, unclear project contribution</p>	<ul style="list-style-type: none"> • There is limited evidence for this outcome as government informants were not accessible for interviews. However, one interview informant from an international non-profit organization noted external initiatives underway to enhance local government capacity • The majority of survey respondents (14) suggest that local governments do not yet have enhanced capacity for improved policy and effective practice. However, one survey respondent suggested partnerships are being built to improve focus on the issue, but it is unclear the extent to which this initiative is connected to the SNDP <ul style="list-style-type: none"> • Partnerships between government and civil society have been built to intervene in the WASH sector. From federal to LGA leaderships, there is now a greater focus on ending open defecation (<i>survey</i>) 	<p>Facilitating factors:</p> <ul style="list-style-type: none"> • Government actors' involvement in the data collection phases of the SNDP likely stimulated learning, reflection, and skills-building • By highlighting gaps and presenting engagement options (e.g., WhatsApp group), the SNDP facilitated local government participants' the enhanced capacity for knowledge sharing and learning <p>Barriers:</p> <ul style="list-style-type: none"> • The Nigerian context and LGA priorities are challenged by the lack of political will and commitment at the sub-national level • As a result of poor funding and low capacities to implement WASH projects, local governmental agendas do not prioritise WASH • There remains no regional resource that government staff or community members can turn to for resource information, certification, or skills development <p>Alternative explanations:</p> <ul style="list-style-type: none"> • External initiatives have been implemented to enhance government capacity (e.g., six federally-funded local universities in the Niger Delta offer capacity-building courses focused on WASH for local governments) • Efforts have been made by agencies such as UNICEF to train RUWASSA to build local governmental capacity
<p>PI's professional development enhanced by research experiences <i>[intermediate outcome]</i></p> <p>Realized, clear project contribution</p>	<ul style="list-style-type: none"> • Four interview informants agreed that the PI's professional development was enhanced by the research experience. These informants include both researchers, and practitioners working in the Nigerian and international WASH sector. Document evidence also supported the realization of this outcome <ul style="list-style-type: none"> • The PI's heightened expertise is connected to the completion of the SNDP (<i>interviews</i>) • The PI is in an advisor for WASH practitioners and organizations, and is a source of information on WASH issues (<i>interviews</i>) • The PI's professional and practitioner skills and networks were improved, deepened, broadened, and heightened by completing the doctoral research (<i>interviews</i>) • The SNDP provided the PI with more motivation to discuss sanitation as an urgent issue and priority for organizations (<i>interviews</i>) 	<p>Facilitating factors:</p> <ul style="list-style-type: none"> • The PI generated an opportunity for professional development through the doctoral research by connecting the SNDP to their work at PIND • The PI expanded their professional networks through the SNDP by involving WASH stakeholders in the data collection process • Coalitions were created and strengthened through the research process, which provided the PI with the opportunity to share their knowledge and research findings to other system actors • By being immersed in the doctoral research process, the PI acquired knowledge, skills, and understanding to assist their future work in the topic • Acquiring a doctorate was one of the PI's aims in pursuing the research <p>Alternative explanations:</p>

	<ul style="list-style-type: none"> Academically, the PI quickly became adept at research communication and how to develop a sustained argument (<i>interviews</i>) A doctorate is a life-changing experience which has permanently changed the PI's depth of understanding, perspective, and approach to future work on the topic (<i>documents</i>) One survey respondent stated that the PI is now a main source of information for the WASH sector (<i>survey</i>) 	<ul style="list-style-type: none"> Some informants believed that the PI was already a WASH expert due to their experience in the sector prior to joining the DSocSci program
<p>The PI has deeper understanding of issues in WASH and how to approach working in challenging contexts [<i>end-of-project outcome</i>]</p> <p>Realized, clear project contribution</p>	<ul style="list-style-type: none"> One practitioner from a non-profit organization stated that the PI can apply project learning and support collaborations on sanitation topics (e.g., uncover challenges, fill gaps, design solutions, etc.) (<i>interviews</i>) One informant stated that the PI built their knowledge and expertise from the research experience (<i>interviews</i>) The PI's understanding of the topic is reinforced, and the PI has more tools when working in regions outside of the Niger Delta which face similar sanitation challenges (<i>documents</i>) The PI's depth of understanding is permanently changed (<i>documents</i>) 	<p>Facilitating factors:</p> <ul style="list-style-type: none"> The PI built their own capacity through the research process by using methods which required them to immerse themselves in the research experience The research process provided the PI with an opportunity to explore topical issues that they were passionate about and which were of value to their future work
<p>Knowledge network of scholars and practitioners share development knowledge and facilitate knowledge-to-practice transformation (TI) [<i>end-of-project outcome</i>]</p> <p>Realized, clear project contribution</p>	<ul style="list-style-type: none"> Five interview informants from international developmental organizations and non-profit organizations stated that TI, a knowledge network of scholars and practitioners, was a direct outcome of the SNDP <ul style="list-style-type: none"> The PI is now the executive director of Transform International (TI), which has a primary focus on WASH (<i>interviews, documents</i>) TI is one of the most substantial outcomes of the SNDP (<i>interviews</i>) The PI applied their doctoral knowledge and continues to share SNDP knowledge through TI with other practitioners working in different developing countries (e.g., Malawi, Papua New Guinea, Kenya, Tanzania, and Bolivia) through a two-way knowledge exchange of best practices (<i>interviews</i>) Without the SNDP experience, it is unlikely that TI and its associated networks would have been formed (<i>interviews</i>) 	<p>Facilitating factors:</p> <ul style="list-style-type: none"> By identifying the need for a knowledge sharing mechanism for the Niger Delta and other regions, the PI established an organization to share best practices and build-capacity of NGOs working in WASH TI co-produces knowledge with practitioners who are experts across a multitude of fields to build capacity of local actors and facilitate knowledge-to-practice. This also supports coalition strengthening By aligning TI's work with the work of other NGOs, the PI contributes to sustainability in international development projects TI works with a network of similar NGOs across developing countries to share best practices and sustainability knowledge, improve efficiency and remove duplication of work

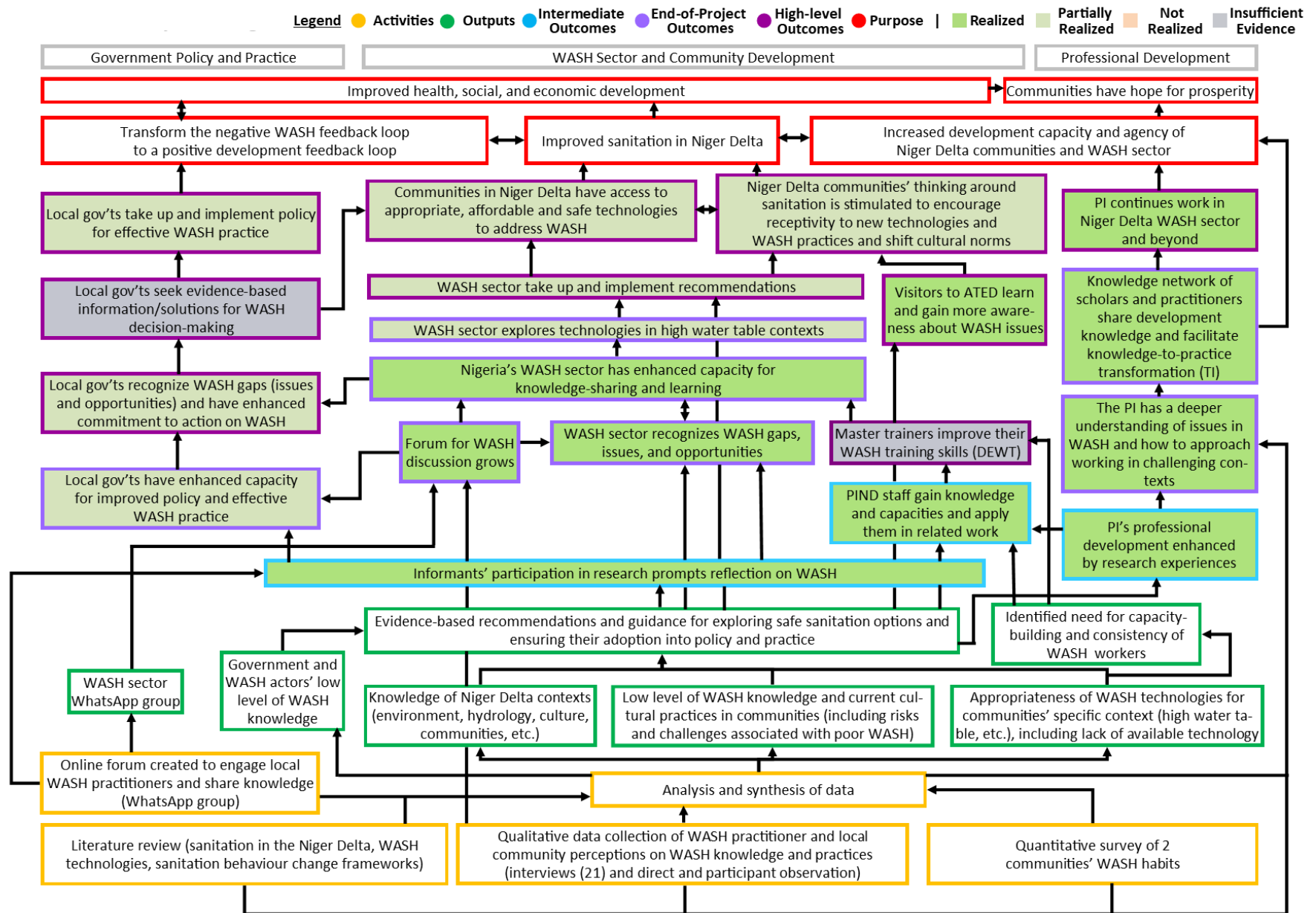


Figure 4. SNDP Theory of Change, with outcomes colour-coded to reflect extent of outcome realization

Mechanisms Leveraged by the Project

The SNDP leveraged mechanisms of change that spanned across multiple impact pathways (Table 4). Some of the same mechanisms supported outcome realization in different pathways, demonstrating the multiple ways in which a single mechanism can be leveraged to support various change processes.

Table 4. Mechanisms of outcome realization by pathway leveraged by the SNDP, using Belcher et al.'s (2019) classification

<i>Mechanism</i>	<i>Pathway</i>		
	<i>WASH Sector and Community Development</i>	<i>Government Policy and Practice</i>	<i>Professional Development</i>
Scientific knowledge increased/knowledge gap filled	✓	✓	✓
Methods developed and/or refined			
Knowledge co-produced			
Research agenda influenced			
Alignment of research with parallel issues/initiatives		✓	
Capacity of actors in system improved			✓
Coalitions strengthened or created	✓		✓
Policy window opportunity realized			
Reputation leveraged or enhanced	✓		✓

Within the *WASH sector and community development* pathway, the SNDP was designed to examine: current sanitation practices; efforts made to improve sanitation; the extent to which those efforts have succeeded; and additional aspects needed to improve sanitation sustainably, effectively filling knowledge gaps via an exploratory case study method. SNDP methods (e.g., household surveys, key informant interviews, etc.) enabled the PI to rigorously and reliably collect data to increase the scientific knowledge on community sanitation practices in the Niger Delta and gather practitioner perspectives (i.e., NGO, CBO, government, consultants) of the WASH sector and realities facing communities. The PI made an effort to establish respectful and positive relationships with interview participants by expressing shared interest in the subject matter to encourage participation in the SNDP, which contributed to the intermediate outcome '*informants' participation in research prompts reflection on WASH*' (Gilbert, 2017). Similarly, care was taken when engaging communities to ensure participants had a clear understanding of the research objectives (e.g., financial hand-outs would not be given, promises were not made). These factors highlight the leveraging of the mechanism 'scientific knowledge increased/knowledge gap filled'.

Through leveraging the PI's professional role at PIND, knowledge gained through the SNDP was transferred to the PI's colleagues also working in the WASH sector, leveraging the reputation and networks of the PI. Learning from the PI as a colleague and through a mentor relationship supported the strengthening of coalitions. However, some suggested that PIND discontinued their focus on WASH after the PI left the organization (Prac11). Therefore, PIND did not fully leverage opportunities presented by the SNDP to support the realization of outcomes suggesting that insufficient institutional capacity was developed. If PIND had continued to focus on WASH and if the PI had remained in the organization, the SNDP would have had greater influence on the wider Niger Delta WASH sector (Prac11). Familiar with the siloing of the Niger Delta's WASH sector, the PI identified the need for a mechanism of discussion and a community of practice where stakeholders and practitioners could engage with one another to share information. By leveraging the PI's networks and reputation built from two years of experience working in the Niger Delta WASH sector prior to the SNDP, the PI was able to successfully establish a functioning and active forum for discussion through the WASH sector WhatsApp group, subsequently strengthening informal coalitions among WASH sector practitioners. Moreover, the WhatsApp group facilitates ongoing capacity development of members through sharing of new knowledge, information, and best practices.

In the *government policy and practice* pathway, the SNDP involved government actors in data collection which addressed some knowledge gaps and stimulated reflection on current policy and practice (end-of-project outcome). In order to access government actors for data collection purposes, the PI leveraged their reputation from having worked in the Niger Delta WASH sector. By situating the SNDP within the sanitation Millennium

Development Goal (Goal 7c) and recognising that the government have an important role to play in leading change in WASH (Gilbert, 2017), the SNDP aligned the research with parallel issues and initiatives. However, due to the unstable local government and unfavourable political conditions, the PI was unable to leverage a policy window opportunity.

In the *professional development* pathway, the SNDP and doctoral experience provided the PI with multiple opportunities for professional development to expand upon their knowledge from previous work at PIND (intermediate outcome). Through the DSocSci program, the PI gained new knowledge and research capacities (e.g., academic literacy, academic communication skills, research design, etc.). Likewise, the PI learned through the research process, particularly when using methods which required immersion within the research experience (e.g., participant observation). The PI's expertise and reputation as a WASH expert were enhanced as a result, and the project provided the opportunity for the PI to develop networks and develop coalitions with other WASH sector actors. Professional capacity gained through the research process, coupled with enhanced networks and recognition of expertise, have supported the PI to have a deeper understanding of issues in WASH (end-of-project outcome) and continue working in similar contexts to that of the Niger Delta (high-level outcome). Noticing the dearth of knowledge sharing and coalitions in Niger Delta and other WASH sectors more generally, the SNDP laid the foundation to establish a larger and formalized coalition to support best practices and capacity-building of NGOs working in WASH and community development. TI was subsequently launched to connect practitioners and experts across multiple fields, build capacities of local actors, and facilitate knowledge-to-practice processes (end-of-project outcome). By aligning TI's work with the work of other NGOs, TI contributes to increased sustainability in community development projects. The PI is also a member of other academic discussion groups (e.g., a global health forum network) where knowledge and experience from SNDP have been shared.

Alternative Explanations of Outcome Realization

WASH Sector and Community Development Pathway

As a result of extensive consultation between federal and sub-national governments, the Nigerian government released the National Action Plan for the Revitalization of Nigeria's WASH Sector in April 2018 which establishes a 13-year revitalization strategy. One of the proposals that has come out of the National Action Plan is to prepare steps to achieve an open defecation free (ODF) Nigeria by 2025 (Doc7, Prac8, Survey7, Survey17, Survey26, Survey27, Survey30, Survey31, Survey38). This recent focus and prioritization to end open defecation has raised the importance of appropriate sanitation technology development and provision. One practitioner felt that as long as there are no solutions for safe sanitation technology options for riverine communities, ending open defecation will remain difficult if not impossible (Prac6). Governmental initiatives like ODF have encouraged the WASH sector to explore technologies in high water table contexts. CLTS has been embraced by the Nigerian government and is also part of the National Action Plan on WASH (Prac5). CLTS has been implemented in some riverine communities of the Niger Delta and has directly supported communities to take ownership of local WASH programs (Doc3, Survey17, Survey40). For example, CLTS has led to the increased sensitization and behavioural change of communities resulting in more LGAs being declared ODF (Survey40). Also, the recent implementation of fines for individuals who openly defecate on private land have contributed to the shift in cultural norms and prevention of unsafe sanitation practices (Prac3). Select universities across six regions of the Niger Delta have implemented federally funded programs that provide WASH training. It is expected that the states where participating universities are located will sponsor and encourage citizens, civil servants, and NGOs to attend these programs to learn more about safe WASH practices (Res2). Although several other initiatives external to the SNDP have been implemented to enhance government capacity, contextual factors including corruption have proven a barrier to progress.

One survey respondent also suggests that USAID funding has improved WASH activities, particularly in Delta State with the e-WASH Project (Survey15). USAID have implemented institutional capacity-building programs such as the WASH Coordination Project (2016-2018). Under this project, USAID established a community of practice for water and sanitation, suggested to be "*the first of its kind to boost knowledge exchange within the*

country's WASH sector" (Prac8). Data from the survey suggests that increased communication and knowledge sharing within the WASH sector has had a substantial influence on supporting safe sanitation practices within the Niger Delta (Survey6, Survey17, Survey40, Survey42).

UNICEF have also placed emphasis on capacity-building and step-down training for practitioners and RUWASSA staff in the WASH sector to ensure that quality of training is sustained from the training of the trainers down to the local level resulting in master trainers' WASH training skills being improved (Prac9). UNICEF are supporting community-led processes to change open defecation behaviours and develop alternative technologies to improve sanitation practices through a recent study on adaptive technology solutions for the Niger Delta (Prac6). The organization directly leverages its partnerships within the sector and has developed strong networks with the Federal Ministry of Water Resources, State Ministry of Water and Sanitation, and LGAs to support their provision of safe sanitation access in rural areas (Prac10). However, some options remain unaffordable for individuals living in riverine environments. UNICEF also completed extensive work through the EU Niger Delta Support Programme in ten LGA's, which demonstrated the value in developing stronger governance and support structures at the sub-national and community levels (Gilbert, 2017). This included a focus on strengthening government efforts to eradicate the practice of open defecation, as well as national and subnational bodies' capacity to develop and implement equitable and gender-sensitive WASH policies, strategies, and guidelines (UNICEF, 2019).

Media campaigns such as radio and television commercials have also contributed to the slow and gradual shift in social norms around safe sanitation practices (Prac3). Other research projects have engaged with communities in the Niger Delta region to understand persisting sanitation challenges and why communities may not currently be using improved sanitation options that are available. For example, needs assessments have been completed by researchers in partnership with the Common Wealth Association (COMASSOC) to examine intervention methods using a community engagement approach, encouraging community ownership of the problem and solutions and fostering a shift in cultural norms (Res2). Outside of Nigeria, the WASH sector within Africa is noted to have been doing well in identifying low-tech solutions for different environmental challenges (Res3). One survey respondent suggested that there has been increased knowledge and access to adequate water and sanitation facilities, but it is unclear from evidence what initiatives supported this change.

Government Policy and Practice Pathway

Local governments are noted to have enhanced commitment to action on WASH as a result of the alignment of the Nigerian National Action Plan on WASH with the Sustainable Development Goals (SDGs) (Prac11, Doc7). This has re-established the country's focus from basic sanitation provision to a focus on safely managed sanitation, adding a further level of complexity (Prac11). Furthermore, UNICEF works closely with the private sector to address WASH issues and ensure there is sufficient engagement and support at the sub-national level with buy-in from local authorities for enhanced commitment to action on WASH (Prac10).

As a result of the National Action Plan, there is increased advocacy within government to prioritize WASH issues. This advocacy has led to the implementation of policy for effective WASH practice (Survey2, Survey32). For example, the Minister of Water Resources recently dedicated a presentation to the issue of open defecation at the National Economic Council (attended by all 36 governors of Nigeria). In another example, the federal government declared a state of emergency in sanitation, with governments at the sub-national level expected to do the same (Prac8, Res2). To date, some states have followed through; however, few are located in the Niger Delta, and informants were unsure as to whether local governments in the Niger Delta have taken necessary action (Prac8, Res2). The declaration of the state of emergency by federal and some local governments has led to a number of other WASH actors to focus on sanitation improvement (Res2). Other policy implemented for effective WASH practice includes the 'Clean Nigeria: Use the Toilet' campaign to jumpstart the National Action Plan on WASH (Doc7). Launched in April 2019, the campaign encourages states to develop plans to address safe sanitation practices (Prac10). Survey respondents suggested that to an extent, there has been improvement in the drive to implement WASH programmes and policies exemplified by the 'Clean Nigeria: Use the Toilet' campaign. WASH

consultants play a key role in coordinating and supporting states to implement the National Action Plan, such as technical assistance and strategy development to fulfill the targets stated in the plan (Prac8). These targets include meeting SDG6 (clean water and sanitation for all people) by 2030 and achieving an ODF Nigeria by 2025. However, with the SDG target now only ten years away, practitioners are wary of the time it has taken to implement the plan with these goals falling further out of reach (Prac8). The declaration of the state of emergency in WASH, the ‘Clean Nigeria: Use the Toilet’ campaign, and the National Action Plan are noted by survey respondents to have been the biggest improvements in the Nigerian WASH sector over the past three years (Survey7, Survey12, Survey20, Survey24, Survey25, Survey26, Survey27, Survey28, Survey34, Survey38, Survey40). Lastly, at the local level, the government in Delta state has received approval through the state assembly for a modified water bill that sets forth the structure to deliver WASH services. Some states have implemented or are in the process of establishing WASH policies, laws, ODF road maps, and implementation guidelines (Survey2, Survey32).

The above evidence recognizes that a number of alternative explanations have contributed to outcome realization, including efforts by national government, development organizations, and other researchers. Efforts by national government, including the implementation of the National Action Plan for the Revitalization of the WASH sector, highlight the alignment of the SNDP with current initiatives and its social relevance as a research problem. For example, this government plan recognises the importance of appropriate sanitation technology development and provision, supporting the SNDP’s findings. The National Action Plan was released following the completion of the SNDP, with evidence suggesting that increased effort needs to be made at the local level to improve the commitment to action on WASH. The implementation of capacity-building programs for institutions and practitioners, and the establishment of the community of practice for knowledge exchange by USAID and UNICEF suggests that the SNDP identified a relevant problem within the Nigerian WASH sector regarding a lack of knowledge-transfer and appropriate policies. The SNDP reinforces many initiatives currently underway in the sector. However, the SNDP does not discuss or build on these other initiatives in detail. Overall, it is unclear from evidence whether the SNDP had an effect on the creation or implementation of these government and organizational initiatives.

Table 5. To what extent have the following factors contributed to changes in the Nigerian WASH sector?

	<i>High</i>	<i>Medium</i>	<i>Low</i>	<i>No Influence</i>	<i>Unsure</i>
New technology	5	14	11	4	0
Investment from NGOs, international organizations, and/or private sector	17	12	5	0	1
Increased communication/knowledge sharing within the WASH sector	13	15	5	1	0
Change in culture/ understanding/ attitudes around WASH	6	15	11	1	1
Government investment in infrastructure	2	6	22	4	0
Increased awareness of WASH issues (e.g., media discussions, demonstration centres, etc.)	4	17	13	0	0
Decreased cost of technologies	3	8	15	4	0
Financial incentives to install WASH facilities	3	8	15	6	2
New knowledge (e.g., research)	4	10	16	1	3

Were there any positive or negative unexpected outcomes from this project?

Informants agreed that there were few negative outcomes from the SNDP, only citing the mental and emotional toll associated with a doctorate that the PI may have experienced (Prac1, Prac2, Prac4, Prac5, Prac7, Res1).

There were few unexpected outcomes, which is in part an artefact of the ToC’s retrospective development, which

can make the distinction between expected and unexpected outcomes difficult to discern. That is, most intermediate and end-of-project outcomes had already manifested when the ToC was documented, so they do not present as ‘unexpected’. For example, the knowledge network of scholars and practitioners sharing development knowledge and facilitating knowledge-to-practice in the form of TI was not anticipated at project inception, but completion of the DSocSci program was expected to lead to various professional development opportunities. Most unexpected outcomes were positive and pertained to changed ways of working for WASH sector actors, opportunities for funding for future work, and modifications in safe sanitation protocol.

The SNDP and the PI’s relationships with practitioners led to others being inspired to work on the topic. For example, the establishment of TI provided partners with the opportunity to “*help [their] research come alive*” (Prac2) by collaborating with experts to make their vision a reality. The SNDP also triggered increased levels of advocacy with some key stakeholders who invest in the WASH sector (Prac4). Informants who work within the organizations the PI partnered and worked with (e.g., PIND, TI) suggested that the SNDP made a solid contribution to the future of these organizations, ensuring that future staff have a clear direction upon which to build (Prac4, Prac7). The SNDP provided a basis for further sanitation technology innovations from which to build and presented approaches to address sanitation challenges faced by the riverine communities of the Niger Delta. The findings from the SNDP, particularly those focused on the use of CLTS, are transferable to other communities with similar contexts as those in the Niger Delta (e.g., an organization in Kenya is currently piloting a sanitation product as a result of the PI and their research on the topic) (Prac5). The SNDP also supported modifications in a Nigerian national protocol for certifying communities as ODF in collaboration with UNICEF and the Federal Ministry of Water Resources (Prac6). The previous protocol stated that every household must own a latrine for the community to be certified as ODF. The SNDP contributed to the discussions for the review of this protocol to acknowledge that it may not be possible for all households to have their own latrine owing to geographical factors of the riverine context and the availability of materials. These discussions led to a revision of the protocol, which has now made it possible for riverine households to share latrines and still achieve ODF status. One informant suggested that SNDP findings and the PI’s interactions brought this discussion to the forefront of the Niger Delta areas and helped to revise this protocol (Prac6).

Interactions with the PI are noted to have inspired others working in the sector to consider unconventional solutions to sanitation issues in the Niger Delta (Prac9). The PI acted as a strong positive influence for WASH practitioners within their professional sphere of influence, and the SNDP provided additional insights and clear practical recommendations that could be streamlined into practitioners’ everyday work (Prac9). The SNDP also contributed to a change in perspective regarding the importance of research and development in the WASH sector. Targeted dissemination of the SNDP findings through presentations at conferences, discussions with PIND colleagues, and a WEDEC journal article contributed to opportunities for collaborative funding to explore market-based approaches for safe sanitation options in partnership with DIFD and UNICEF (Res4). Discussions on how to solidify funding remain underway; however, the proposed partnership intends to explore supply chains, market systems, and market product development in the Niger Delta. The academic community within the PI’s partnering organizations noted to have changed their views of how to interact and work with communities; prior ways of working were predominantly top-down, whereas the SNDP inspired a grass-roots approach by revealing the benefits of working with communities to develop community-led solutions (Res3).

Could the outcomes have been realized in the absence of the project?

Although there have been no critical changes in the sanitation situation of the Niger Delta since the completion of the SNDP, the project supported an increased focus on the topic in a more productive framework (Prac2, Prac5). This increased focus included exploring post-CLTS strategies, developing appropriate technologies for the Niger Delta context, and tracing the sanitation value chain (Prac4, Prac5). As previously mentioned, the SNDP provided a foundation of knowledge on the topic on which other system actors and researchers could expand (Prac4). One practitioner stated that without the SNDP, it would have taken system actors longer to reach the current stage of active discussions on riverine sanitation in Nigeria (Prac6). The SNDP also highlighted the need for a collective

vision across the sanitation sector for there to be major improvements; this understanding may have taken longer to establish in the absence of the project (Prac2). The Niger Delta WASH sector would be worse off without the completion of the SNDP and the knowledge produced by the project due to the SNDP's success in highlighting the benefits of CLTS strategies, the sanitation value chain, and the value of technology and training (Prac5). The SNDP instilled a level of urgency which would have taken longer to be brought to the discussion in the absence of the project (Prac5, Res3). This sense of urgency created by the SNDP encouraged other organizations and system actors to focus on the topic, with some informants suggesting that they may not have prioritised WASH at this point without the SNDP and their interactions with the PI (Prac5). In the absence of the SNDP and its contributions, the WASH sector would continue to work in silos and remain uncoordinated (Prac7). Recommendations as thorough and practical as those presented in the SNDP would have taken much longer to produce in the absence of the project (Prac7, Prac9). Without the SNDP, it is unlikely that TI would have been formed, such that the organization's connections and networks would not exist, and progress supported by TI to date would not have taken place (Prac7). The PI expanded their knowledge through the SNDP, and much of this knowledge framed the need for TI and has subsequently been transferred to the organization (Res4). Completing the SNDP provided the PI with knowledge and confidence which is unlikely to have been achieved by other means (Res4).

Were the assumptions pertaining to why changes were expected sustained?

Project assumptions underpin why the project as designed and implemented would contribute to social change in the problem context. Seven of the eight assumptions were sustained, and one is too early to assess (Table 6). The SNDP used a transdisciplinary approach and leveraged the PI's professional networks to engage with a range of system actors outside of the academic realm to co-produce knowledge, build networks, and disseminate knowledge. These characteristics help explain why the project was successful in realizing outcomes. Providing a platform for future work on the topic was a deliberate intent of the SNDP, which supported actors to continue exploring safe sanitation options for the Niger Delta region. Theories on social capital (Putnam, 2000), stakeholder engagement (Freeman, 1984), and agenda-setting (Stachowiak, 2013; McCombs & Shaw, 1972) help explain why expected changes based on assumptions did or did not occur in the case of the SNDP.

The PI's in-depth knowledge and prior working experience in the Niger Delta WASH sector were beneficial to the research process and extended the SNDP's influence on the sector. The PI's contextual understanding, pre-existing networks, and social capital were vital resources for the SNDP and supported knowledge-to-action following project completion because practitioners in the PI's network were more likely to read and use knowledge shared by the PI due to heightened levels of trust. Social capital describes the value of social relations that have productive benefits and enable society to function effectively – this can include social networks (Putnam, 2000). Social capital theory suggests that social relationships are resources that can lead to the development and accumulation of human capital, including increased trust. The PI was able to effectively leverage their social capital to access knowledge through their networks for data collection as well as share knowledge back through dissemination of SNDP findings. However, further targeted knowledge dissemination could have been beneficial to ensure that the findings were shared beyond participants to expand the PI's sphere of influence (Prac9). The PI's efforts to establish respectful and positive relationships with participants supported trust-building to facilitate cooperation and collective action that would be mutually beneficial (Bhandari & Yasunobu, 2009). The SNDP also successfully influenced the social capital of other actors in the WASH sector by building networks and communities of practice through the WASH sector WhatsApp group and providing opportunities for capacity-building for PIND staff. By leveraging the PI's social capital, establishing networks, trust, and new relationships, the SNDP successfully contributed to increased knowledge sharing in the Niger Delta WASH sector.

Table 6. Project assumptions assessment

<i>Assumption</i>	<i>Result</i>	<i>Evidence</i>
<p>There is a need for more appropriate sanitation technologies to improve policy and practice for the challenging context of the Niger Delta (e.g., environmental conditions, etc.)</p> <p>[WASH sector and community development pathway]</p> <p>[Government policy and practice pathway]</p>	<p>Sustained. SNDP conclusions state that appropriate, affordable, locally produced, and sustainable technical solutions to the sanitation challenges in the Niger Delta are absent. Technology options are constrained as a result of the local geography, presenting a unique sanitation challenge. For viable and safe options to exist, and in order to realize sustainable progress on WASH conditions in the region, innovations need to be sought, adapted with community and user inputs, and tested. In addition to geographical constraints, informants agreed that affordability of technology and community poverty are pressing challenges. With the recent focus on ending open defecation in the Niger Delta, there is greater recognition that without affordable and appropriate sanitation technologies, reaching this goal will be difficult if not impossible. The SNDP successfully brought this knowledge to the attention of partners within the PI's sphere of influence.</p>	<p>"The conclusions of [the] research are that appropriate, affordable, locally produced and sustainable technical solutions to the sanitation problems in the Niger Delta are absent" (Doc2)</p> <p>"There are clear constraints on technology options due to the unique geography of the region" (Doc3)</p> <p>"For viable, safe options to exist, innovations need to be sought, adapted with community/user input and tested" (Doc2)</p> <p>"The sanitation challenge in riverine communities of the Niger Delta is unique, as not all sanitation technologies are suitable in that environment due to the high-water table and frequent flooding" (Doc3)</p> <p><i>"we had a lot of challenges with getting communities to be able to construct latrines in those mostly water-logged environments and that is where we felt we have to find solutions that may be able to adapt to the context and still deliver safe sanitation services"</i> (Prac6)</p> <p><i>"The second challenge is around technology – the Niger Delta has the issue of very high rainfall, the water table is high and the land space is not so much, so technology that is appropriate for such environment to be able to get affordable and yet durable latrines is also a challenge"</i> (Prac9)</p> <p><i>"There is also another challenge that the types of latrines that are put out are not suited to these areas. So, if you're looking at areas where the water table is high, you have latrines that are going as low as the water table, and then you have human waste contaminating underground water sources"</i> (Prac5)</p> <p><i>"I think the recent vibes around ending open defecation and prioritizing, rather than focusing on latrine construction, people are now beginning to put more emphasis on ending open defecation, that has really drawn a lot of attention for as long as there is no solution in terms of latrine technology options for people living in those wetlands, then stopping open defecation in such environment will remain difficult, if not impossible"</i> (Prac6)</p> <p><i>"First, [the PI's] research has brought to the forefront the issue of one, the need for appropriate technology options for the Niger Delta [...] It has also brought to the for the need to look at market-based approaches to sanitation programming within the Niger Delta"</i> (Prac9)</p>
<p>The SNDP creates an opportunity for informants to engage on the topic through an interdisciplinary perspective</p>	<p>Sustained. Working with a range of actors (including NGOs, CBOs, RUWASSA, LGA WASH departments, and community WASH committees) outside of the academic realm is a fundamental element of the transdisciplinary approaches, and the PI was successfully at understood and managed these relationships. The SNDP's methods relied on informant engagement through a quantitative study of habits in two</p>	<p><i>"that is part of the transdisciplinary method, you work with people outside of the academic enterprise, and I think [the PI] handled that extremely well"</i> (Res3)</p> <p>"A quantitative study of habits in two riverine communities [...] were gathered using a structured interviewer-administered questionnaire" (Doc2)</p> <p>"semi-structured in-depth interviews [...] Participants were drawn from larger and smaller NGOs, from community-based organizations working on community development projects, from sub-national level RUWASSA (rural water and sanitation</p>

<p>[WASH sector and community development pathway]</p> <p>[Government policy and practice pathway]</p>	<p>riverine communities, and qualitative data collection through semi-structured interviews. The PI engaged at the community level to witness challenges of sanitation first-hand, engage with a broad range of stakeholders, and develop conclusions that reflect the current academic work on the topic, as well as the results from community engagement. A transdisciplinary approach was essential for the SNDP to blend the corporate and community worlds with behavioural theory and social change.</p>	<p>teams responsible for state interventions in WASH), from local government area (LGA) WASH departments and community WASH committees” (Doc2)</p> <p><i>“the primary area is going right down to the communities conducting research and I think that is something [the PI] also did in [their] research because [the PI] has been to most of these Niger Delta communities and [...] saw the challenges first hand, [they] engaged with stakeholders and practitioners and then was able to come up with [their] own conclusions”</i> (Prac9)</p> <p><i>“[the PI] was able to engage very deeply with the communities, and [they are] one of the very few persons who has very, very strong knowledge in terms of community sanitation within the Niger Delta because [they were] quite passionate about it, [they] engaged a broad spectrum of stakeholders and then was able to bring a lot of academic work and research into it, so I think [the PI] has done quite good work there”</i> (Prac9)</p> <p><i>“If [the PI] can’t do interdisciplinary work [they] can’t blend the corporate and the community and social theory and social change [...] You have to be able to do that and [the PI’s] research showed that clearly”</i> (Res1)</p>
<p>There is an identified need and benefit to participate in a community of practice/forum to share WASH information and knowledge</p> <p>[WASH sector and community development pathway]</p>	<p>Sustained. The SNDP confirmed the importance of stakeholder engagement and involvement in interventions for a sense of ownership to support the success of WASH implementation. The SNDP states that a community of practice would be major step forward, where government, NGO, and private sector actors can share best practices and put knowledge into practice. Informants agreed that prior to the SNDP, there was no community of practice for the Niger Delta as practitioners worked individually or in silos. There is an overall agreement that the lack of systemic knowledge sharing is one of the main challenges in the region, leading to the repetition of mistakes and failure to build on existing knowledge and experience. By highlighting this gap, several communities of practice have been formed. The SNDP successfully influenced the sector to create partner buy-in for training program development to improve sector engagement, collaboration, and knowledge sharing.</p>	<p>“As confirmed by [the SNDP], stakeholders must be engaged and involved, and feel ownership of a project; key influencers play a significant role as gatekeepers, models of change and social norms, and trusted resources for information; conflict, both internal to the community and external, must be assessed and taken into account. Failure to do these things jeopardizes the success of a program” (Doc2)</p> <p>“A major step forward would be a regional community of practice, that includes government, NGO, and private sector actors, if possible international advisors, that holds regular sector wide meetings to share model practices, activities, update results and planning, and share experiences in order to put knowledge into-practice” (Doc2)</p> <p><i>“There are pockets of individuals doing things, but there is no body of, there is no community of practice that one can say is bringing people together in the Niger Delta [...] so people work independently or individually”</i> (Prac8)</p> <p><i>“that is one challenge that we have across Nigeria. You need to know individuals to get information, there is no systematic way of repository of knowledge of research information and knowledge which is one of the challenges and one of the reasons of why we started the community of practice under that program”</i> (Prac8)</p> <p><i>“Under that project we [...] established a community of practice for water and sanitation [...] where we tried to get practitioners to share knowledge and to bring materials to a central place [...] so there are a few people here and there, but what I think would be useful for the Niger Delta and for Nigeria generally is for various communities of practice to aggregate around thematic issues to encourage one another and to boost knowledge and learning across the field”</i> (Prac8)</p> <p><i>“I think [the PI] was one of those who was able to influence the sector to buy into partnerships with the centre for the water sanitation technology in Canada to develop some training programs and try to see how this sector can be more engaging, how to see how different stakeholders can begin to collaborate. So, that has helped us to be more engaging, so there’s more of knowledge sharing now”</i> (Prac9)</p>

<p>The recommendations are useful, practical, and accessible for implementation, and were sufficiently rigorous to be taken seriously</p> <p>[WASH sector and community development pathway]</p> <p>[Government policy and practice pathway]</p> <p>[Professional development pathway]</p>	<p>Sustained. The SNDP was designed as an exploratory study owing to the lack of research on sanitation in the Niger Delta context. The SNDP upheld scientific rigour in its methods. The recommendations were formulated from the empirical evidence collected through the SNDP, which increased their relevance and utility. Informants suggested that the SNDP provided powerful and useful recommendations to inform future work on the topic. These clear recommendations have assisted WASH practitioners in their work, in terms of informing their approach and streamlining their thinking. Informants suggested that most if not all SNDP recommendations are being taken up by the WASH sector in the Niger Delta in some way, although this cannot be solely attributed to the SNDP. Project results and methods have been published within a supporting article to satisfy academic rigour and contribute to research on the topic of improving sanitation in the Niger Delta.</p>	<p>“This is an extremely broad topic but given the lack of research on this topic in the Niger Delta, it is necessary to start with exploratory research that is broad, in order to provide a basis for better understanding the issues and options that can provide recommendations for more focused research in the future” (Doc3)</p> <p>“[The PI] came up with recommendations that will form the foundation of future work on this issue” (Doc4)</p> <p><i>“I think [the PI] has been a very strong positive influence and [the] research also has thrown a lot more light in the area of sanitation with very clear recommendations that has helped me as a person in my work. Maybe not remembering the recommendations one after the other in my brain, but in the course of my work and in the approach, it is more like something that has been streamlined into my thinking” (Prac9)</i></p> <p>“[The PI] had some pretty powerful recommendations” (Res3)</p> <p>“So, [the PI was] assessed on how [the PI] used the evidence to create [the] conclusions, those are academic criteria, but everyone was struck by how useful the project was” (Res3)</p> <p>“[the SNDP] has some very useful recommendations and insights” (Prac5)</p> <p>“I think all of [the PI’s] recommendations are being taken up at one point or the other” (Prac9)</p>
<p>Partners are receptive to and develop an interest in evidence-based information and innovation around appropriate sanitation technologies to address WASH issues</p> <p>[WASH sector and community development pathway]</p>	<p>Sustained: Community members were aware of the need to improve the sanitation situation within the Niger Delta but had no means of moving forward prior to the SNDP. The project’s approach to engagement and dissemination supported partners’ realization that an affordable solution to persisting sanitation challenges could exist and encouraged some partners to explore what could be done to address gaps in the Niger Delta WASH sector. Partners have also begun to show an interest in evidence-based information regarding sanitation technologies (e.g., reviewing scientific studies on technology utility, sanitation recommendations for contexts similar to that of the Niger Delta).</p>	<p>“The women [within the communities] are desperate for some way to improve their situation. They’re not looking for handouts, but they can’t do it themselves because they can’t get the education, they can’t get financing – there are no options for them [...] People want a better way of life – they just don’t know how to move forward” (Doc6)</p> <p><i>“[the PI] is very much an open book type person. The people were receptive to finding answers and working with [the PI] because [their] style is one of training and education and mentoring” (Prac1)</i></p> <p><i>“people are looking to understand ‘Okay, that is the way,’ because for people who are in need of a solution, you know, so for them to now believe that here could be an affordable solution, I think that is quite commendable” (Prac4)</i></p> <p><i>“[the PI’s] research spurred some of us into extra action on what we can contribute to address the gaps, the official gaps in Niger Delta” (Prac4)</i></p> <p><i>“So if we only have, for instance, a new technology, we look at [...] scientific studies that have been done about these technologies, where it’s been rolled out, the utility, the use, feedback if that is available, before we roll it out. We look at suggestions made by researchers in different parts of Africa, on possible solutions, [...] what recommendations have been made by researchers, recommendations to solve problems similar to the ones we’re trying to solve in our area.” (Prac5)</i></p> <p><i>“there is a small physical centre at the ATED exhibit, but there is an online access to the library where we have got about 1,500 titles on appropriate technologies. We are always willing to get more publication[s] to upload onto the online library so that when people are looking for information around WASH, then if you have got loads of those then I am</i></p>

		<i>happy to actually put those online because it draws a lot of traffic within the Niger Delta, people are looking for information around sanitation or around bio-digestion” (Prac3)</i>
<p>There is the appropriate infrastructure, market, community demand (change in cultural norms), and capacity for maintenance, for WASH technologies in the Niger Delta region</p> <p>[WASH sector and community development pathway]</p>	<p>Not sustained, too early to assess. Having the appropriate infrastructure, market supply, community demand, and capacity for maintenance are necessary to drive progress for improved sanitation in the Niger Delta, but corruption, the challenging landscape, embedded cultural norms, and a lack of a strong state governance continue to act as barriers. Communities most in need of improved sanitation technologies in the Niger Delta are those who are the poorest with the greatest infrastructure development requirement. However, some progress is being made in terms of sanitation marketing and sanitation financing to support developments in the Niger Delta WASH sector.</p>	<p><i>“You have a situation where those that live in marshy grounds happen to be the poorest and the infrastructure need, or the infrastructure requirement for them to be able to construct these facilities seem to be on the other end” (Prac6)</i></p> <p><i>“The Niger Delta has its own very specific set of challenges which are the cost of the technology needed will inevitably be higher, there’s a lot more corruption, travelling to their communities is harder which pushes up costs even further, the technical solution and technologies aren’t available locally, and also I think governments are a severe issue in the Niger Delta, so they haven’t got a good strong state government, or they didn’t when I was last aware of it” (Prac11)</i></p> <p><i>“What we didn’t think deep about was the fact that the Niger Delta environment and landscape or geology [...] poses a lot of challenge[s] in terms of deployment of WASH infrastructure” (Prac6)</i></p> <p><i>“then we also have the private sector which come in with their own expertise in terms of sanitation marketing – so we have toilet business owners, we have artisans, we have those who are into providing financing models for institutions and all of that” (Prac9)</i></p> <p><i>“I think it is a combination of both, a combination of people not actually getting the infrastructure that is required into those communities and the lack of technology, but then again if one wants to apply one’s mind or self to it then of course the technologies are actually available but it is just getting the resources or getting the right kind of people to make sure those infrastructure gets to those communities” (Prac3)</i></p> <p><i>“I mean CLTS has been modified in Nigeria context to be CLTS++ we call it, so we do sanitation marketing and we do sanitation financing. So, when people get to this level of conviction that they need to construct the latrines, they say ‘Well what shall we do? Who will construct it for us?’ So, there will be what we call the toilet business owners who will come with options of latrine designs that people will pick from depending on what they want to do, it starts from the simplest to the more sophisticated. Then for those that are poor, they will need to find some financing mechanisms and we are also working on that” (Prac10)</i></p> <p><i>“the third issue is the area of sanitation marketing – providing the supply for these kinds of products, because when you create the demand and the supply is not there, the technology is not there, the artisans are not there, the financing models are not there, it is difficult to move forward. But there’s a sanitation marketing model that looks at the training of artisans, the development of technology options and designs and also looking at financing models that can enable households access funds, and payback over time” (Prac9)</i></p>
<p>The PI’s experience working with PIND positions them well to influence the Niger Delta WASH sector</p>	<p>Sustained. The PI was involved in international WASH projects prior to being hired at PIND, providing the PI with former knowledge, experience, and professional networks to influence the WASH sector. As the SNDP was conducted simultaneously to the PI’s work at PIND, knowledge gained</p>	<p><i>“[the PI was] involved with international water sanitation and hygiene projects and, after some self-education, was hired to work with a non-government organization in Nigeria called the Foundation for Partnership Initiatives in the Niger Delta (PIND)” (Doc4)</i></p> <p><i>“As this research is being undertaken throughout the period of [the PI’s] work with the Appropriate Technology Enabled Development (ATED) program of PIND Foundation,</i></p>

<p>[WASH sector and community development pathway]</p> <p>[Professional development pathway]</p>	<p>through the SNDP was shared through PIND networks (e.g., the PIND website, exhibits at the ATED Demonstration Centre, ATED training programs, workshop presentations, conferences, meetings with partners, etc.). Insights gained also informed the planning and implementation of interventions by the ATED team. The PI's experience supported the sufficient transfer of knowledge to PIND staff who now apply this knowledge to different aspects of their WASH work. The PI also introduced appropriate sanitation technology to the ATED Centre, which has received increased attention by practitioners within the WASH sector. The respectful and positive relationships with participants extended the PI's influence on others working in the Niger Delta WASH sector because of existing trust and participants' connections to others in the PI's network.</p> <p>However, informants suggested that PIND is only loosely associated with WASH and is reducing their current WASH programs, meaning that SNDP findings have not been fully leveraged within the organization.</p>	<p>knowledge gained will be shared in a number of ways in addition to [the] dissertation, which include online information on the PIND website, through training programs (the ATED program has a mandate to develop ongoing training programs), presentations to workshops, conferences, and meetings with partners, displays and exhibits at the ATED Demonstration Centre. Insights gained will also inform planning and implementation of interventions by the ATED team" (Doc3)</p> <p>"[the PI] made an effort to establish respectful and positive relationships with participants, and a shared interest in the subject matter" (Doc3)</p> <p>"[When I joined PIND,] <i>if the state wasn't set well for me, I think I would have found it difficult to work. But since I came, I would say I have had a smooth ride – partly based on [the PI's] efforts when [the PI] was here in Nigeria [...]</i> [the PI] wrote [the] <i>thesis based on WASH experience here in the Niger Delta, so I think it is a solid contribution because I think [the PI's] research would have made it into the [ATED] centre</i>" (Prac4)</p> <p>"so, within the [PIND] WASH section, there was sufficient transfer of knowledge through [the PI's] efforts, which some of us like me and my other colleague have enveloped and we use those lenses to look at sanitation programming in different aspects of our work" (Prac9)</p> <p>"unfortunately, I think [the PI's] primary host for the research was PIND and PIND as an organization is only loosely associated with WASH and is in fact pulling right back from WASH right now. If it was an organization that is strongly associated with WASH and will stay in WASH and that [the PI] was firmly embedded within, that research would inevitably have influence" (Prac11)</p>
<p>A doctorate holds universal recognition and provides the opportunity to expand on research capacities and expertise (professional networks etc.)</p> <p>[Professional development pathway]</p>	<p>Sustained. The build-up of knowledge and expertise based on experiences gained through the SNDP has provided the PI with increased knowledge and skills for their future work in the Niger Delta and similar WASH contexts. Having a doctorate in WASH has provided the PI with perceived legitimacy, further opportunities to share knowledge, and continue learning. Informants suggested that the PI's experience, competencies, and expertise were recognised partly as a result of their doctorate.</p>	<p>"I think [the PI has] done very well, there is no doubt that people recognize their experience and their competence" (Res3)</p> <p>"having completed the doctorate on this topic, [the PI is] surprised at the credibility it has given [them] [...] it is an opportunity to share knowledge and learn" (Res4)</p> <p>"[The PI] suggests that this build-up of knowledge and expertise based on the experiences [they] had has provided [the PI] with more tools and a different starting place when [they] visit a new environment" (Res4)</p> <p>"the fact that [the PI] has done a PhD and not only understands that the academic, theoretical look at something is important, but that the knowledge needs to be shaped into action in some way [...] it's that practitioner knowledge, the true meaning of a doctorate versus a PhD, and I think that [the PI] optimizes that. [The PI] has turned [their] knowledge into action in the form of TT" (Prac2)</p>

Stakeholder engagement also played a key role in ensuring effective transfer of knowledge-to-practice and stimulating practitioners to build-on the SNDP and its findings (Prac4, Prac5, Prac9, Res4). The SNDP “*honoured*” (Res1) all stakeholders in the Niger Delta WASH sector including Niger Delta communities, WASH practitioners, civil society, RUWASSA, NGOs, CBOs, and LGA WASH departments by gathering diverse perspectives to influence change in the Niger Delta WASH sector. Semi-structured interviews were chosen to “*allow freedom for the conversation to go where it needs to go*” (Gilbert, 2017, p.85). Engaging stakeholders within the research process can increase the quality and robustness of decisions, result in increased trust in decisions, and enhance the rate of knowledge-to-action while assuring that local needs are met (Freeman, 1984). SNDP stakeholder engagement supported the process of reflection by asking key actors about their WASH knowledge and practices. This process of reflection increased awareness of WASH gaps and issues for actors, including government representatives who were involved in data collection. Stakeholder engagement ensured that the recommendations were both relevant and useful for those working within the Niger Delta WASH sector to support uptake and implementation of the recommendations.

Partially realized outcomes in the government policy and practice pathway can be explained using advocacy coalitions (Sabatier, 2013) and multiple-streams theory (Kingdon, 1994). Involving government actors within the data collection process facilitated opportunities for government participants to reflect on the sector and enhance governmental capacity for knowledge sharing and learning through the WhatsApp group. This inclusion also built informal advocacy coalitions between government and other WASH sector actors through information sharing and relationship building in the WhatsApp group. Cairney (2013) describes coalitions as containing “people from a variety of positions (elected and agency officials, interest group leaders, researchers) who share a particular belief system and who show a non-trivial degree of coordinated activity over time”. With WASH practitioners and relevant government actors recognizing the benefit of participating in the WhatsApp group community of practice, the group grew in size in terms of members and activity subsequently contributing to enhanced local government, NGO, and other WASH practitioner knowledge sharing, learning, and improved policy and practice. The three streams stated in multiple-streams theory (problem stream, policy stream, and politics stream) are separate streams and are not a linear process; however, when these three elements come together, a window of opportunity is formed (Kingdon, 1994). For multiple-streams theory to be successful, policy makers must be aware of the problem and be receptive to the proposed solution through appropriate knowledge dissemination (problem stream). By including policy actors in the data collection process and WhatsApp group, the SNDP was successful at raising attention to the issue and sharing potential solutions, meeting the criteria of the problem stream. The policy stream refers to a solution to the problem that is available. Cairney (2013) notes that “while attention lurches quickly from issue to issue, viable solutions involving major policy change take time to develop. In the context of the Niger Delta, possible solutions are presented by the SNDP, yet the PI notes that further exploration is needed to find a technology option that is suitable for the Niger Delta context, made with locally available materials, and can be serviced locally as well (Gilbert, 2017). Although progress has been made towards the policy stream, it will take time for an overall solution to the problem to become available. Lastly, the politics stream suggests that “policymakers have the motive and opportunity to turn it into policy” (Cairney, 2013). At the time of the evaluation, the politics stream has not yet been fulfilled owing unfavourable political conditions and unstable local governments. With encouraging significant improvements at the government level (recommendation six identified in the SNDP) are needed to support the politics stream for policy change to happen.

The SNDP findings highlighted the importance of the lack of appropriate sanitation technologies and the need for behavioural interventions among stakeholders, which were previously low priority or not recognized in the WASH sector. By presenting these findings as new information and demonstrating their importance to the future progress of sanitation, the SNDP employed principles described in agenda-setting theory (Stachowiak, 2013; McCombs & Shaw, 1972). Agenda-setting or media influence theory describes the ability of the media (or in this case, research) to influence the ranking of topics on the public agenda by establishing a hierarchy of information frequency. When a topic is given importance and increased attention over other topics, the audience will

automatically discern the topic to be most important. By employing participatory methods and by packaging knowledge in an appropriate means to the intended audience, the SNDP informed actors involved in the topic, shifted the perception of the topic's importance, and subsequently influenced the practitioner agenda for future work on the topic.

Are the higher-level changes likely to be realized?

All higher-level changes identified in the SNDP ToC have the potential to be realised. At the time of the evaluation, there was evidence indicating that seven out of ten high-level outcomes have begun to or have already been realized (Table 7; see Appendix 8 for more detailed results). For the remaining three high-level outcomes, realization of respective antecedent outcomes (i.e., intermediate and end-of-project outcomes) shows promise for future changes to manifest. Some high-level outcomes will take longer to emerge as they are dependent on ongoing processes or factors beyond the scope of the SNDP, such as changes in infrastructure and political motivation.

The SNDP presented evidence-based recommendations and guidance to explore safe sanitation options; prompted informants to reflect on WASH gaps, issues, and opportunities; and supported capacity-building within the Niger Delta's WASH sector to share knowledge and best practices. As a result, some high-level outcomes within the *WASH sector and community development* pathway have preliminary evidence to suggest partial realization with clear project contribution. Evidence suggests a number of other initiatives and external factors currently underway also contributed to the high-level outcomes within this pathway. The SNDP provided the PI with the opportunity to enhance their professional development through the research process and strengthened collaborations that have bearing on high-level outcomes within the *professional development* pathway. There is insufficient evidence to assess the high-level outcomes in the *government policy and practice* pathway because of the difficulty in contacting government informants for interviews. However, some preliminary evidence suggests that other initiatives and policy implementation are underway at the national level, and local governments are encouraged to follow suit.

Table 7. Higher-level outcome assessments

Results	Evidence and Mechanisms	
Outcome Assessment	Summary of supporting evidence for assessment	Contextual factors and causal mechanisms affecting outcome realization
<p>WASH sector take-up and implement recommendations</p> <p>Partially realized, unclear project contribution</p>	<ul style="list-style-type: none"> Two interview informants from PIND and international non-profit organizations state that the WASH sector has taken-up and implemented the SNDP recommendations to a degree. However, it is unclear to what extent the SNDP directly contributed to these changes <ul style="list-style-type: none"> The sector has begun to develop a small number of appropriate, affordable, and durable technologies and train artisans to build these technologies (<i>interviews</i>) Some INGOs are focusing on understanding market approaches (<i>interviews</i>) Improved coordination and knowledge sharing are underway via the WASH sector WhatsApp group and the work of TI (<i>interviews</i>) Behaviour change approaches have been further developed through the rebranding of CLTS++, which has been taken up by the WASH sector (<i>interviews</i>) The private sector is playing a greater leading role in the development of innovative solutions (<i>interviews</i>) The SNDP recommendations have been used to address WASH sector issues in the Niger Delta, particularly the recommendation for sanitation technology options which is currently being explored by UNICEF (<i>survey</i>) The national government is attempting to motivate regional governments to improve WASH, indicating governmental momentum However, it is unclear to what extent the SNDP directly contributed to the above changes (<i>interviews</i>) 	<p>Facilitating factors:</p> <ul style="list-style-type: none"> The PI disseminated their findings through their professional networks with WASH organizations, PIND colleagues, and TI The PI presented SNDP findings at conferences, including WEDEC, to share their research with a variety of practitioner, government, and researcher audiences Creating and strengthening coalitions with WASH sector actors and providing a knowledge base on which future work can build have supported the implementation of the SNDP recommendations <p>Alternative explanations:</p> <ul style="list-style-type: none"> Other WASH projects are ongoing in the Niger Delta which continue to expand upon the SNDP's work
<p>Master trainers improve their WASH training skills (DEWT)</p> <p>Insufficient evidence</p>	<ul style="list-style-type: none"> One interview informant from an international non-profit organization discussed the training of trainers, but direct linkage to the SNDP is uncertain. Document evidence suggesting that trainers' capacity has improved <ul style="list-style-type: none"> Evidence confirms that the training of trainers occurred, but there is minimal evidence to assess whether trainers' skills improved through this initiative (<i>interviews</i>) It is unclear whether training is directly related to the SNDP or the PI's previous work at PIND (<i>interviews</i>) Trainers' capacity has improved via the PI's supervision and other ongoing training initiatives (<i>documents</i>) Trainers were not interviewed for the evaluation; perceptions from other informants familiar with DEWT were used to assess this outcome 	<p>Facilitating factors:</p> <ul style="list-style-type: none"> DEWT was supervised by the PI while the PI was completing the SNDP <p>Alternative explanations:</p> <ul style="list-style-type: none"> The PI, as well as other organizations such as PIND, continue to advocate and host knowledge sharing workshops and training sessions

<p>Visitors to ATED learn and gain more awareness about WASH issues</p> <p>Realized, clear project contribution</p>	<ul style="list-style-type: none"> • Three interview informants from PIND and international non-profit organizations state that visitors to the ATED center are gaining more awareness about WASH issues. This is supported by document evidence <ul style="list-style-type: none"> • Practitioners who attended ATED had increased learning and awareness of WASH issues, particularly around appropriate technology options (e.g., biosand filters) (<i>interviews</i>) • The ATED Demonstration Centre provides capacity-building on suitable sanitation technologies for the Niger Delta, which would not otherwise be available in the region (<i>interviews</i>) • It is through the PI's direct efforts that the ATED Demonstration Centre has the appropriate technology options on display (e.g., biodigester) (<i>interviews</i>) • SNDP informants expressed great interest in technologies displayed at the ATED Demonstration Centre (<i>documents</i>) 	<p>Facilitating factors:</p> <ul style="list-style-type: none"> • Exposing ATED Demonstration Centre visitors to appropriate technologies on display can support awareness-building about WASH issues presented in the exhibit • PIND continues to invite WASH sector actors to the ATED Demonstration Centre to spread awareness and encourage uptake of appropriate technologies • Key actors from academic institutions, professional bodies, and private businesses have been invited to attend the ATED Demonstration Centre with the expectation that they will share this knowledge and implement it in their own activities
<p>Niger Delta communities' thinking around sanitation is stimulated to encourage receptivity to new technologies and WASH practices and shift cultural norms</p> <p>Partially realized, unclear project contribution</p>	<ul style="list-style-type: none"> • Three interview informants from PIND and international non-profit organizations state that Niger Delta communities are becoming more receptive to new WASH technologies and WASH practices. However, one interview informant from an international development organization believes that this is yet to happen due to embedded cultural attitudes <ul style="list-style-type: none"> ○ The SNDP contributed to the capacity-building of local communities and organizations in the PI's network (e.g., PIND, UNICEF, AquaClara Kenya) (<i>interviews</i>) ○ Identification of the critical need for affordable sanitation solutions within the SNDP findings helped shift community attitudes to recognize alternative technologies exist ○ Recognition is a first step in building receptivity toward alternative technologies and WASH practices that are safer for communities (<i>interviews</i>) • No community members were interviewed for the evaluation, so practitioners' perceptions could not be verified 	<p>Facilitating factors:</p> <ul style="list-style-type: none"> • Niger Delta communities participated in the SNDP, which could have prompted reflection on the topic of WASH and safe sanitation (e.g., asking individuals about their WASH practices may make them more inquisitive about the topic) <p>Barriers:</p> <ul style="list-style-type: none"> • Past donor attempts to encourage sanitation technology uptake have failed, and left communities distrustful of donor motives • There have been difficulties in the past to get community buy-in and use of technologies because of cultural attitudes toward donor hand-outs in the region • Attitudes and cultural norms are difficult to change, and both require consistent and persuasive argumentation to shift and manifest in behaviour change <p>Alternative explanations:</p> <ul style="list-style-type: none"> • Other initiatives in the region (e.g., CLTS++) continue to support attitudinal change of communities
<p>Communities in Niger Delta have access to appropriate, affordable and safe technologies to address WASH</p> <p>Partially realized, unclear project contribution</p>	<ul style="list-style-type: none"> • Two interview informants from international non-profit organizations believe that the SNDP contributed to other organizations piloting technologies and encouraged communities to believe that solutions are available. However, two interview informants from PIND and international non-profits state that appropriate technologies have yet to be locally developed or taken up at scale with the SNDP having minimal contribution <ul style="list-style-type: none"> • The SNDP did not contribute to the identification or innovation of new technologies (<i>interviews</i>) 	<p>Facilitating factors:</p> <ul style="list-style-type: none"> • Targeted dissemination of SNDP findings stimulated other projects to continue to work on the topic of improving sanitation in the Niger Delta (e.g., UNICEF is currently exploring new sanitation technologies for high water-table contexts) <p>Barriers:</p> <ul style="list-style-type: none"> • Despite increased discussions on the topic of sanitation technologies and organizations' exploration of appropriate sanitation technologies, there has been low adoption of appropriate

	<ul style="list-style-type: none"> • The SNDP triggered others to explore and pilot appropriate technologies (<i>interviews</i>) • However, there is limited evidence to suggest that the SNDP had a direct influence on communities in the Niger Delta having access to appropriate, affordable, and safe technologies to address WASH (<i>interviews</i>) 	<p>technologies because necessary changes in mindset is a slow and gradual process</p> <ul style="list-style-type: none"> • There has been some adoption of technology options, but not without difficulties <p>Alternative explanations:</p> <ul style="list-style-type: none"> • Other NGOs have piloted alternative sanitation approaches with communities in the Niger Delta
Local governments recognize WASH gaps (issues and opportunities) and have enhanced commitment to action on WASH Partially realized, unclear project contribution	<ul style="list-style-type: none"> • Two interview informants from PIND and international non-profit organizations state that local government have implemented campaigns and are pushing for change in terms of improving WASH in the Niger Delta. Two survey respondents agree stating that some local governments have made financial commitments to promote WASH. However, one survey respondent suggests that there has been low commitment to WASH by government at all levels. It is unclear to what extent the SNDP directly contributed to any changes <ul style="list-style-type: none"> ○ Government actors learned on WASH from their participation in the SNDP ○ All levels of government now understand what ending open defecation means and how to approach it, with some LGAs committed to the goal of becoming ODF (<i>survey</i>) • Government representatives were not interviewed for the evaluation; perceptions from other informants were used to assess this outcome 	<p>Facilitating factors:</p> <ul style="list-style-type: none"> • The PI was able to access and include government participants in the SNDP through their professional networks <p>Barriers:</p> <ul style="list-style-type: none"> • Contextual factors, such as the local government's low commitment to action on WASH, have hindered the realization of this outcome <p>Alternative explanations:</p> <ul style="list-style-type: none"> • National government initiatives are underway (e.g., 'Clean Nigeria: Use the Toilet' campaign, the National Action Plan, and the Warri Economic Summit) • Government initiatives can be expected to influence local governments through a top-down approach • The Society of Water and Sanitation (NEWSAN) is currently building capacity to create more awareness of WASH gaps and opportunities in states and communities
Local governments seek evidence-based information/solutions for WASH decision-making Insufficient evidence	<ul style="list-style-type: none"> • Government representatives were not interviewed for the evaluation; perceptions from other informants were used to assess this outcome. 	<p>Facilitating factors:</p> <ul style="list-style-type: none"> • Local governments must recognize that there is a need for changes in the WASH sector in order to progress • Evidence-based information and solutions will need to be viewed as credible and relevant to address local government needs to be incorporated into decision-making and policy <p>Alternative explanations:</p> <ul style="list-style-type: none"> • Government consultants play an important role in providing technical assistance, clarification, strategy development, and guidance to governments in order to fulfill National Action Plan targets (e.g., SDG 6 by 2030, ODF Nigeria by 2025) • Government actors already seek advice and evidence-based information from WASH consultants to support policy implementation • Other reports exploring the issues around sanitation have been sponsored by state government, indicating local governments are seeking evidence-based information and solutions for WASH decision-making

		<p>Barriers:</p> <ul style="list-style-type: none"> Informants are unsure as to whether local governments actively review research; if so, it is likely that this is done inefficiently with a focus on planning and developing policies and strategies. Interview evidence suggests that this has not progressed
<p>Local governments take-up and implement policy for effective WASH practice</p> <p>Partially realized, unclear project contribution</p>	<ul style="list-style-type: none"> One interview informant is currently assisting local government to create a National Action Plan to support the ‘Clean Nigeria: Use the Toilet’ campaign. Three survey respondents also suggest that some states have started to implement WASH policy. However, it is unclear to what extent the SNDP contributed to these changes. Two survey respondents believe that policymakers do not have the funding or will to implement WASH policy <ul style="list-style-type: none"> Policy is being implemented at the national level to support Nigeria’s commitment to the SDGs The National Action Plan on WASH passed legislation in 2018 The ‘Clean Nigeria: Use the Toilet’ campaign, now underway, was backed by an executive order signed by the President of Nigeria Some local governments have also begun to implement policy, but the extent is unclear Some states have started to implement WASH policy and are approving budget to support policies (e.g., the Open Defecation Free Road Map and implementation guidelines) (<i>survey</i>) Government representatives were not interviewed for the evaluation; perceptions from other informants were used to assess this outcome 	<p>Facilitating factors:</p> <ul style="list-style-type: none"> The WASH sector’s exploration of technologies in high water table contexts is likely to eventually result in a viable solution Overtime, appropriate infrastructure will likely improve With favorable political environments, including a strong and stable local government, policymakers will then have the opportunity to turn the available solutions into policy <p>Barriers:</p> <ul style="list-style-type: none"> A lack of political will at the local level has left some local governments unwilling to implement and enforce WASH policy <p>Alternative explanations:</p> <ul style="list-style-type: none"> Government consultants have assisted the preparation of the National Action Plan to support the implementation of the ‘Clean Nigeria: Use the Toilet’ campaign
<p>PI continues work in Niger Delta WASH sector and beyond</p> <p>Realized, clear project contribution</p>	<ul style="list-style-type: none"> Six interview informants from PIND, international non-profit organizations, as well as researchers, state that the PI continues to work in the Niger Delta WASH sector and beyond through PIND projects and their work at TI <ul style="list-style-type: none"> The PI continues to apply a similar community-based approach to community work used in the SNDP in their work at TI (<i>interviews</i>) The PI has participated in discussions outside of TI’s network on sanitation issues <ul style="list-style-type: none"> Through these discussions, further knowledge sharing networks and communities of practice have been leveraged by the PI (<i>interviews</i>) The PI continues to collaborate with PIND on their campaign focused on WASH in schools (<i>interviews</i>) 	<p>Facilitating factors:</p> <ul style="list-style-type: none"> SNDP provided an opportunity for the PI to further develop their skills, increase professional exposure, and become recognized as an expert by practitioners working on sanitation in the Niger Delta The SNDP reinforced the PI’s passion on the topic, leading the PI to establish TI to continue this work internationally <p>Alternative explanations:</p> <ul style="list-style-type: none"> The PI’s passion for sanitation existed prior to their doctoral work, and likely the PI would have remained connected to the sector regardless

Research Project Assessment

What elements of the research design and implementation supported outcome realization, and how?

Belcher et al.'s (2016) Transdisciplinary Research QAF is used to assess the degree to which the project employed inter- and transdisciplinary principles; it is not used as a measure of excellence, but instead used to elicit lessons for research design and implementation. Overall, the SNDP's design and implementation aligns with principles and criteria of relevant, credible, legitimate, and effective research, and it produced knowledge that is useful and used (see Appendix 7 for QAF results and justifications for the project assessment). Based on the assessment, most QAF criteria scored low in comparison to other transdisciplinary research projects (see Figure 5). Informants thought the SNDP was implemented appropriately because the PI had previous experience working in the context and recommendations were described as practical and timely (Prac4, Prac9, Res1). The PI had adequate competencies to undertake the research based on their in-depth understanding of the sector, which played a crucial role in supporting significant changes through the SNDP (Prac2, Prac3, Prac4, Prac5, Prac6, Prac7, Prac9, Res1, Res3). These characteristics supported the relevance, credibility, legitimacy, and effectiveness of the research process and the knowledge produced and supported outcome realization.

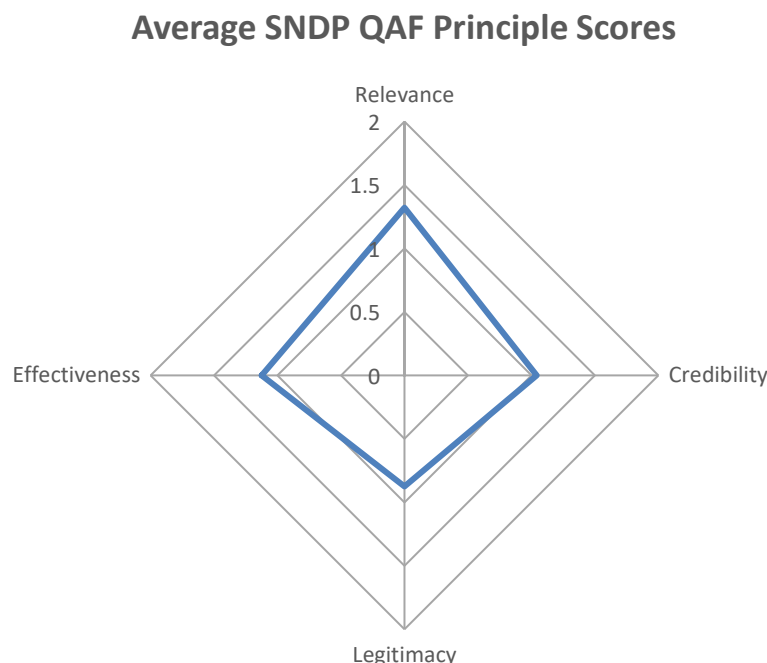


Figure 5. Scoring of the SNDP against QAF principles of Relevance, Credibility, Legitimacy, and Effectiveness (0 = the criterion was not satisfied; 1 = the criterion was partially satisfied; and 2 = the criterion was fully satisfied).

Relevance

Figure 6 presents the scores for criteria under the *Relevance* principle. The SNDP effectively addressed a *socially relevant research problem* and effectively *engaged with the problem context* to satisfy these criteria. However, criteria such as *relevant research objectives and design* and *effective communication* were not fully satisfied, and likely affected outcomes relating to the wider use of the research within the WASH sector outside of the PI's direct sphere of influence, such as outcomes within the *government policy and practice* pathway. Had the SNDP findings been shared through targeted dissemination and ongoing engagement with government actors, it is likely that they would have greater awareness of riverine-specific issues and solutions to generate and enhance governmental commitment to action on WASH for communities within the Niger Delta.

The SNDP identifies academic and practical gaps, discusses negative spillover effects of poor sanitation, lack of appropriate WASH technologies for riverine systems, and the siloization of Nigeria's WASH sector to clearly define the socio-ecological context. The dissertation also effectively situates the research project within MDG 7

to ensure environmental sustainability and acknowledges the benefits of improving access to safe WASH. The research design is relevant and appropriate to the problem context and the exploratory nature of the project to learn from experiences of system actors, and to provide an understanding of issues in order to make recommendations of how to proceed effectively (Doc3). The project also accounts for and accommodates community needs and values in the design of the approach on a sensitive and taboo topic. The PI reviewed what is currently being used for sanitation, as well as options that could be considered in the future – it was important to consider the full cycle of fecal management, as well as the safety and appropriateness of the technology (Doc3).

Average SNDP Relevance Scores

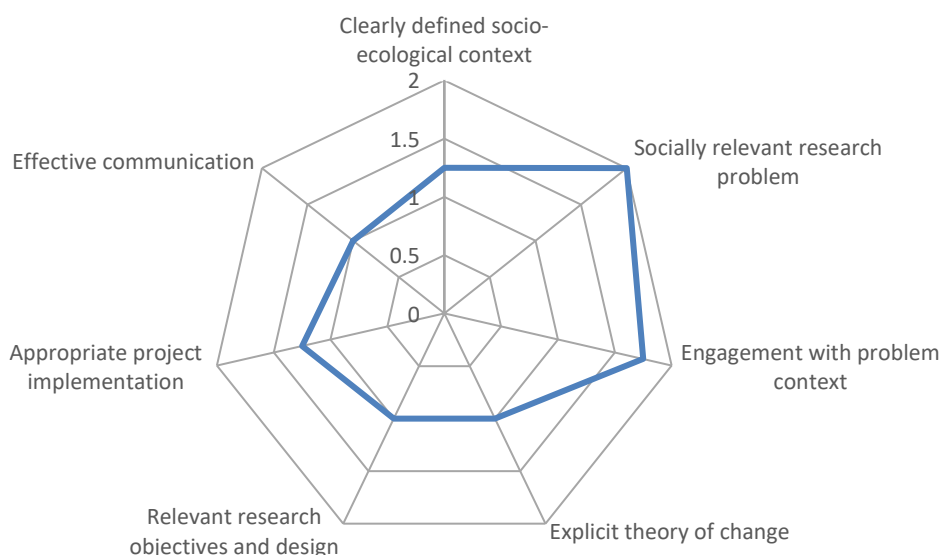


Figure 6. Project satisfaction of relevance criteria

The PI interacted sufficiently with the problem context through their personal experience as a WASH practitioner in Nigeria and through the fieldwork which engaged a range of system actors to gain a breadth and depth of understanding. System actors were receptive to finding answers and working with the PI because of the PI's style and focus on capacity-building by engaging deeply with communities and a broad spectrum of stakeholders (Prac1, Prac9). The research advisory committee commended the PI's communication during the research process. For example, the communication of results was perceived to be accessible and well-organized, with the dissertation written with the audience in mind rather than drawing on academic language to support the use and uptake of the SNDP findings by WASH practitioners and communities (Res1). The PI kept in touch with some participants providing them with feedback on the progress of the research and sharing copies of the dissertation with them so that participant inputs could be shared. Most informants suggest that their views were taken into account by the PI (Prac9). The PI's in-depth knowledge of the context and experience within the region also positioned them well to influence the context through their access to Nigerian WASH networks and through working at PIND which enabled them to utilise multiple dissemination strategies through these networks. Informants reflect on the relevance and value of the SNDP, and the practical application of the findings are considered and discussed, including how findings are expected to be used at PIND.

In terms of design, the SNDP has a singular objective which lacks specificity and is presented more as a statement of interest. Although the SNDP engaged a range of system actors, it is unclear to what extent this engagement was leveraged (e.g., problem context engagement versus information extraction). There was also no discussion within the dissertation of how communications during the research process were planned. System actors not directly involved in the research process, as well as those outside of the PI's sphere of influence, had low awareness of SNDP results. For example, the majority of survey respondents (21) were unaware of the SNDP.

The analysis of relevance criteria highlights the importance of the PI's work in the context prior to the SNDP. This in-depth knowledge of the context and system was a vital support in completing research in such a sensitive area (Res1). With little prior research on sanitation in the Niger Delta, the SNDP is necessarily broad to provide a base of understanding and how to move forward (Doc3). However, by having a set of objectives that situate the research within the social problem and discuss how the research is expected to contribute to this problem, the research design of the SNDP could have been strengthened to support academic transparency. To further increase transparency, discussion of the communication process could have been utilized which may have supported further knowledge dissemination to actors not directly involved in the research process.

Credibility

Figure 7 presents the scores for criteria under the *Credibility* principle. The PI had *adequate competencies* to undertake the research and influence changes in knowledge by providing a deeper understanding of the issues; changes in attitude by encouraging practitioners to search for solutions that are not conventional; and changes in relationships through TI and the WASH sector WhatsApp group. Criteria such as *ongoing monitoring and reflexivity* did not score highly as the documentation mentions the importance of reflexivity, but it is not clear the extent to which or how reflection was done. The criterion *limitations stated* was not at all satisfied as the limitations of the SNDP and its results are not discussed in the dissertation.

Average SNDP Credibility Scores

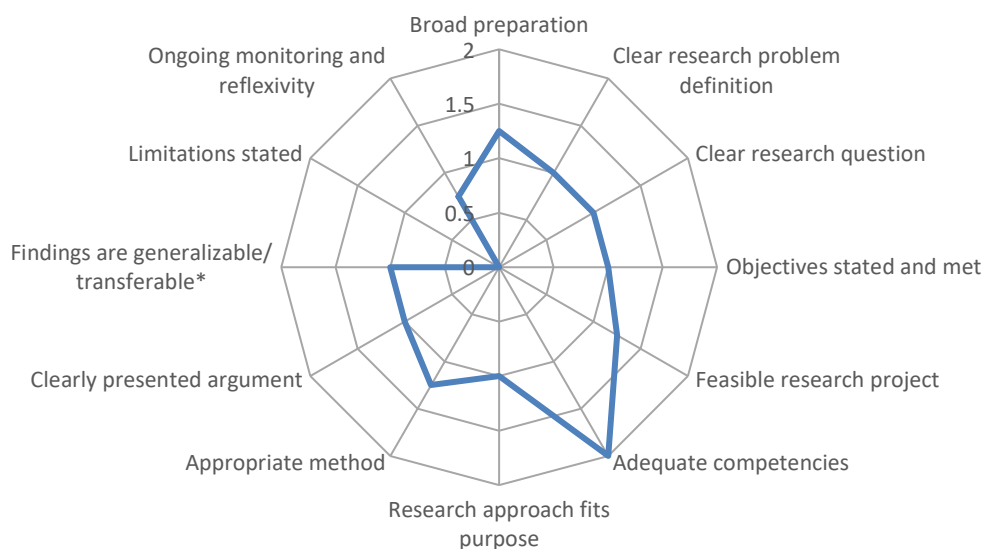


Figure 7. Project satisfaction of credibility criteria. Criteria marked with an Asterisk (*) have been rephrased from the original QAF (Appendix 7) for clarity and presentation.

The PI had the adequate competencies necessary to complete the research owing to their extensive prior knowledge of Nigeria and the WASH sector. The PI had first-hand experience in the WASH sector, had volunteered for WASRAG for many years, and had worked for Rotary in South Africa which led the PI to work professionally in the field (Doc3). The PI was contracted by PIND as manager of the ATED program and then became an advisor to the program; this role allowed the PI to explore ways that appropriate technology solutions could improve the life and livelihood of communities, including the ways local communities could access safe WASH (Doc6). Informants commented on the PI's passion for their work, expertise, and commitment in a tough social, cultural, economic, environmental, and political context (Res1). Relationships with PIND staff also allowed the PI to share knowledge through collegial relationships, which supported PIND staff to gain knowledge and capacities and apply them in related work. Enumerators received basic research training, such as how to ask questions and record answers using Android phones for the survey, which provided them with skills to effectively gather data (Doc2). To answer the how and why underpinning their research questions, the PI sought thick

description of human interactions (Geertz, 1973) by including qualitative evidence (Agee, 2009) through semi-structured interviews (Doc2) to ensure the research approach fit its purpose. As the PI's interest lay in seeking a deep and rich understanding of the situation, technologies, what solutions had been tried, and where barriers existed, the PI interviewed individuals with specific knowledge of the context's WASH issues using purposive sampling (Flick, 2014). The mixed methods approach used was clearly described, systematic, and fit the exploratory nature of the research. To clearly present the argument, results are presented in both narrative and diagrams (e.g., quantitative data). Regarding the transferability and generalizability of findings, the SNDP is built on the premise that the Niger Delta is a unique context with unique sanitation challenges, suggesting that the findings are too specific to be transferable. However, informants noted that the research was transferable as sanitation is a global issue. For example, much of the content is generalizable across other developing countries faced with similar topographies and/or systemic issues (Prac1, Prac7, Res1, Res3). In particular, informants noted similarities between African nations; therefore, many of the findings from the research were thought to be transferable and relatable for other African contexts (Prac5). Likely the methods could be transferable to other contexts, but this is not discussed within documentation.

The PI's previous work in the Niger Delta was a key factor that supported the completion of the SNDP. For example, as result of the PI's previous work in the Niger Delta, the PI had the privilege of access to professional colleagues with whom to discuss issues and reflect on interpretation (Doc3), but the extent of this relationship is not clearly explained. The selection of disciplines and how they were integrated within the SNDP is discussed minimally within the dissertation, with no discussion of paradoxes or conflicts to support the robustness of the research findings (Belcher et al., 2016). The SNDP also misses the opportunity to fully leverage the data collected. For example, the SNDP's quantitative data have only been used for demographic purposes and there is no correlation of how the quantitative data support or contradict the qualitative findings. There is also only a brief discussion of scientific rigor, including acknowledgement of bias. The analyses within the dissertation do not demonstrate synthesis of results, instead reading as a list of anecdotes and informant opinions. The documentation only contains one brief section acknowledging limited data availability and the difficulty in corroborating self-reported qualitative research given the low number of external sources; limitations are not meaningfully discussed in terms of the implications for results. The documentation states that efforts were made to record observations in order to validate self-reported data (Doc2). It is also unclear whether the limitations were accounted for on an ongoing basis throughout the SNDP. The dissertation mentions the importance of reflexivity, but it is not clear the extent to which or how reflection was completed. For example, the dissertation notes that reflexivity can include checking methods, analysis, and interpretation with both academic literature and the population being researched (e.g., collaboration, critical reference group). One informant noted that the quantitative methods underwent significant re-thinking, but this is not documented within the dissertation (Res3).

Overall, the PI had the adequate competencies to support the SNDP; the PI's intimate knowledge of the context and networks in the region were vital to the success of the research and allowed for the collection of diverse perspectives (Doc3). The exploratory approach of the SNDP was appropriate to address the stated objective; a thorough rationale is provided within the documentation to collect data from communities (accounting for stigma associated with the topic) with a clear discussion for the inclusion of methodologies. However, the SNDP missed the opportunity to draw connections between the qualitative and quantitative data for a stronger argument, and further transparency regarding relationships and bias could support trustworthiness (Belcher et al., 2016). Improvement could also be made to logically connect the recommendations to the results with alternative explanations not adequately explored within documentation.

Legitimacy

Figure 8 presents the scores for criteria under the *Legitimacy* principle. The SNDP was successful at ensuring the *research was ethical* by following RRU ethical review processes and protecting the anonymity of informants. However, the SNDP was less thorough at the *disclosure of perspective* and *effective collaboration* owing to its extractive nature and failure to disclose connections with the Chevron Corporation who founded PIND in 2010.

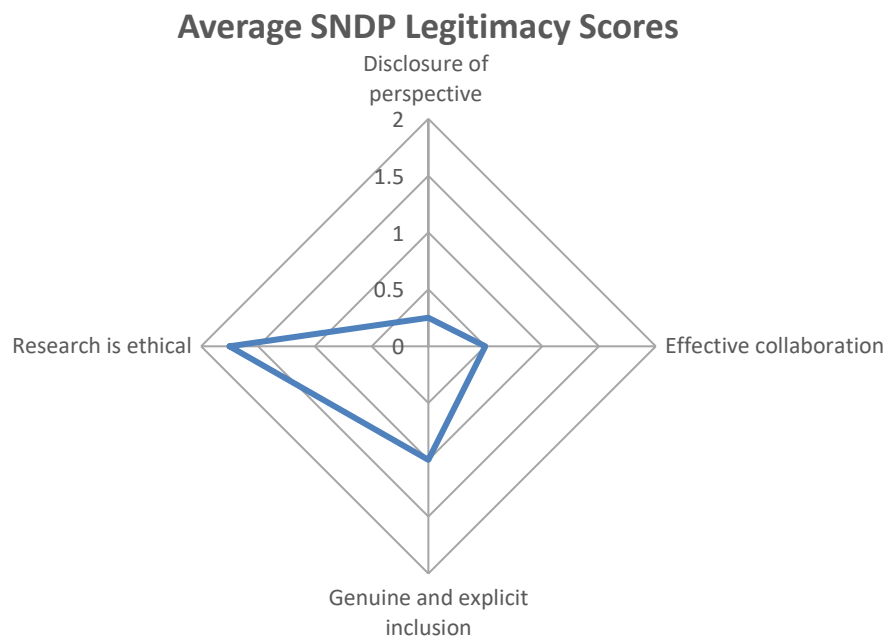


Figure 8. Project satisfaction of legitimacy criteria

The interviews gave an impression that the PI separated the doctoral work from their work at PIND, which was not clearly disclosed. Advisory committee members reflected positively on their relationships with the PI, including the PI's openness to results and communication during the research process. The PI successfully brought corporate, political, and community actors in the research, including the relationship with PIND and its sponsor, Chevron Corporation (Res1, Res3). The project received ethical approval by RRU Research Ethics Board. The SNDP complied with the guiding principles laid out in the Tri-council Policy Statement for Ethical Conduct for Research Involving Humans and RRU's Research Policy (Doc3). Anonymity of participants was maintained, and consideration of how to ethically engage communities on a sensitive or taboo topic is given. Each participant in both the quantitative and qualitative research completed a consent form that included information as to confidentiality and the right to withdraw, as well as a description of the project, and possible uses of the research (Doc3). The documentation also briefly mentions the ethical importance of reflexivity.

Although SNDP documentation indicates an awareness of personal biases, these biases are not openly explained or discussed in terms of the implications for the research. Research positionality is also not discussed in great detail outside of the PI's ties with PIND and the ATED Demonstration Centre. Mitacs funding received, the partnership with PIND, and personal and professional relationships with some SNDP participants were noted within documentation; however, the connection to the Chevron Corporation through PIND was not disclosed. The PI did acknowledge that their critical reference group was built from prior connections within the WASH sector; however, the relationship could have been explained in greater detail to illustrate the nature of the critical reference group's contributions. Similarly, the relationship with the enumerators could have been explained in greater detail beyond stating the training that they received. The SNDP is noted to have not been a collaborative piece of work; evidence indicates an extractive relationship in terms of collecting data from communities.

The SNDP was an ethical project which maintained the anonymity of participants and highlighted the importance of reflexivity. Overall, there was scope for the project to be more collaborative through the PI's professional connections at PIND and with other WASH practitioners to improve the uptake and use of the SNDP findings and recommendations. A more in-depth discussion of relationships, biases, and positionality would have supported transparency in order to build trust among possible users of the research findings.

Effectiveness

Figure 9 presents scores for criteria under the *Effectiveness* principle. Effectiveness manifested most clearly in the SNDP's contribution to a *significant outcome*. The SNDP effectively built the *social capacity* of the PI and

contributed to their knowledge base to support their future work in the topic, but missed the opportunity to intentionally build capacity of other system actors (e.g., enumerators, practitioners, governments). The SNDP helped bridge existing knowledge gaps and expanded on what was already known to produce recommendations that could be applied. By intentionally building the capacity of other system actors, it is likely that the SNDP findings and recommendations would have been used more widely in the Niger Delta WASH sector.

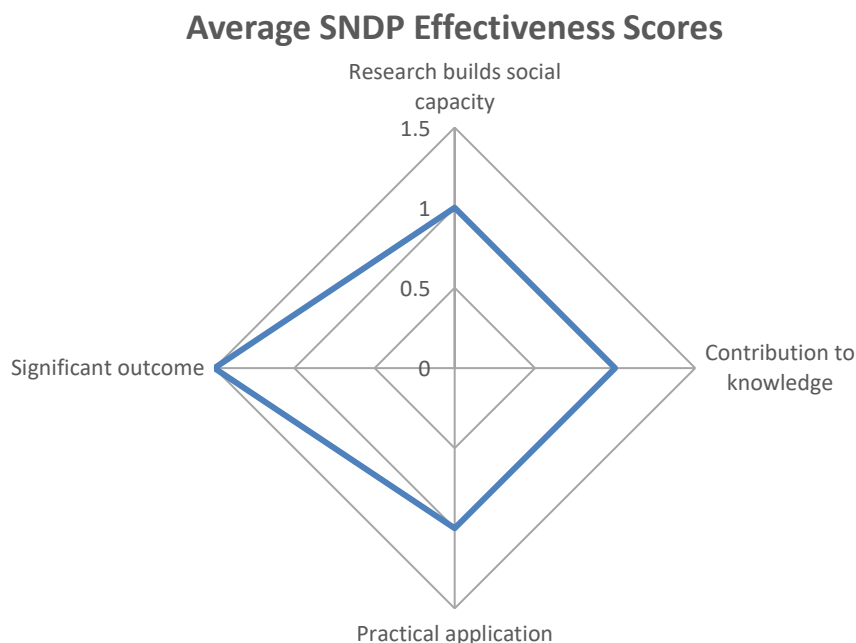


Figure 9. Project satisfaction of effectiveness criteria.

The SNDP clearly contributed to the partial or full realization of seven of the ten intermediate and end-of-project outcomes. The research capacity-building of the PI was high, as the PI applied academic-based knowledge and built the necessary research skills to conduct the research. For example, the PI's understanding of and approaches to WASH interventions have been permanently expanded (Doc3). The expansion of the PI's knowledge base now guides TI's work and provides the organization with a firm foundation on which to based informed decision-making on WASH-related projects. TI has created a space where experiences can be shared and where TI members can seek assistance with technical issues, fundraising, and other sustainable development challenges (Doc5). Other than their work with TI, the PI has also continued to work with NGOs, governments, and communities to develop safe, locally-made, and environmentally-suitable toilets for the Niger Delta (Doc4, Doc6). The SNDP planned for the research and associated knowledge to be used within the ATED Demonstration Centre, but informants were unable to specify in detail how this was integrated. However, some suggest that there was sufficient transfer of knowledge through the PI to colleagues in PIND who have used the findings to look at sanitation programming in a new light (Prac9). The SNDP is not thought to have generated new knowledge, but it did bridge connections in existing knowledge and expanded on what is already known. Informants indicated that they now think more deeply about the topic and related issues as a result of the SNDP (i.e., how to support WASH developments in the Niger Delta). Some informants suggested that the report is a useful resource for reference as it is well-tailored to communicate the crux of the challenges and the approaches that can be used in riverine communities of the Niger Delta (Prac4, Prac7). The SNDP is also noted to have catalyzed thoughts around what could be done to support appropriate technology development in the region (Prac4, Prac9). Informants suggest that enhanced knowledge-sharing and learning are occurring more frequently in the Niger Delta between organizations venturing into sanitation and piloting products. No innovations were developed from the research; however, recommendations were intended for uptake to form the foundation for future work on the issue (Prac4). Informants suggest that a number of the recommendations have been implemented and integrated by the WASH

community, but it is uncertain to what extent this was a direct contribution of the SNDP as the WASH sector was previously working on a number of the issues highlighted by the project.

Owing to the PI's previous work in the sector, there remains some overlap between the SNDP and the PI's other work leading to confusion between project outputs and contributions. As previously mentioned, some informants suggest that the SNDP provided more of a context summary rather than produced solutions, and informants were unsure of what benefit this has had on the Niger Delta WASH sector (Prac11). There was scope for further contribution to knowledge in terms of exploring elements in greater depth, which is noted to have been a missed opportunity for contribution to wider academic knowledge (Prac11). It is also suggested by some informants that the research questions were too broad to have led to any significant changes in KASR as the SNDP summarized what was commonly known in the sector (Prac11). While the targeted recommendations were deemed to be useful, practical, and accessible to influence practitioners' agendas, and there is a demand for information and direction to address WASH issues from practitioners, reliance on the PI's sphere of influence to spread awareness of the research amongst the wider WASH sector did not work as expected. There was also scope for more intentional capacity-building of the enumerators and other system actors as part of the SNDP's research activities.

Overall, the SNDP contributed to the capacity-building of the PI and expanded their knowledge base to support their continued work on the topic within the Niger Delta and beyond. The SNDP also triggered some practitioners working in the sector to focus on appropriate technology solutions for the context, with some recommendations having been implemented on a regional scale. However, it is unclear from the evidence to what extent the SNDP had a direct contribution to this as a number of other interventions are also underway. Although the SNDP planned for the SNDP knowledge to be used within the ATED Demonstration Centre, this does not appear to be widely known. Exploring some elements in greater depth would have contributed to wider academic knowledge, and more targeted research questions would have supported further changes in KASR (Prac11). Lastly, more targeted dissemination and engagement would have supported outcomes in both the *WASH sector and community development* and *government policy and practice* pathways.

To what extent and how did the project engage effectively with relevant stakeholders?

Informants believed that the SNDP "*honoured relevant stakeholders*" (Res1), such as communities, local WASH practitioners, NGOs, CBOs, and local and subnational government actors, by including them in the project as participants. Moreover, the project's engagement supported the PI's capacity-building as well as some participants within PIND and the PI's direct sphere of influence (Prac8, Prac9). The SNDP's stakeholder engagement is characterized by three stages: engagement during the project, end-of-project engagement, and post-project engagement.

Engagement During the Project

The SNDP planned and implemented various engagement activities during the project to engage relevant actors within the Niger Delta WASH sector. Most mid-project engagement activities were used for the purpose of data collection. For example, two-hundred and fifty-seven households were surveyed from two riverine communities, and twenty-one interviews were completed with practitioners with non-governmental organizations, civil society, or government, as well as some community members. The SNDP ensured that gender and different age groups were well represented, using a staggered random sampling method to limit bias and ensure the representativeness of the sample. Semi-structured interviews allowed for a professional conversation between the PI and the interviewee (Doc3). Participants were asked about their observations and experiences working in riverine communities (Doc3). As the ATED program developed, the PI hosted a WhatsApp group for practitioners working in the Niger Delta's WASH sector to share experiences and knowledge (Doc3). The PI made the WhatsApp group aware that the research was taking place and used the group as a data collection tool by asking questions to the group. The PI indicated that responses to questions shared within the group would be used anonymously to inform the SNDP. The PI also engaged with, participated in, and observed the WhatsApp group to gain further understanding of issues, corroborate data and evidence collected from other sources, and improve questions asked in the qualitative element of the SNDP (Doc3). A critical reference group was engaged during

the project, which consisted of the PI's professional colleagues with whom issues and interpretations of data were discussed; however, the extent of this relationship is unclear from the evaluation evidence. The PI engaged local community members, PIND, government and political players, government consultants, WASH practitioners, corporate players, NGOs, and CBOs to uncover appropriate answers and solutions for local people through interviews, participant observation, and the WhatsApp group (Prac1, Res1). This allowed for a cross-section of practitioners working in the sector with differing perspectives on interventions and the realities of practice in the field (Doc3). However, it is possible that some key players of the sanitation value chain, including waste disposers were not engaged by the SNDP, which would have been beneficial to the end-of-project and longer-term outcomes (Prac9). It was also a challenge to engage and involve government actors in the project because of the instability of local and national government (Res3). The PI also used observation as a data collection tool which was employed when engaging at the community level to witness local sanitation challenges first-hand (Prac9). Relationships outside of academia (including those with PIND) were vital for the success of the SNDP and knowledge dissemination; according to one researcher, the PI understood and handled these engagements well (Res3). Although the likelihood for the SNDP to explicitly contribute to change was questioned by some informants (Prac3), others felt that engaging local communities allowed the project to build knowledge and changes in attitudes (Res1, Res3). Informants highlighted that the SNDP's engagement was culturally sensitive and enumerators were trained on how to effectively interact with participants and record survey answers (Doc2, Res3); though, again, the extent of engagement beyond this training could not be corroborated with other evidence. Informants described the PI as a good listener, open to communication during the research process, and had the appropriate networks to support successful data collection (Prac1). The PI kept in touch with participants during the research process and provided feedback on the progress of the research, shared copies of the draft report, and asked participants for their input which made participants feel like their views were considered (Prac9).

End-of-project Engagement

The SNDP's end-of-project engagement was predominantly for dissemination purposes. As the project was undertaken throughout the PI's period of work at the PIND ATED Demonstration Centre, this was a useful avenue to share SNDP findings, such as through the PIND website, exhibits at the ATED Demonstration Centre, training programs, workshop presentations, conferences, and meetings with partners (Doc3). Evidence indicates that these dissemination engagement strategies were planned, but whether or not the extent to which these were implemented could not be confirmed. Informants questioned how widely SNDP findings were disseminated (Prac1, Prac5, Prac11). For example, some informants explained that they did not receive a summary of the research that could then be shared more broadly within their networks (Prac11). Informants identified the need for the results and recommendations to be more widely distributed and disseminated within the sector (e.g., multiple online dissemination platforms) so that government, NGOs, and other system actors outside SNDP participants could access and use the findings and recommendations (Prac5). Moreover, one informant noted that the research findings were shared back to the communities as part of the end-of-project engagement (Res3), but there is no evidence detailing how this was completed or to corroborate the claim. Finally, the PI's departure from the SNDP's partnering organization, PIND, at the end of the project has meant that project influence diminished once direct engagement by the PI stopped, especially as PIND is now loosely associated with WASH (Prac11). If PIND were an organization that was more strongly associated with WASH and continued to work on the topic, the SNDP's invested engagement in the organization would have likely had a greater influence (Prac11). As previously stated, the SNDP is not a collaborative piece of work and evidence indicates an extractive relationship in terms of collecting data from communities. There was scope for the project to be more collaborative through the PI's established professional connections at PIND and with other WASH practitioners to contribute to the dissemination and use of findings beyond the end of project.

Post-project Engagement

The PI has continued to engage with relevant WASH stakeholders post-project through TI, which works with a network of centres around the world, including PIND (Doc6, Prac1, Prac11). Informants suggested that the PI successfully transferred knowledge into action in the form of TI by bringing practitioners and non-profit

organizations together to continue to focus on sanitation issues (Prac2). Through TI, the PI engages with university students in the United States to develop low-cost durable toilet solutions suitable to the Niger Delta but focusing on different communities to those included within the SNDP (Doc2). The PI's consulting work has allowed them to continue their community engagement approach post-project by sharing and applying their knowledge. However, it is noted that this is not a sole contribution of the SNDP, as the PI worked in community engagement prior to the project (Res3). As the PI continues their work in the field, the SNDP and its findings remain accessible to its target audiences (Res3).

To what extent were the findings sufficiently relevant to achieve the stated objectives?

The stated objective of the SNDP was to “learn from the experiences of government, communities, individuals, and practitioners, to provide an understanding of issues, options, levels of knowledge, attitudes and cultural issues, failures and successes, in order to make recommendations as to how to proceed effectively” (Doc3, p.18). This objective was realized by the SNDP. The project effectively elicited learning from the experiences of relevant system actors to better understand the current context of WASH in the Niger Delta and developed tailored recommendations for future work on the topic.

As indicated in the QAF assessment, the SNDP addressed a socially relevant research problem by both situating the project within MDG 7 and identifying academic and practical gaps. In general, the academic focus on sanitation issues and WASH practices across Nigeria is weak (Prac8). Impressions of the research findings' relevance are inferred from informant comments regarding the PI's extensive knowledge of the context and the PI's professional networks and connections. The experience and groundwork laid prior to the SNDP supported the PI to undertake research in a taboo and sensitive topical area. Moreover, the PI's approach to ethical community-based engagement enabled the PI to generate relevant findings and outputs. For example, the PI was careful politically and had humility about what they learned (Res1). By involving the experiences of government, communities, individuals, and practitioners in the SNDP, the PI explored the WASH system as a whole (Prac1). This allowed the PI to do “*the right thing at the right time*” (Prac4) to support the relevance of the findings to achieve the stated objective. The practicality of the research design and implementation was also vital to the success of the project in order to inform how best to make changes from the experiences of relevant systems actors (Prac1). The PI's open-book nature ensured that practitioners were receptive to working with the PI, which increased the relevance of project design and implementation and ultimately the findings as a result (Prac1, Prac9). One practitioner described the SNDP findings as a “*compendium of considerations*” (Prac7) to be implemented within a successful WASH program (Prac7). The informant felt that the findings are a helpful and useful resource that WASH practitioners can read and on which they can reflect. Moreover, the informant was impressed at how broad and complete the report is as a checklist (Prac7). However, other practitioners suggested that the SNDP only provided a context summary and did not contribute to any solutions in how to proceed effectively in the topic (Prac11). The informant attributed this to the broadness of the research questions, as the results present “*snapshot of what was already known in the Niger Delta WASH sector*” (Prac11). The report was written with a generic audience in mind rather than focusing solely on the academic audience to ensure the project was accessible to relevant system actors (Res1).

To what extent and how are target audiences aware of and using the project outputs?

Key content outputs of the SNDP include: the recommendations; knowledge of appropriate solutions; knowledge of the geographical, cultural, and political contexts; and appropriate behavioural change frameworks. All but two interview informants were aware of the SNDP, with six of the fourteen interview informants stating that they were aware of the SNDP but did not have an in-depth understanding of the project's activities or its outputs. This indicates a low level of awareness among target audiences. Approximately half of survey respondents stated that they did not know about the research despite the strategies used to disseminate SNDP findings (i.e., sharing in the WhatsApp group). There is uncertainty regarding how widely disseminated the SNDP findings were, with one informant suggesting that if they had not known the PI, they would not be aware of the research (Prac5).

What do you know about the PI's research on improving sanitation in the Niger Delta?

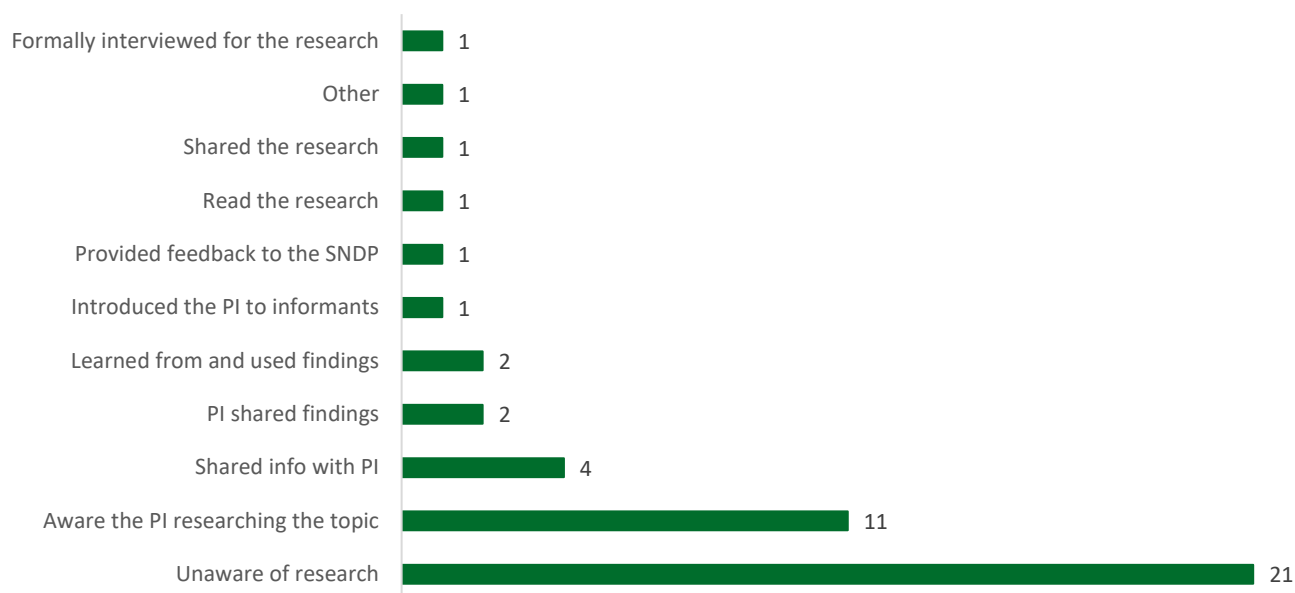


Figure 10. Survey respondents' familiarity with the SNDP and its outputs

Evidence suggests that SNDP outputs were shared with target audiences via the completed dissertation, a summary article developed for the PI's presentation at the 2017 WEDEC International Conference, and a magazine article. There is limited evidence that awareness of SNDP and its outputs spread through these networks to people not directly engaged in the project – the majority of those who were aware of the project were either involved in the process or had worked with the PI. For example, one informant was familiar with the SNDP findings because the PI had shared their dissertation with colleagues in a meeting (Prac1). Specific outputs of the project were not discussed in detail by the informants, who suggested that the report was not widely read and only a small number of presentations were completed (Prac6). One practitioner described the main contribution of the SNDP to be a contextual overview, but the PI did not create a summary output that could be shared more widely with the sector (e.g., a PowerPoint presentation) (Prac11). The PI explained that findings were not shared in a dissemination workshop with participants, as those that participated in the SNDP were not a cohesive group and the geographical context made it difficult to travel (personal communication). However, when the PI shared their findings at the WEDEC conference, they noted there was interest in the research which led to some collaborations to seek funding (personal communication). Informants acknowledged that the SNDP is a useful study and the more widely disseminated it is within the sector the better (Prac9).

Academic Uses

Contributing to the academic knowledge base on the topic was not an objective of the SNDP which instead focused on the practical uptake of the outputs and findings by practitioners. As a result, a *research* pathway was not identified within the SNDP ToC. While the dissertation is available on RRU's research database (i.e., open source), the project has not been cited to date and does not appear to have been used by other researchers.

Use of Outputs

Survey respondents were asked: "To what extent do you agree with the following statement: '[The PI's] research has influenced or contributed to my work on WASH'" (Figure 11). Out of the forty-two respondents, over half were either neutral (11), preferred to not answer (7), or provided no response (10). Six respondents disagreed with the statement. Only seven respondents indicated that the PI's research had influenced their work. In a follow-up question, survey respondents noted that the SNDP provided them with a better understanding of WASH issues

and the SNDP has led to other research on ecological sanitation and reuse of resources (e.g., plastics for toilet structures). Two respondents stated that they are using the SNDP findings in their work as WASH practitioners, including using the project as a case study. However, no further specificity is given, and it is unclear from the evidence to what extent the SNDP report or its associated outputs have been used by practitioners in the Niger Delta or similar contexts.



Figure 11. Survey responses to the question: ‘The PI’s research has influenced or contributed to my work on WASH’

How does Royal Roads support student success in research?

RRU and the DSocSci program played a key role in supporting the success of the SNDP and the PI. For example, RRU fosters a culture of research for impact, with a conviction that research does not remain on a shelf following its completion (Doc4). The DSocSci program was developed for working professionals who can draw on their practitioner experience in their doctoral work to create change-making research, ensuring the research is applicable to their role as a professional (Res1). The doctorate program supported the PI to complete research that was relevant to their role as a WASH practitioner and fit the PI’s aspirations (Doc6). One practitioner described the PI embodiment of the RRU culture of turning knowledge into action through the SNDP (Prac2). RRU’s DSocSci is a blended program which admits students from diverse backgrounds and careers, balancing online coursework with an annual three weeks residency on campus (Doc6). For the PI, this blended structure enabled them to continue their practitioner work in the Niger Delta while undertaking their studies at RRU, including the flexibility to travel back and forth (personal communication). The PI felt the nature of the doctoral program at RRU was broad enough to allow flexibility to do the research that they really wanted to do (personal communication). The program structure for distance-learning worked well with the PI’s schedule while allowing the PI to build relationships within the cohort during residency with colleagues from a range of backgrounds, ages, and ideas (personal communication). In one instance, the fostered networks and relationships developed led to a new professional relationship with a fellow DSocSci student when TI was established (Prac2, Res3, Res4). Being an interdisciplinary program, the DSocSci offers flexibility academically to explore beyond disciplinary boundaries, giving it a reputation for being innovative and progressive. This was a key deciding factor for the PI to apply to the doctoral program at RRU (personal communication). The interdisciplinary environment supported the SNDP to implement change, as DSocSci students are encouraged to blend the corporate and community

setting with the academic realm (i.e., something that is not as encouraged at traditional universities) (Res1). The RRU Learning, Teaching and Research Model is focused on applied research which allows students to focus their research at the societal level rather than narrowing their focus to the molecular level. According to one researcher, this applied focus is the foundational ethos of the program (Res3).

One way in which RRU ensures doctoral research is change-driven is by teaching ToC concepts in the methodology course. This ensures that students are conscious of change and the importance of documenting it. Although the PI did not have an explicit ToC, informants indicated that the PI documented their implicit ToC well (Res1). The DSocSci course provides students with the flexibility to guide themselves through the process, as their expert knowledge within their own professional fields enables students at RRU to have more collegial relationships with their professors. The program also encourages students to get their research out into the world and ensure that findings are accessible to, understandable, and can be used by their target audiences (e.g., avoiding academic jargon). Students learn to write with the audience in mind (Res1).

What lessons about effective research practice can be learned from this case study?

Interview informants discussed the importance of research; for example, effective research contributes to the refinement of solutions, ensures solutions are adapted to the context of the locality, and provides solutions that are practical for and used within that locality (Prac8, Prac10). Informants believed that effective research should begin with a thorough needs assessment and address a specific challenge to solve real-world problems, rather than research that “*targets low-hanging fruit*” (Prac6, Prac9, Res1). Effective research should engage system actors who have the means to solve the identified problem as well as work with the actors who will benefit from the solution to the problem (Res3). In order to support change within an actor group, research questions should be co-created and knowledge should be co-developed to ensure that the research is guided by the target audience (Prac11, Res3). The co-development of research questions could have been implemented in the SNDP to ensure that the project produced findings and solutions that were relevant for and could be directly used by system actors. Effective research needs to generate and present practical solutions in ways that practitioners can easily understand and use; recommendations and solutions need to be user-focused, and their applications should directly benefit communities or society as a whole (Prac7, Res2, Res3). One informant suggested that effective research provides a baseline; for example, to establish what is currently known on the topic and what gaps exist for exploration (Prac3). Providing this baseline for future research is one goal that the SNDP accomplished. Effective research must also provide recommendations that can be applied into the context, as demonstrated by the SNDP (Prac3). One practitioner advised that research should be planned with an end-goal to ensure there is a clear understanding of what can be expected from outcomes between the researcher, partners, participants, and other system actors, for example through the use of a ToC (Prac8).

Project Lessons

The SNDP supported the realization of outcomes across multiple pathways by using mechanisms such as filling knowledge gaps, leveraging reputations, building capacities, and strengthening and creating coalitions to support positive changes for the PI and practitioners involved in the research process. Outcomes were also realized in part owing to the PI’s existing knowledge and experience in the sector, the PI’s established networks, and the transdisciplinary nature of the project which enabled elements of the SNDP’s process and outputs to be relevant, credible, legitimate, and effective. These characteristics ensured that relevant system actors were involved in the project, which provided them with an opportunity to reflect critically on pressing issues and possible solutions. Yet, had the SNDP planned further dissemination and engagement with actors not directly involved in the research, it is likely that the project would have had greater reach and influence in the wider sector and expanded the PI’s sphere of influence. Other research projects could benefit from the lessons gained from the SNDP on how to conduct research in the challenging context of the Niger Delta, the benefits of leveraging networks, and the benefits of conducting transdisciplinary research.

- **Leveraging the PI’s professional networks and social capital were effective strategies to collect data and to ensure knowledge-to-practice through dissemination.** When completing research that aims to

influence a sector, strategic partnerships with individuals and organizations working within the sector can support the collection of data and the dissemination of knowledge through professional relationships. Strategic partnerships can also ensure continued work on the topic by highlighting gaps, issues, and opportunities through processes of reflection. The PI's competencies and in-depth understanding of the sector played a crucial role in supporting significant changes through the SNDP. However, not all researchers will have the same level of in-depth knowledge and experience of the context prior to a project as the PI had with the SNDP. If researchers lack this knowledge, strategic partnerships with actors who have these qualities can help ensure the relevance of the research and extend a project's influence with respective system.

- **A transdisciplinary approach supported the blending of the corporate, community, and practitioner worlds to ensure the usefulness of SNDP recommendations.** The transdisciplinary approach of the SNDP allowed the PI to engage with all necessary system actors outside of the academic realm to build networks, and disseminate knowledge. Genuine involvement of relevant actors in the research process (e.g., co-generation) can ensure diverse perspectives are reflected and increase the relevance and utility of the research questions, activities, and ultimately the findings. Transdisciplinary styles of engagement can support more effective transfer of knowledge-into-practice and stimulates practitioners to explore findings and build upon the research by building trust and capacities. However, the selection of disciplines and how they are integrated within the project should be discussed, a shortfall of the SNDP, including paradoxes or conflicts to ensure academic rigour and trust in research findings and recommendations.
- **To further support outcome realization through research design and implementation, a discussion of project limitations is needed within the SNDP, and data collected should be fully leveraged (e.g., drawing correlations between qualitative and quantitative data).** The research project assessment using the QAF revealed that theoretically, the appropriate project methodology is needed to support the transfer of findings to inform or design solutions to the research problem. Completing a thorough review of existing research on the topic is paramount to ensure that the project is situated within the appropriate problem context, fills a knowledge gap, and guarantees that the recommendations created will be useful and used. If the SNDP had further leveraged the data to draw correlations between qualitative and quantitative data results would have strengthened the argument and demonstrated syntheses of results. Logically connecting the recommendations to the results with a discussion of alternative explanations would have improved the rigour and trustworthiness of SNDP recommendations for uptake and use on a wide scale. Meaningfully discussing limitations, including the implications for results, personal biases, research positionality, and accounting for limitations on an ongoing basis throughout the projects can influence the uptake of findings and recommendations.
- **Establishing respectful and positive relationships increased trust in the PI, the research project, and the outputs.** The SNDP established respectful and positive relationships with interview participants through their shared mutual interest in the subject matter. The care taken during project engagement with communities ensured participating households had a clear understanding of the research objectives and the expectations of their participation. The PI's cultivation of trust through relationship-building led to cooperation and collective action with WASH practitioners involved in the research to explore the topic in more detail. These collaborations were mutually beneficial and contributed to changes in WASH sector actors and WASH organizations by raising the awareness and importance of a focus on appropriate sanitation technologies for the Niger Delta (Bhandari & Yasunobu, 2009). Stakeholder engagement guaranteed that the recommendations were both relevant and useful to those working within the Niger Delta WASH sector which supported their implementation.
- **Further intentional collaboration and knowledge dissemination with system actors and organizations not directly involved in the SNDP would support the implementation of recommendations within the sector.** Evidence indicates an extractive relationship, with the SNDP collecting data from communities with little follow-up. Although enumerators received training, their

capacity is not considered within SNDP documentation or as an outcome of the project. More intentional capacity-building of actors within the system would support the implementation of recommendations within the sector by highlighting gaps, knowledge sharing, and providing actors with the skills to continue work on the topic. Further targeted knowledge dissemination outside of those directly involved in the SNDP would have been beneficial and likely would have supported further progress on sanitation issues in the Niger Delta. Relying on previously established professional networks and partnering organizations as the main dissemination targets limited the reach and influence of the SNDP. Moreover, this strategy is dependent upon organizations remaining engaged on the topic, which was not the case for PIND, the main partner organization. Further identification of boundary partners would have supported outcomes related to the sufficient engagement with the problem context.

Contextual Lessons

The SNDP was well-situated within the problem context owing to the PI's extensive experience in WASH and the Niger Delta. This factor played a key role in the accomplishments of the project and limited the effects of contextual barriers present in the Niger Delta. The project engaged the following contexts by:

- *WASH sector context:* As a result of the PI's knowledge and experience of having worked specifically in the Niger Delta WASH sector, the PI was familiar with the cultural dynamics and other actors active in the region. Yet, the PI did not fully leverage this knowledge in the SNDP to build alignment or collaborations with other projects underway led by USAID and UNICEF. By collaborating with other projects currently underway in the sector, the PI could have situated the research more appropriately in the context and identified gaps to ensure the recommendations could be used by USAID and UNICEF.
 - *Difficulty in influencing cultural norms:* Difficulties in influencing cultural norms, particularly around a taboo topic such as sanitation in the Niger Delta, can be addressed by understanding the taboos and creating a conversation to engage a cross-section of actors within the context, from communities on-the-ground to experts in the field to government policy-makers. Through conversation on the practices, concerns, issues and options in sanitation, there is a greater likelihood that the topic will be placed on decision makers' agendas (Black & Fawcett, 2008). Being aware of and adopting appropriate behaviour change frameworks through a transdisciplinary method can support the increased conversation to lead to a change in cultural norms.
- *Political context:* The PI was also familiar with political actors working within the Niger Delta WASH sector. This helped the SNDP to engage with representatives from RUWASSA and LGA for interviews. However, the project overlooked the value of investigating the regulatory context of WASH in Nigeria and the Niger Delta, as an in-depth review of current policies and political practices could have provided useful insights for the recommendations.
 - For change to happen in the Niger Delta WASH sector, support and buy-in is needed from multiple levels of government who each face a multitude of barriers, needs and resource limitations (e.g., lack of funding, communication challenges in remote areas etc.). Projects working in the Niger Delta WASH context should consider these aspects to find solutions to address some of these systemic barriers that affect WASH governance. Building connections with and leveraging government informants who can champion the research and solutions are effective ways to foster political will, but difficult without an insider perspective at the national level. Aligning the research with existing political efforts on WASH in Nigeria may have enabled greater use of the SNDP recommendations by government actors.

Evaluation Lessons

The following evaluation lessons and limitations should be considered with regards to the Outcome Evaluation approach, data, and results.

Limitations of the analytical framework: Retrospective documentation of a ToC can make the distinction between intended and unintended outcomes unclear. In the case of the SNDP, some outcomes that were identified during the ToC workshop were not expected at project inception (e.g., *knowledge network of scholars and practitioners share development knowledge and facilitate knowledge-to-practice transformation (TI)*). In addition, having the PI identify informants to test the outcomes can also increase the risk of introducing bias into data collection as informants may be selected for their likelihood to reflect positively on the project's results and outcomes. To address this limitation, snowballing for additional perspectives and sources of information was undertaken. A survey of the WhatsApp group was also completed to gather data more widely than the PI's direct sphere of influence, which helped to reduce bias.

Limitations of the data and results: Assessments using the Outcome Evaluation approach rely on informant perspectives. Interviews were conducted a few years after the project concluded, making recall of project details and processes difficult for informants. There was also some confusion in separating outcomes related to the SNDP from the PI's extensive work in the sector prior to and following the completion of the SNDP. This led to several outcomes being identified with unclear project contribution. However, it was observed that those closest to and more involved the project could recall more details of the project and its contributions. These individuals also perceived the project's influence to be higher than those more distant from the project. Despite efforts to reach government officials, community members, and trainers (i.e., DEWT), these informants were not accessed. As a result, many of the outcomes in the *government policy and practice* pathway relied upon perceptions from other system actor groups which could not be triangulated or verified.

Recommendations

The SNDP demonstrated some characteristics of an effective transdisciplinary project by focusing on a socially relevant research problem, effectively engaging with the problem context, ensuring adequate competencies were reflected in the research team, adhering to ethical standards of research conduct, and contributing to a significant outcome. These elements of project design and implementation contributed to positive outcomes across multiple pathways in the project's ToC. The project incorporated many elements of transdisciplinary research into its design and implementation, which leveraged diverse mechanisms to support outcome realization. These results align with Belcher et al.'s (2019) findings on the connection between transdisciplinary characteristics and the leveraging of mechanisms. There were also elements of the project that could be strengthened. The evaluation concludes with the following recommendations for future research, which can apply to other RRU graduate student research projects or research more broadly.

1. **Use a ToC to plan and monitor progress.** This includes developing explicit, realistic, and logical assumptions and theories about how and why a research project is expected to contribute to a change process. Developing a ToC and its underlying theories and assumptions at project inception can help to target project activities, as well as leverage opportunities that arise throughout the research process. Deliberately planning for outcomes would have supported the SNDP to identify opportunities for further engagement and dissemination that was needed in order to reach target audiences outside of the SNDP's participants. Developing a ToC at project inception can also help to identify the possible benefits of the project to participants and intended users, supporting the project to think more critically about engagement.
2. **Develop a research question and objectives that aid the structure and purpose of the research project.** Involving system actors in the development of the research questions and objectives can increase the relevance and appropriateness of the project. Objectives should be specific in terms of what knowledge is needed and how the project will produce that knowledge, and should not be presented as a statement of interest. More cohesive research questions and objectives support more effective research design and implementation to realize outcomes. Effective research should begin with a thorough needs assessment to address a specific challenge and solve real-world problems. To support change in an actor group, research

questions should be co-created and likewise knowledge should be co-developed to ensure that research is guided by the needs of target audiences.

3. **Fully leverage data collected to strengthen the argument and support the robustness of the research.** The mixed-methods approach used by the SNDP fit the exploratory nature of the research; however, the project does not fully leverage the data collected. For example, the dissertation does not correlate the quantitative and qualitative data it collected, which limited the strength of the analyses and overlooked aspects that could have been synthesized and discussed; for example, the connection between respondents' demographics and their beliefs on sanitation practices in the Niger Delta could have shed further light on socio-cultural and socio-economic barriers that need to be addressed.
4. **Partner strategically to leverage social networks and optimize opportunities for mutual learning, dissemination, and outreach.** The SNDP was not a collaborative piece of work, and evidence indicates the project was extractive in terms its data collection. Had the project been more collaborative in terms of the co-creation of research questions, objectives, and follow-up, the SNDP could have supported further progress on outcomes and had greater reach beyond participants directly involved in the SNDP. Recognizing the opportunity to benefit participants in the research process would have more directly contributed to the capacity-building of system actors. Leveraging social networks and strategic partnerships are effective ways to access data and contribute to organizational change through dissemination and outreach. Effective research should engage system actors who have the means to solve the identified problem as well as work with the actors who will benefit from the solution to the problem. Dissemination should be planned and implemented throughout and beyond obtaining results. Moreover, follow-up with project participants, partners, and target audiences past data collection is an important strategy to maximize the influence of a project.

Appendix 1. Invitation to Participate in Interview

Dear Participant,

I am writing to you with regards to my doctoral research, “Improving Sanitation in the Niger Delta”, that I completed in 2017. My research was selected as a case study for a Royal Roads University research project focusing on the contribution of the University’s graduate student research projects to change processes.

Given your participation within my research and your insight into sanitation in the Niger Delta, the Sustainability Research Effectiveness team based at Royal Roads University would like to invite you to take part in their study as an informant who can share their experience and perceptions about my research and its contributions. More information on the study can be found in the attached invitation letter.

However, as I guaranteed your anonymity in my own research project, I would like to ask if you are interested and willing to extend your anonymity contract to include the Sustainability Research Effectiveness team. With your consent to participate in the study, I will forward your contact information to the Sustainability Research Effectiveness team so they can liaise with you directly to arrange an interview. Participation is voluntary; you do not have to participate if you do not wish. If you do not wish to participate, none of your information will be shared with the Sustainability Research Effectiveness team. Further information regarding Royal Roads University’s ethical guidelines can be found in the attached invitation form, which also includes a consent form.

Contact information for the Sustainability Research Effectiveness team is also available in the attached invitation letter should you wish to contact them directly to answer any questions regarding this research or would like additional information to assist you in reaching a decision about your participation. These questions can also be directed to me should you wish to remain anonymous before you reach a decision.

Please respond to let me know if you would be interested and willing to participate, or to raise any questions or concerns that you may have.

Yours sincerely,
Principal Investigator

Appendix 2. Evidence Sources

Code	Class	Author(s)	Reference	Date
Doc1	Presentation speaking notes	Gilbert	Unpublished speaking notes	2017
Doc2	Peer-reviewed article	Gilbert & King	Gilbert, N., & King, L. (2017). Improving sanitation in the Niger Delta. Local Action with International Cooperation to Improve and Sustain Water, Sanitation and Hygiene (WASH) Services: Proceedings of the 40th WEDC International Conference. Paper 2626. 24-28 July, 2017. Loughborough, United Kingdom.	2017
Doc3	Dissertation	Gilbert	Gilbert, N. (2017). Improved Sanitation in the Niger Delta. (Doctoral Dissertation). Retrieved from https://viurrspace.ca/bitstream/handle/10613/4896/Gilbert_royalroadsdoc_1313E_10032.pdf	2017
Doc4	News article	RRU	RRU. (2018). Research into action. Retrieved from https://research.royalroads.ca/sites/default/files/Research%20in%20Action%202018_0.pdf	2018
Doc5	Presentation speaking notes	Gilbert	Unpublished speaking notes	2017
Doc6	News article	RRU	WestJet magazine. (2018). Victoria Scholar Has a Global Vision for Health. Retrieved from https://www.westjetmagazine.com/story/article/victoria-scholar-global-vision-health	2018
Doc7	Policy document	Federal Ministry of Water Resources, Nigeria	Federal Ministry of Water Resources. (2018). National Action Plan for the Revitalization of Nigeria's WASH sector. Retrieved from https://waterresources.gov.ng/policy-documents/	2018
Prac1	Interview	Practitioner informant	Unpublished case study interview transcript	2019
Prac2	Interview	Practitioner informant	Unpublished case study interview transcript	2019
Prac3	Interview	Practitioner informant	Unpublished case study interview transcript	2019
Prac4	Interview	Practitioner informant	Unpublished case study interview transcript	2019
Prac5	Interview	Practitioner informant	Unpublished case study interview transcript	2019
Prac6	Interview	Practitioner informant	Unpublished case study interview transcript	2019
Prac7	Interview	Practitioner informant	Unpublished case study interview transcript	2019
Prac8	Interview	Practitioner informant	Unpublished case study interview transcript	2019
Prac9	Interview	Practitioner informant	Unpublished case study interview transcript	2019
Prac10	Interview	Practitioner informant	Unpublished case study interview transcript	2019
Prac11	Interview	Practitioner informant	Unpublished case study interview transcript	2019
Res1	Interview	Researcher informant	Unpublished case study interview transcript	2019
Res2	Interview	Researcher informant	Unpublished case study interview transcript	2019
Res3	Interview	Researcher informant	Unpublished case study interview transcript	2019
Res4	Interview	Researcher informant	Unpublished case study interview transcript	2019
Survey	Survey	WhatsApp survey participants	Unpublished survey administered to WASH sector WhatsApp group	2019
Vid1	Video	National Geographic	National Geographic (2019). Clean Water. Retrieved from https://www.nationalgeographic.com/activate/clean-water/	2019

Appendix 3. Semi-structured Interview Guide

A) General questions about the respondent, their expertise on the topic, & recent/significant changes in topic (purpose to build rapport & clarify the context)

Main Question	Probes	Intent: What we are trying to find out Do NOT ask these directly.
1. What is your role within [organization]?	<ul style="list-style-type: none"> How is your work related to WASH? How long have you been doing this kind of work? 	<i>Understanding the respondent's job/organization and the relevance of the topic to their work.</i>
2. What role does [organization] play in WASH?	<ul style="list-style-type: none"> How long has your organization been involved in work related to WASH? 	Finding out the expertise of the respondent and their professional connection to the topic, as well as their influence on the topic of focus.
3. What are the main challenges related to WASH in the Niger Delta?	<ul style="list-style-type: none"> What is the reasoning for these challenges? 	<i>Personal expertise & perceptions on the topic of focus.</i> Interviewee's knowledge level, understanding, and perceptions on the problems & issues relevant to the focus of the project – what do they think the problems are and how they frame the problems. QAF: Rel1, Rel2, Rel3, Rel5
4. What have been the most important developments related to WASH in the Niger Delta in the last five years?	<ul style="list-style-type: none"> In the discussions, events, ideas, institutions, policy, and/or practice?³ What are the implications of these developments? Why do you think these are important? 	<i>Understanding people's perceptions of the situation and identifying possible changes in policy & practice.</i> Getting an idea of the way in which the issues in question are perceived by interviewees, and get a range of various perspectives/understandings of the developments, causalities & people's values in relation to issues. QAF: Rel1, Rel2, Rel3
5. Who are the key players in the discussion, policy, or practice of WASH in the Niger Delta?	<ul style="list-style-type: none"> What role do government/academic/NGO /international/ private sector/communities play?⁴ In what ways have they (each) been influential? 	<i>Understanding people's perceptions of who is who in changing policy & practice.</i> Getting an overview of who people consider as key actors in the process. This question will also provide insights about the power dynamics between the stakeholders (e.g., who has power over whom). QAF: Rel1, Rel3
6. What information/knowledge has been the most influential in related to WASH [in the Niger Delta]?	<ul style="list-style-type: none"> Who is promoting the information/knowledge or event in question? In your opinion, has the information [what they mentioned] influenced policy and practice? How? Probe for examples. 	<i>Understanding what kind of knowledge is used in decision-making in general.</i> Getting a better picture of what kind of knowledge & other factors are influencing WASH, and from where the ideas are coming. More detailed information about possible changes in policy & practice because of new information/scientific knowledge. QAF: Rel1, Rel2, Rel3

³ All terminology should be adjusted & verbally explained so it is appropriate to each interviewee (please record any adaptations in the post-interview notes).

⁴ It is not necessary to ask all questions to every informant – the list merely illustrates what kind of information we are trying to find out.

B) Understanding links between knowledge sharing & decision-making processes (purpose to assess important sources of influence on policy & practice)

Main Question	Probes	Intent: What we are trying to find out Do NOT ask these directly.
7. When doing work related to WASH, where do you (or your organization) get the information you need to do your work?	<ul style="list-style-type: none"> What kinds of information? How does that information help guide decisions around what your organization does? 	<p><i>Understanding what kind of knowledge is used in decision-making in general.</i></p> <p>Getting a better picture of what kind of information is seen as important and/or used in decision-making (scientific or non-scientific). QAF: Rel7, Eff2</p>
8. Do you use scientific information in your work in relation to WASH?	<ul style="list-style-type: none"> How has it influenced or contributed to your work? Where did you get that information? (Any specific events, publication, meetings, etc.) What are the main barriers to using scientific information? 	<p><i>Understanding what the role of science is in decision-making.</i></p> <p>Getting a better picture of the ways in which scientific knowledge is used by organisations, how they get the science they use, and what prevents them from basing their decision-making on scientific research findings. QAF: Rel7, Eff2, Eff3</p>
9. Which factors are influence your (personal and/or organization) decision-making around issues related to WASH?	<ul style="list-style-type: none"> Political factors Individual or organizational advocates Scientific information/ research Public opinion Precedent in other jurisdictions Global pressures/ influences Are there any additional factors? 	<p><i>Understanding what other aspects influence decision-making.</i></p> <p>Understanding how people see decision-making situations, which aspects matter most in making changes in policy & practice, and how research findings matter in relation to other factors.</p>

C) Determine respondent's awareness of and/or involvement in the principal investigator's project

Main Question	Probes	Intent: What we are trying to find out Do NOT ask these directly.
<p>10. Have you heard about [the principal investigator]'s research on WASH in the Niger Delta?</p> <p>*if they do not recognize the PI's name, prompt with details about the project</p>	<p>[to non-partners]</p> <ul style="list-style-type: none"> What do you know about the research project? How did you hear about it? How would you describe your interactions with the project or the principal investigator? (e.g., presentations, workshops, etc.) <p>[to partners]</p> <ul style="list-style-type: none"> How did you get involved in the project? What was your role in the project? What was your contribution to the project? (e.g., meetings, provide information, connect people, make recommendations, etc.) Do you think that your input was taken into account? 	<p><i>Understanding awareness, role, & length of engagement with relevant actors and/or project partners.</i></p> <p>Finding out informant's awareness & opinions about the project. Finding out to what extent the degree & length of engagement in the project may be associated with changes in policy & practice. QAF: Rel3, Rel7, Cre7, Cre8, Leg1, Leg2, Leg3, Leg4, Eff2</p>

<i>[Ask 11 ONLY to participants & those who said they know the principal investigator and the project]</i>		
11. How would you describe your participation/collaboration experience in the project?	<ul style="list-style-type: none"> How would you characterize your opportunity to participate and engage in the research? (i.e., rigid/ restricted by student, open/facilitated by the PI/ participatory) Do you have any suggestions regarding how engagement/participation could have been made more meaningful for you? Do you think any key stakeholders were excluded from the research? Any examples of positive experiences/what was done well? Any promising practices? How could the participation/collaboration work even better in the future? 	<p><i>Understanding personal experience and feedback.</i></p> <p>Further details of the influence of the project on the personal level, possible additional aspects (re: knowledge translation). Potential for improvement. QAF: Leg2, Leg3</p>

D) Perceptions on design and implementation elements and how the programming at Royal Roads University supports student success (ask only to members of the research advisory committee)

Main Question	Probes	Intent: What we are trying to find out Do NOT ask these directly.
12. How do you think the DSocSci program helps to support effective student research?	<ul style="list-style-type: none"> How is research taught in the program? How is the applied research focus reflected in the program? How do you think [the principal investigator]'s project was influenced by the program (positively, negatively)? 	<p><i>Understanding program influence on effective research practice.</i></p> <p>QAF: Cre1, Cre5, Cre6, Cre8</p>
13. How was [the principal investigator]'s project assessed?	<ul style="list-style-type: none"> What criteria were used? What would you say are some of the challenges of assessing research of this kind? 	<p><i>Understanding how student research is assessed, and how advisory committee members conceptualizes research effectiveness.</i></p>
14. How would you characterize the design and implementation of [the principal investigator]'s project?	<ul style="list-style-type: none"> Did [the principal investigator] demonstrate a comprehensive understanding of the context and elements relevant to the research problem? How would you describe the application of the methods? Was the execution suitable to the research objectives? Was the execution suitable to the context? Do you think resources were sufficiently and effectively allocated? Were there any issues with the design that you can recall? How were these addressed? Do you think any important stakeholders were excluded? 	<p><i>Perspectives about project design and implementation.</i></p> <p>QAF: Rel3, Rel5, Rel6, Cre1, Cre4, Cre7, Cre8</p>

E) Research outcomes assessment (ask only if they are aware of the project) (purpose to determine extent of outcome achievement and research influence on knowledge or social process contributions around WASH in the Niger Delta and beyond)

Main Question	Probes	Intent: What we are trying to find out Do NOT ask these directly.
15. What contributions do you think [the principal investigator]’s project has made to WASH in the Niger Delta?	<ul style="list-style-type: none"> • Changes in knowledge/understanding? • Changes in attitudes? • Changes in skills? • Changes in relationships? • Changes in behaviour? • At what level do these changes mostly occur? (i.e., organizational, individual, governmental, policy, practice) • When did these changes occur? (during, post-project) • What are the implications of these changes? • Were there any negative outcomes of this project? If yes, please describe. • Probe for specific outcomes the principal investigator thought the informant could speak to. • What do you think the principal investigator did well to achieve these results? • How accessible did you find the results and communication during the process? • Do you think the research can be transferred to other contexts? 	<p><i>Understanding the respondent’s opinion about the contributions of the research.</i></p> <p>Finding out the respondent’s opinion on the student’s research contributions (without leading to specific outcomes). Can give an indication of the utility of the research.</p> <p>Finding out how the student’s research is/was perceived and conceptualized by interviewees to get an overall characterization of the change process. This will help us construct narratives about alternative and/or supplementary theories of change.</p> <p>Finding out about the explicit outcomes/impacts of the project in question anywhere (in the world) of which the informant is aware, not just within their own work/organization.</p> <p>QAF: Rel6, Rel7, Cre7, Cre8, Cre10, Leg3, Eff1, Eff2, Eff3, Eff4</p>
16. Has the research contributed to or influenced your work on the topic?	<ul style="list-style-type: none"> • What were the most important things you learned? • Have there been any positive or negative impacts on knowledge, awareness, policy, capacity, or practice? • In what ways? [ask for examples] • [If respondent mentions knowledge, ask about what knowledge product it came from] 	<p><i>Understanding how the student’s research has influenced their work (re: the topic of focus).</i></p> <p>Finding out about linkages between project and informant’s work on the topic of focus*, and whether the research has contributed to changes in policy & practice, the debate, awareness in the topic, knowledge, capacity, or any other type of contributions. Getting a sense whether the change is perceived as positive or negative.</p> <p>QAF: Rel5, Eff1, Eff2, Eff3, Eff4</p>
17. If there was more time and resources available, what do you think [the principal investigator] could have done differently to produce more useful findings and/or change?	<ul style="list-style-type: none"> • Why do you think these would be useful? [ask for examples] • How do you think [the principal investigator] could have integrated these into their project? • Why do you think this [suggestion] was not done? • Do you think resources were efficiently and appropriately allocated? 	<p><i>Understanding alternative ToCs and perspectives of the research potential beyond what it did achieve/intended to, and other opportunities.</i></p> <p>Hold to the end of the interview – if the interviewee starts talking about it at the beginning, please lead them back to any of the questions above and ask to return to the question.</p> <p>This Q allows participants to give feedback to the project and helps identify gaps/challenges, but we know many of the problems</p>

		<p>already and do not want to let this dominate/ mislead the main focus of the interview.</p> <p>Use this opportunity to increase the depth of any previous answers by probing and relating this question to any other points informants raise – if/when appropriate.</p> <p>QAF: Rel3, Rel5, Rel5, Rel7, Cre1, Leg3</p>
18. What would have happened in the topic of WASH in the Niger Delta and beyond if this research had not been conducted?	<ul style="list-style-type: none"> Probe to clarify if needed (the role of the project in improving collaboration, social networks, participation, engagement, etc.) 	<p>Testing “zero hypothesis”.</p> <p>Using a different angle to understand the true influence of the project by asking what would be different had the PI not done this work.</p> <p>QAF: Eff4</p>

F) Closing Questions

Main Question	Probes	Intent: What we are trying to find out Do NOT ask these directly.
19. What does effective research mean to you?	<ul style="list-style-type: none"> What does effective research look like? 	<i>Understanding opinions on research effectiveness.</i>
20. Do you have any additional remarks with regard to the role of [the principal investigator]’s project, or research in general, in change processes?	<ul style="list-style-type: none"> Is there anything else you would like to add that has not been discussed that will be useful for our evaluation? 	<p>Closing</p> <p>Last remarks, things they might want to add that were not addressed, and closure.</p>

Appendix 4. Survey Tool

IMPROVING SANITATION IN THE NIGER DELTA

INTRODUCTION

Thank you for agreeing to participate in this survey. The Sustainability Research Effectiveness Program is investigating to what extent and how graduate student research at Royal Roads University supports change processes and contributes to positive social and environmental outcomes. This project is based on a series of case studies of completed Masters and Doctoral research projects that demonstrate high potential for change. [The PI's] research on sanitation in the Niger Delta has been selected as one of the case studies.

The objective of this survey is to obtain background information on the WASH sector in Nigeria, in addition to your awareness and perceptions of [the PI's] research and its contributions. You do not need to be aware of [the PI's] research to participate in the survey.

The survey is expected to take 10 minutes to complete. Participation is voluntary, and all answers provided are anonymous. For further information on this survey, please contact the e-mail provided.

To begin, please click **Next**

BACKGROUND

1) How long have you worked in WASH?

- ☐ <1 year ☐ 1 year to 5 years ☐ 5 years to 10 years ☐ 10 years to 20 years
☐ >20 years ☐ Prefer not to answer ☐ I do not work in the WASH sector

2) What are the main challenges currently facing the WASH sector in Nigeria? (open text box)

3) What progress has been made over the past 2 years to address these challenges? (open text box)

KEY STAKEHOLDERS

The following question aims to gather your opinion on key stakeholders within the Nigerian WASH sector.

4) Please select all that apply:

	I consider this a key stakeholder	I get/use information from this source	I work with this actor in my work on WASH
National-level policy makers			
State-level policy-makers			
Rural Water Supply and Sanitation Agency (RUWASSA)			
Local Government Associations			
International organizations (e.g., UN, WHO, UNDP, UNICEF, World Bank Group, etc.):			
Universities/researchers/academics			
Private sector			
NGOs			
Local communities			
Professional networks			
WhatsApp Group			
The Internet	N/A		
Other (please specify)			

CONTRIBUTORS TO CHANGE IN THE NIGERIAN WASH SECTOR:

- 5) To what extent have the following factors contributed to changes within the Nigerian WASH sector (please select all that apply):

	High	Medium	Low	No influence	Unsure
New technology					
Investment from NGOs or international organizations					
Increased communication/knowledge sharing within the sector					
Change in culture/understanding/attitudes around WASH					
Government investment in infrastructure					
Increased awareness of WASH issues (media discussions, demonstration centres etc.)					
Decreased cost of technologies					
Financial incentives to install WASH facilities					
New knowledge (academic research etc.)					
Other (please specify)					

- 6) Please provide an example(s): (open text box)

WASH SECTOR WHATSAPP GROUP

The next section aims to gather information on your use of the WASH WhatsApp group.

- 7) On average, how often do you use the WASH WhatsApp group?
- More than once a week
 - Once a week
 - More than once a month
 - Once a month
 - Less than once a month
 - Never
 - Prefer not to answer
- 8) How do you use/participate in the WASH sector WhatsApp group? Select all that apply.
- I ask questions to the group
 - I answer other people's questions
 - I share information to the group
 - I use information shared to the group
 - I use it to connect with other WASH practitioners in the group
 - Other (please state)
 - I'm a member, but I don't use it
 - Prefer not to answer

KNOWLEDGE [THE PI'S] RESEARCH

The next questions aim to gather information on your knowledge of [the PI's] research.

- 9) What do you know about [the PI's] research on sanitation in the Niger Delta? Select all that apply
- I do not know about the research
 - I know [the PI] was researching this topic
 - I shared information with [the PI] (e.g., documents, reports, etc.)
 - I was formally interviewed for the research
 - I recommended/introduced [the PI] to other people for [their] research
 - [The PI] shared [their] findings with me
 - I gave feedback to the research

- h. I have read [the] research
- i. I have learned from and used [the] research
- j. I have shared [the] research and/or recommendations to others
- k. Other (please state)

WASH DEVELOPMENTS IN NIGERIA

The next section aims to gather information on developments within the Nigerian WASH sector.

To what extent do you agree with the following statements:

- 10) 'The Nigerian WASH sector is generally more aware of WASH gaps, issues, and/or opportunities now than 2 years ago'

- ☐ Strongly Disagree ☐ Disagree ☐ Somewhat Disagree ☐ Neutral
☐ Somewhat Agree ☐ Agree ☐ Strongly Agree ☐ Prefer not to answer

- 11) Has [the PI's] research contributed to the increased awareness of WASH gaps, issues and/or opportunities?

- a. Yes
- b. No
- c. Unsure
- d. Prefer not to answer

- 12) To what extent has [the PI's] research contributed to the increased awareness of WASH gaps, issues and/or opportunities?

Slider rating scale from 0 = 'Not at all', to 100 = 'Significantly'

- 13) Please provide an example(s): (open text box)

- 14) To what extent do you agree with the following statement: 'WASH practitioners in Nigeria share information with and learn from each other more now than they did 2 years ago'

- ☐ Strongly Disagree ☐ Disagree ☐ Somewhat Disagree ☐ Neutral
☐ Somewhat Agree ☐ Agree ☐ Strongly Agree ☐ Prefer not to answer

- 15) Has [the PI's] research contributed to greater information sharing between Nigerian WASH practitioners?

- a) Yes
- b) No
- c) Unsure
- d) Prefer not to answer

- 16) To what extent has [the PI's] research contributed to greater information sharing between WASH practitioners in Nigeria?

Slider rating scale from 0 = 'Not at all', to 100 = 'Significantly'

- 17) Please provide an example(s): (open text box)

- 18) To what extent do you agree with the following statement: 'The Nigerian WASH sector is exploring WASH technologies that are appropriate for high water table contexts'

- ☐ Strongly Disagree ☐ Disagree ☐ Somewhat Disagree ☐ Neutral
☐ Somewhat Agree ☐ Agree ☐ Strongly Agree ☐ Prefer not to answer

- 19) Has [the PI's] research contributed to the exploration of WASH technologies for high water table contexts?

- a) Yes
- b) No
- c) Unsure
- d) Prefer not to answer

20) To what extent has [the PI]'s research contributed to the exploration of WASH technologies for high water table contexts?

Slider rating scale from 0 = 'Not at all', to 100 = 'Significantly'

21) Please provide an example(s): (open text box)

22) To what extent do you agree with the following statement: '[the PI's] research has influenced or contributed to my work on WASH'

- | | | | |
|--|-----------------------------------|--|---|
| <input type="checkbox"/> Strongly Disagree | <input type="checkbox"/> Disagree | <input type="checkbox"/> Somewhat Disagree | <input type="checkbox"/> Neutral |
| <input type="checkbox"/> Somewhat Agree | <input type="checkbox"/> Agree | <input type="checkbox"/> Strongly Agree | <input type="checkbox"/> Prefer not to answer |

23) Please provide an example(s) of how [the PI's] research has influenced or contributed to your work on WASH: (open text box)

ADDITIONAL COMMENTS

24) Do you have any additional comments about WASH in Nigeria or [the PI's] research that you think is important to our study? (open text box)

THANK YOU

Thank you for participating in our survey. The Sustainability Research Effectiveness Program will also be interviewing WASH sector actors to gather further information on the context of the Nigerian WASH sector and awareness of [the PI's] research. **If you would like to participate in an interview, please enter your email address below: (open text box)**

END SURVEY

Appendix 5. Codebooks

Outcomes Codebook

<i>Code</i>	<i>Description</i>	<i>Comment</i>
Alternative explanation(s)	Factors, actors, or processes external to the project that contributed to outcome achievement.	Aligned with questions from interview guide on other developments, factors, and challenges.
Application	Any reference to possible practical applications resulting from the research (or any other related research in the region/topic). Include comments of whether participants have used or applied knowledge from the project (or another project/training) in their work, and how it changed practices. Include any indication of future intentions to apply or use knowledge in academic, policy, or practice contexts.	• Evaluation Research Question 2d: <i>To what extent and how are target audiences aware of and using the project outputs?</i>
Barriers	Comments related to factors that obstructed the research process and its contributions.	• Evaluation Research Question 2f: <i>What lessons about effective research practice can be learned from this case study?</i>
Changes in attitude	Evidence of changes in attitudes.	• Evaluation Research Question 1a: <i>To what extent and how were the intended outcomes realized?</i>
Changes in behaviour	Evidence of changes in behaviour.	• Evaluation Research Question 1a: <i>To what extent and how were the intended outcomes realized?</i>
Changes in knowledge	Evidence of changes in knowledge.	• Evaluation Research Question 1a: <i>To what extent and how were the intended outcomes realized?</i>
Changes in relationships	Evidence of changes in relationships.	• Evaluation Research Question 1a: <i>To what extent and how were the intended outcomes realized?</i>
Changes in skills	Evidence of changes in skills.	• Evaluation Research Question 1a: <i>To what extent and how were the intended outcomes realized?</i>
Characteristics of project design & implementation	Comments relating to perceptions of the design and implementation of the project.	• Evaluation Research Question 2a: <i>What elements of project design and implementation supported outcome realization, and how?</i>
Characteristics of researcher	Comments relating to perceptions of the PI, how they conducted themselves, their personality, and their soft skills, etc.	
Decision-making	Any data pertaining to decision-making done during the project, or influences on stakeholder decision-making.	Aligns with questions in the interview guide pertaining to decision-making and knowledge.
Dissemination & knowledge sharing	Information on how, where, and with whom the research was shared (planned or unexpected opportunities).	Code aspects of ‘knowledge translation’ and ‘brokering’. • Evaluation Research Question 2a: <i>What elements of project design and implementation supported outcome realization, and how?</i> • Evaluation Research Question 2d: <i>To what extent and how are target audiences aware of and using the project outputs?</i>

Facilitating factors	Comments related to factors that facilitated/supported the research process and its contributions.	• Evaluation Research Question 2f: <i>What lessons about effective research practice can be learned from this case study?</i>
Knowledge sources	Comments of where people get their knowledge and how they use it in their work. Comments of what type of knowledge/research people perceive to be credible or useful.	• Evaluation Research Question 2d: <i>To what extent and how are target audiences aware of and using the project outputs?</i>
Perceptions on research effectiveness	Informants' ideas on what constitutes effective research. Discussion of effective research qualities.	• Evaluation Research Question 2f: <i>What lessons about effective research practice can be learned from this case study?</i>
Power	Any aspects related with power and power dynamics.	
Relevant actors	Identification and information pertaining to actors relevant to the context, whether they be direct participants in the research, actors within the context, actors working on issues/topics within the context/system, or boundary partners.	• Evaluation Research Question 2b: <i>To what extent and how did the project engage effectively with relevant stakeholders?</i>
RRU-related information	Any comments related to RRU, its programs, pedagogy, decisions to attend, benefits gained, critiques, etc.	• Evaluation Research Question 2e: <i>How does RRU support student success in research?</i> • Evaluation Research Question 2f: <i>What lessons about effective research practice can be learned from this case study?</i>
Social networks	Any reference to networks and connections between people or organizations that go beyond knowing about the other's existence.	
Trust	Comments related to relationships and trust. Also trust of researcher, findings, organizations, or other actors in the system.	
Unexpected outcomes	Comments of other changes in knowledge, attitudes, skills, relationships, and/or behaviour resulting fully or in part from the research that were not identified by the PI.	• Evaluation Research Question 1b: <i>Were there any positive or negative unexpected outcomes from this project?</i>
Zero hypothesis	A different angle to understand the true influence of the research by asking what would be different had the student not done their research.	• Evaluation Research Question 1c: <i>Could the outcomes have been realized in the absence of the project?</i>
<i>Case-specific Outcomes</i> Outcomes were identified in the ToC workshop and are reflected in the ToC model.		
Informants' participation in research prompts reflection on WASH	Intermediate outcome.	• Evaluation Research Question 1a: <i>To what extent and how were outcomes realized?</i>
PIND staff gain knowledge and capacities and apply them in related work	Intermediate outcome.	• Evaluation Research Question 1a: <i>To what extent and how were outcomes realized?</i>
PI's professional development enhanced by research experiences	Intermediate outcome.	• Evaluation Research Question 1a: <i>To what extent and how were outcomes realized?</i>

Local governments have enhanced capacity for improved policy and effective WASH practices	End-of-project outcome.	• Evaluation Research Question 1a: <i>To what extent and how were outcomes realized?</i>
Forum for WASH discussion grows	End-of-project outcome.	• Evaluation Research Question 1a: <i>To what extent and how were outcomes realized?</i>
WASH sector recognizes WASH gaps, issues, and opportunities	End-of-project outcome.	• Evaluation Research Question 1a: <i>To what extent and how were outcomes realized?</i>
Nigeria's WASH sector has enhanced capacity for knowledge-sharing and learning	End-of-project outcome.	• Evaluation Research Question 1a: <i>To what extent and how were outcomes realized?</i>
WASH sector explores technologies in high water table contexts	End-of-project outcome.	• Evaluation Research Question 1a: <i>To what extent and how were outcomes realized?</i>
The PI has a deeper understanding of issues in WASH and how to approach working in challenging contexts	End-of-project outcome.	• Evaluation Research Question 1a: <i>To what extent and how were outcomes realized?</i>
Knowledge network of scholars and practitioners share development knowledge and facilitate knowledge-to-practice transformation (TI)	End-of-project outcome.	• Evaluation Research Question 1a: <i>To what extent and how were outcomes realized?</i>
Local governments recognize WASH gaps (issues and opportunities) and have enhanced commitment to action on WASH	High-level outcome.	• Evaluation Research Question 1a: <i>To what extent and how were outcomes realized?</i> • Evaluation Research Question 1e: <i>Are the higher-level changes likely to be realized??</i>
Local governments seek evidence-based information/solutions for WASH decision-making	High-level outcome.	• Evaluation Research Question 1a: <i>To what extent and how were outcomes realized?</i> • Evaluation Research Question 1e: <i>Are the higher-level changes likely to be realized??</i>
Local governments take up and implement policy for effective WASH practice	High-level outcome.	• Evaluation Research Question 1a: <i>To what extent and how were outcomes realized?</i> • Evaluation Research Question 1e: <i>Are the higher-level changes likely to be realized??</i>
WASH sector take up and implement recommendations	High-level outcome.	• Evaluation Research Question 1a: <i>To what extent and how were outcomes realized?</i> • Evaluation Research Question 1e: <i>Are the higher-level changes likely to be realized??</i>

Communities in Niger Delta have access to appropriate, affordable and safe technologies to address WASH	High-level outcome.	<ul style="list-style-type: none"> • Evaluation Research Question 1a: <i>To what extent and how were outcomes realized?</i> • Evaluation Research Question 1e: <i>Are the higher-level changes likely to be realized??</i>
Master trainers improve their WASH training skills (DEWT)	High-level outcome.	<ul style="list-style-type: none"> • Evaluation Research Question 1a: <i>To what extent and how were outcomes realized?</i> • Evaluation Research Question 1e: <i>Are the higher-level changes likely to be realized??</i>
Visitors to ATED learn and gain more awareness about WASH issues	High-level outcome.	<ul style="list-style-type: none"> • Evaluation Research Question 1a: <i>To what extent and how were outcomes realized?</i> • Evaluation Research Question 1e: <i>Are the higher-level changes likely to be realized??</i>
PI continues work in Niger Delta WASH sector and beyond	High-level outcome.	<ul style="list-style-type: none"> • Evaluation Research Question 1a: <i>To what extent and how were outcomes realized?</i> • Evaluation Research Question 1e: <i>Are the higher-level changes likely to be realized??</i>
Niger Delta communities' thinking around sanitation is stimulated to encourage receptivity to new technologies and WASH practices and shift cultural norms	Impact.	<ul style="list-style-type: none"> • Evaluation Research Question 1e: <i>Are the higher-level changes likely to be realized?</i>

QAF Codebook

<i>Code</i>	<i>Description</i>	<i>Comment</i>
Alternative explanations are explored	An indicator for the ‘Clearly presented argument’ criterion. Part of the Credibility Principle.	• Evaluation Research Question 1c: <i>Could the outcomes have been realized in the absence of the project?</i>
Analyses and interpretations are adequately explained (clearly described terminology and logic leading to conclusions)	An indicator for the ‘Clearly presented argument’ criterion. Part of the Credibility Principle.	
Any changes to research project as a result of reflection are described and justified	An indicator for the ‘Ongoing monitoring and reflexivity’ criterion. Part of the Credibility Principle.	
Approach is justified in reference to the context	An indicator for the ‘Research approach fits purpose’ criterion. Part of the Credibility Principle.	
Bias is identified (researchers’ positions, sources of support, financing, collaborations, partnerships, research mandate, assumptions, goals and bounds placed on commissioned research)	An indicator for the ‘Disclosure of perspective’ criterion. Part of the Legitimacy Principle.	
Biases and limitations are recognized	An indicator for the ‘Adequate competencies’ criterion. Part of the Credibility Principle.	
Collaboration process is discussed	An indicator for the ‘Effective collaboration’ criterion. Part of the Legitimacy Principle.	• Evaluation Research Question 2b: <i>To what extent and how did the project engage effectively with relevant stakeholders?</i>
Considering full range of stakeholders explicitly identifies ethical challenges and how they were resolved	An indicator for the ‘Research is ethical’ criterion. Part of the Legitimacy Principle.	
Context is analyzed sufficiently to identify research entry points	An indicator for the ‘Clearly defined socio-ecological context’ criterion. Part of the Relevance Principle.	
Context is defined and described	An indicator for the ‘Clearly defined socio-ecological context’ criterion. Part of the Relevance Principle.	
Demonstration that opportunities and process for collaboration are appropriate to the context and actors involved (e.g., clear and explicit roles and responsibilities agreed upon, transparent and appropriate decision-making structures)	An indicator for the ‘Effective collaboration’ criterion. Part of the Legitimacy Principle.	• Evaluation Research Question 2b: <i>To what extent and how did the project engage effectively with relevant stakeholders?</i>
Ethical review process followed is described	An indicator for the ‘Research is ethical’ criterion. Part of the Legitimacy Principle.	

Evidence is provided that necessary skills, knowledge and expertise are represented in the research team in the right measure to address the problem	An indicator for the ‘Adequate competencies’ criterion. Part of the Credibility Principle.	
Evidence of changes in behavior among participants or stakeholders	An indicator for the ‘Research builds social capacity’ criterion. Part of the Effectiveness Principle.	• Evaluation Research Question 1a: <i>To what extent and how were outcomes achieved?</i>
Evidence of changes in knowledge and understanding among participants (stakeholders)	An indicator for the ‘Research builds social capacity’ criterion. Part of the Effectiveness Principle.	• Evaluation Research Question 1a: <i>To what extent and how were outcomes realized?</i> • Evaluation Research Question 2d: <i>To what extent and how are target audiences aware of and using the project outputs?</i>
Evidence of changes of perspectives among participants or stakeholders	An indicator for the ‘Research builds social capacity’ criterion. Part of the Effectiveness Principle.	• Evaluation Research Question 1a: <i>To what extent and how were outcomes realized?</i> • Evaluation Research Question 2d: <i>To what extent and how are target audiences aware of and using the project outputs?</i>
Evidence that innovations developed through the research or the research process have been (or will be applied) in the real world	An indicator for the ‘Practical application’ criterion. Part of the Effectiveness Principle.	• Evaluation Research Question 1a: <i>To what extent and how were outcomes realized?</i> • Evaluation Research Question 2d: <i>To what extent and how are target audiences aware of and using the project outputs?</i>
Evidence that knowledge generated by the research has contributed understanding of the research topic and related issues among target audiences	An indicator for the ‘Contribution to knowledge’ criterion. Part of the Effectiveness Principle.	• Evaluation Research Question 1a: <i>To what extent and how were outcomes realized?</i> • Evaluation Research Question 2d: <i>To what extent and how are target audiences aware of and using the project outputs?</i>
Evidence that the research has contributed to positive change in the problem context or innovations that have positive social or environmental impacts	An indicator for the ‘Significant outcome’ criterion. Part of the Effectiveness Principle.	• Evaluation Research Question 1e: <i>Are the higher-level outcomes likely to be realized?</i>
Explains roles and contributions of all participants in the research process	An indicator for the ‘Genuine and explicit inclusion’ criterion. Part of the Legitimacy Principle.	• Evaluation Research Question 2b: <i>To what extent and how did the project engage effectively with relevant stakeholders?</i>
Integration of an appropriate breadth and depth of literature and theory from across disciplines relevant to the context and the context itself	An indicator for the ‘Broad preparation’ criterion. Part of the Credibility Principle.	

Knowledge skills and expertise needed to carry out research are identified	An indicator for the ‘Adequate competencies’ criterion. Part of the Credibility Principle.	
Limitations are accounted for on an ongoing basis	An indicator for the ‘Limitations stated’ criterion. Part of the Credibility Principle.	
Limitations are stated	An indicator for the ‘Limitations stated’ criterion. Part of the Credibility Principle.	
Methods are clearly described	An indicator for the ‘Appropriate methods’ criterion. Part of the Credibility Principle.	
Methods are fit to purpose	An indicator for the ‘Appropriate methods’ criterion. Part of the Credibility Principle.	• Evaluation Research Question 2a: <i>What elements of the research design and implementation supported outcome realization, and how?</i>
Methods are systematic yet adaptable	An indicator for the ‘Appropriate methods’ criterion. Part of the Credibility Principle.	• Evaluation Research Question 2a: <i>What elements of the research design and implementation supported outcome realization, and how?</i>
Methods are transparent	An indicator for the ‘Appropriate methods’ criterion. Part of the Credibility Principle.	
Novel methods or adaptations are justified and explained (including why they were used and how they maintain scientific rigour)	An indicator for the ‘Appropriate methods’ criterion. Part of the Credibility Principle.	• Evaluation Research Question 2a: <i>What elements of the research design and implementation supported outcome realization, and how?</i>
Objectives are achieved	An indicator for the ‘Objectives stated and met’ criterion. Part of the Credibility Principle.	• Evaluation Research Question 2c: <i>To what extent were the research findings sufficiently relevant to achieve the stated objectives?</i>
Objectives clearly stated	An indicator for the ‘Objectives stated and met’ criterion. Part of the Credibility Principle.	
Objectives logically and appropriately related to the context	An indicator for the ‘Objectives stated and met’ criterion. Part of the Credibility Principle.	
Problem defined to show relevance to the context	An indicator for the ‘Socially relevant research problem’ criterion. Part of the Relevance Principle.	
Process of integration (including how paradoxes and conflicts were managed) is discussed	An indicator for the ‘Research approach fits purpose’ criterion. Part of the Credibility Principle.	
Processes of reflection (individually and as a research team) are clearly documented throughout the process	An indicator for the ‘Ongoing monitoring and reflexivity’ criterion. Part of the Credibility Principle.	
Rationale for inclusion and integration of different epistemologies, disciplines, methodologies is explicitly stated	An indicator for the ‘Research approach fits purpose’ criterion. Part of the Credibility Principle.	

Research articulates what the achievement of the outcomes implies for higher level impacts	An indicator for the ‘Explicit Theory of Change’ criterion. Part of the Relevance Principle.	• Evaluation Research Question 1e: <i>Are the higher-level changes likely to be realized?</i>
Research design and resources are appropriate and sufficient to meet the objectives	An indicator for the ‘Feasible research project’ criterion. Part of the Credibility Principle.	
Research design and resources are sufficiently resilient to adapt to unexpected opportunities and challenges throughout the research process	An indicator for the ‘Feasible research project’ criterion. Part of the Credibility Principle.	
Research execution is suitable to objectives	An indicator for the ‘Appropriate project implementation’ criterion. Part of the Relevance Principle.	• Evaluation Research Question 2a: <i>What elements of the research design and implementation supported outcome realization, and how?</i>
Research execution is suitable to the problem context	An indicator for the ‘Appropriate project implementation’ criterion. Part of the Relevance Principle.	• Evaluation Research Question 2a: <i>What elements of the research design and implementation supported outcome realization, and how?</i>
Research explicitly identifies how the outcomes are intended and expected to be realized	An indicator for the ‘Explicit Theory of Change’ criterion. Part of the Relevance Principle.	
Research explicitly identifies its main intended outcomes	An indicator for the ‘Explicit Theory of Change’ criterion. Part of the Relevance Principle.	
Research identified necessary actors	An indicator for the ‘Effective Communication’ criterion. Part of the Relevance Principle.	
Research problem is clearly stated and defined	An indicator for the ‘Clear research problem definition’ criterion. Part of the Credibility Principle.	
Research problem is grounded in the academic literature and problem context	An indicator for the ‘Clear research problem definition’ criterion. Part of the Credibility Principle.	
Research problem is researchable	An indicator for the ‘Clear research problem definition’ criterion. Part of the Credibility Principle.	
Research project communicated with all necessary actors	An indicator for the ‘Effective Communication’ criterion. Part of the Relevance Principle.	• Evaluation Research Question 2b: <i>To what extent and how did the project engage effectively with relevant stakeholders?</i>
Research project planned appropriate communications	An indicator for the ‘Effective Communication’ criterion. Part of the Relevance Principle.	
Research question is clearly stated and defined	An indicator for the ‘Clear research question’ criterion. Part of the Credibility Principle.	
Research question is grounded in the academic literature and problem context	An indicator for the ‘Clear research question’ criterion. Part of the Credibility Principle.	

Research question is justified	An indicator for the ‘Clear research question’ criterion. Part of the Credibility Principle.	
Researcher interacted sufficiently with problem context	An indicator for the ‘Engagement with the problem context’ criterion. Part of the Relevance Principle.	• Evaluation Research Question 2a: <i>What elements of the research design and implementation supported outcome realization, and how?</i>
Researcher(s) interacted appropriately with problem context	An indicator for the ‘Engagement with the problem context’ criterion. Part of the Relevance Principle.	• Evaluation Research Question 2a: <i>What elements of the research design and implementation supported outcome realization, and how?</i>
Researcher(s) is well positioned to influence change process	An indicator for the ‘Engagement with the problem context’ criterion. Part of the Relevance Principle.	
Results are clearly presented	An indicator for the ‘Clearly presented argument’ criterion. Part of the Credibility Principle.	
Stakeholders are engaged appropriately throughout the process	An indicator for the ‘Appropriate project implementation’ criterion. Part of the Relevance Principle.	• Evaluation Research Question 2b: <i>To what extent and how did the project engage effectively with relevant stakeholders?</i>
Statement about the practical application of research activities	An indicator for the ‘Socially relevant research problem’ criterion. Part of the Relevance Principle.	
Statement about the practical application of research outcomes	An indicator for the ‘Socially relevant research problem’ criterion. Part of the Relevance Principle.	
Steps taken to ensure respectful inclusion of diverse actors and views are explicit	An indicator for the ‘Genuine and explicit inclusion’ criterion. Part of the Legitimacy Principle.	• Evaluation Research Question 2b: <i>To what extent and how did the project engage effectively with relevant stakeholders?</i>
The documentation explains the range of participants (cultural backgrounds and perspectives)	An indicator for the ‘Genuine and explicit inclusion’ criterion. Part of the Legitimacy Principle.	• Evaluation Research Question 2b: <i>To what extent and how did the project engage effectively with relevant stakeholders?</i>
The research achieved appropriate communications	An indicator for the ‘Effective Communication’ criterion. Part of the Relevance Principle.	• Evaluation Research Question 2b: <i>To what extent and how did the project engage effectively with relevant stakeholders?</i>
The research design considers stakeholder needs and values	An indicator for the ‘Relevant research objectives and design’ criterion. Part of the Relevance Principle.	• Evaluation Research Question 2b: <i>To what extent and how did the project engage effectively with relevant stakeholders?</i>
The research design is appropriate to the problem context	An indicator for the ‘Relevant research objectives and design’ criterion. Part of the Relevance Principle.	• Evaluation Research Question 2a: <i>What elements of the research design and implementation supported outcome realization, and how?</i>
The research design is relevant	An indicator for the ‘Relevant research objectives and design’ criterion. Part of the Relevance Principle.	• Evaluation Research Question 2a: <i>What elements of the research design and implementation supported outcome realization, and how?</i>

The research design is timely	An indicator for the ‘Relevant research objectives and design’ criterion. Part of the Relevance Principle.	• Evaluation Research Question 2a: <i>What elements of the research design and implementation supported outcome realization, and how?</i>
The research objectives are appropriate to the problem context	An indicator for the ‘Relevant research objectives and design’ criterion. Part of the Relevance Principle.	
The research objectives are relevant	An indicator for the ‘Relevant research objectives and design’ criterion. Part of the Relevance Principle.	
The research objectives consider stakeholder needs and values	An indicator for the ‘Relevant research objectives and design’ criterion. Part of the Relevance Principle.	
Transferability of research findings is explained	An indicator for the ‘Transferability and generalizability of research findings’ criterion. Part of the Credibility Principle.	• Evaluation Research Question 2d: <i>To what extent and how are target audiences aware of and using the project outputs?</i>
Transferability of research process is explained	An indicator for the ‘Transferability and generalizability of research findings’ criterion. Part of the Credibility Principle.	• Evaluation Research Question 2d: <i>To what extent and how are target audiences aware of and using the project outputs? How are they using them?</i>
Understanding an appropriate breadth and depth of literature and theory from across disciplines of the context	An indicator for the ‘Broad preparation’ criterion. Part of the Credibility Principle.	
Understanding an appropriate breadth and depth of literature and theory from across disciplines relevant to the context	An indicator for the ‘Broad preparation’ criterion. Part of the Credibility Principle.	

Appendix 6. Quality Assessment Framework

Research Quality Assessment Framework (adapted from Belcher et al., 2016)

Relevance: The importance, significance, and usefulness of the research problem(s), objectives, processes, and findings to the problem context.		
<i>Criteria</i>	<i>Definition</i>	<i>Rubric Statement</i>
Clearly defined socio-ecological context	The context is well defined, described, and analyzed sufficiently to identify research entry points.	The context is well defined, described, and analyzed sufficiently to identify research entry points.
Socially relevant research problem ⁵	Research problem is relevant to the problem context ⁶ and current academic discourse.	The research problem is defined and framed in a way that clearly shows its relevance to the context and demonstrates that consideration has been given to the practical application of the new knowledge generated.
Engagement with problem context	Researchers demonstrate appropriate ⁷ breadth and depth of understanding of and sufficient interaction with the problem context.	The documentation demonstrates that the research team has interacted appropriately and sufficiently with the problem context to understand it and have potential to influence it (e.g., through site visits, meeting participation, discussion with stakeholders, document review, etc.) and new knowledge is considered and incorporated appropriately as it becomes known.
Explicit theory of change	The research explicitly identifies its main intended outcomes and how they are intended or expected to be realized and how they will contribute to longer-term outcomes and/or impacts.	The research explicitly identifies its main intended outcomes and how they are intended or expected to be realized and how they will contribute to longer-term outcomes and/or impacts.
Relevant research objectives and design	The research objectives and design are relevant and appropriate to the problem context; the research is timely, useful, and appropriate to the societal problem ⁸ ; research design is specific to important context characteristics (includes stakeholder needs and values).	The documentation clearly demonstrates, through sufficient analysis of key factors, needs, and complexity within the context, that the research objectives and design are relevant and appropriate.

⁵ **Research problems** are the particular topic, area of concern, question to be addressed, challenge, opportunity, or focus of the research activity. Research problems are related to the societal problem but take on a specific focus, or framing, within a societal problem.

⁶ **Problem context** refers to the social and environmental setting(s) that gives rise to the research problem, including aspects of: location; culture; scale in time and space; social, political, economic, and ecological/environmental conditions; resources and societal capacity available; uncertainty, complexity and novelty associated with the societal problem; and the extent of agency that is held by stakeholders (Carew & Wickson, 2010).

⁷ Words such as ‘**appropriate**’, ‘**suitable**’, and ‘**adequate**’ are used deliberately to allow for quality criteria to be flexible and specific enough to the needs of individual research projects (Oberg, 2008).

⁸ **Societal problem** is ‘an area in which the need for knowledge related to empirical and practice-oriented questions arises within society due to an uncertain knowledge base and diffuse as well as controversial perceptions of problems’ (Pohl et al., 2007).

Appropriate project implementation	Research execution is suitable to the problem context and the socially relevant research objectives.	The documentation reflects effective project implementation that is appropriate to the context, including ongoing engagement with stakeholders, incorporation of new knowledge, and reflection and adaptation as needed.
Effective communication	Communication during and after the research process ⁹ is appropriate to the context and accessible to stakeholders, users, and other intended audiences.	The documentation indicates that the research project planned and achieved appropriate communications with all necessary actors during the research process.

Credibility: The research findings are robust and the sources of knowledge are dependable. This includes clear demonstration of the adequacy of the data and the methods used to procure the data, including clearly presented and logical interpretation of findings.

<i>Criteria</i>	<i>Definition</i>	<i>Rubric Statement</i>
Broad preparation	The research is based on a strong integrated theoretical and empirical foundation that is relevant to the context.	The documentation demonstrates critical understanding and integration of an appropriate breadth and depth of literature and theory from across disciplines relevant to the context, and of the context itself.
Clear research problem definition	The research problem is clearly defined, researchable, and grounded in the academic literature and the problem context.	The research problem is clearly stated and defined, researchable, and grounded in the academic literature and the problem context.
Clear research question	The research question is clearly stated and defined, researchable, and appropriate to address the research problem.	The research question is clearly stated and defined, researchable, and justified as an appropriate way to address the research problem.
Objectives stated and met	Research objectives are clearly stated and met.	The research objectives are clearly stated, logically and appropriately related to the context and the research problem, and achieved, with any necessary adaptation explained.
Feasible research project	The research design and resources are appropriate and sufficient to meet the objectives as stated, and sufficiently resilient to adapt to unexpected opportunities and challenges throughout the research process.	The research design and resources are appropriate and sufficient to meet the objectives as stated, and sufficiently resilient to adapt to unexpected opportunities and challenges throughout the research process.
Adequate competencies	The skills and competencies of the researcher(s), team, or collaboration (including academic and societal actors) are sufficient and in appropriate balance (without unnecessary complexity) to succeed.	The documentation recognizes the limitations and biases of individuals' knowledge and identifies the knowledge, skills, and expertise needed to carry out the research and provides evidence that they are represented in the research team in the appropriate measure to address the problem.

⁹ **Research process** refers to the series of decisions and actions taken throughout the entire duration of the research project and encompassing all aspects of the research project.

Research approach fits purpose	Disciplines, perspectives, epistemologies, approaches, and theories are combined appropriately to create an approach that is appropriate to the research problem and is able to meet stated objectives.	The documentation explicitly states the rationale for the inclusion and integration of different epistemologies, disciplines, and methodologies, justifies the approach taken in reference to the context, and discusses the process of integration, including how paradoxes and conflicts were managed.
Appropriate methods	Methods are fit to purpose and well suited to answering the research questions and achieving stated objectives.	Methods are clearly described and documentation demonstrates that the methods are fit to purpose, systematic yet adaptable, and transparent. Novel (unproven) methods or adaptations are justified and explained, including why they were used and how they maintain rigor.
Clearly presented argument	The movement from analysis through interpretation to conclusions is transparently and logically described. Sufficient evidence is provided to clearly demonstrate the relationship between evidence and conclusions.	Results are clearly presented. Analyses and interpretations are adequately explained, with clearly described terminology and full exposition of the logic leading to conclusions, including exploration of possible alternate explanations.
Transferability and/or generalizability of research findings	Appropriate and rigorous methods ensure the study's findings are externally valid (generalizable). In some cases, findings may be too context specific to be generalizable in which case research would be judged on its ability to act as a model for future research.	Document clearly explains how the research findings are transferable to other contexts, OR in cases that are too context-specific to be generalizable, discusses aspects of the research process or findings that may be transferable to other contexts and/or used as learning cases.
Limitations stated	Researchers engage in on-going individual and collective reflection in order to explicitly acknowledge and address limitations.	Limitations are clearly stated and adequately accounted for on an ongoing basis through the research project.
Ongoing monitoring and reflexivity ¹⁰	Researchers engage in ongoing reflection and adaptation of the research process, making changes as new obstacles, opportunities, circumstances, and/or knowledge surface.	Processes of reflection, individually and as a research team, are clearly documented throughout the research process along with clear descriptions and justifications for any changes to the research process made as a result of reflection.

Legitimacy: The research process is perceived as fair and ethical. This encompasses the ethical and fair representation of all involved and the appropriate and genuine inclusion and consideration of diverse participants, values, interests, and perspectives.

<i>Criteria</i>	<i>Definition</i>	<i>Rubric Statement</i>
Disclosure of perspective	Actual, perceived, and potential bias is clearly stated and accounted for. This includes aspects of: researchers' position, sources of support, financing, collaborations, partnerships, research mandate, assumptions, goals, and bounds placed on commissioned research.	The documentation identifies potential or actual bias, including aspects of researchers' positions, sources of support, financing, collaborations, partnerships, research mandate, assumptions, goals, and bounds placed on commissioned research.

¹⁰ **Reflexivity** refers to an iterative process of formative, critical reflection on the important interactions and relationships between a research project's process, context, and product(s).

Effective collaboration	Appropriate processes are in place to ensure effective collaboration (e.g., clear and explicit roles and responsibilities agreed upon, transparent and appropriate decision-making structures).	The documentation explicitly discusses the collaboration process, with adequate demonstration that the opportunities and process for collaboration are appropriate to the context and the actors involved (e.g., clear and explicit roles and responsibilities agreed upon, transparent and appropriate decision-making structures).
Genuine and explicit inclusion	Inclusion of diverse actors in the research process is clearly defined. Representation of actors' perspectives, values, and unique contexts is ensured through adequate planning, explicit agreements, communal reflection, and reflexivity.	The documentation explains the range of participants and perspectives/cultural backgrounds involved, clearly describes what steps were taken to ensure the respectful and inclusion of diverse actors/views, and explains the roles and contributions of all participants in the research process.
Research is ethical	Research adheres to standards of ethical conduct.	The documentation describes the ethical review process followed and, considering the full range of stakeholders, explicitly identifies any ethical challenges and how they were resolved.

Effectiveness: The research generates knowledge and stimulates actions that address the problem and contribute to solutions and innovations.

<i>Criteria</i>	<i>Definition</i>	<i>Rubric Statement</i>
Research builds social capacity	Change takes place in individuals, groups, and at the institutional level through shared learning. This can manifest as a change in knowledge, understanding, and/or perspective of participants in the research project.	There is evidence of ¹¹ observed changes in knowledge, behaviour, understanding, and/or perspectives of research participants and/or stakeholders as a result of the research process and/or findings.
Contribution to knowledge	Research contributes to knowledge and understanding in academic and social realms in a timely, relevant, and significant way.	There is evidence ⁹ that knowledge generated by the research has contributed to the understanding of the research topic and related issues among target audiences.
Practical application	Research has a practical application. The findings, process, and/or products of research are used.	There is evidence that innovations developed through the research and/or the research process have been (or will be applied) in the real world.
Significant outcome	Research contributes to the solution of the targeted problem or provides unexpected solutions to other problems. This can include a variety of outcomes: building societal capacity, learning, use of research products, and/or changes in behaviours.	There is evidence that the research has contributed to positive change in the problem context and/or innovations that have positive social or environmental impacts.

¹¹ In an *ex ante* evaluation, 'evidence of' would be replaced with 'potential for'.

Appendix 7. QAF Scores and Justifications

Table 8. Individual evaluator and average scores for all QAF criteria, with justifications for the score allocated

Principle	Criteria	E1	E2	E3	E4	Avg.	Justification/Comments
Relevance	Clearly defined socio-ecological context	1	2	1	1	1.25	Dissertation provides a historical, geographical, socio-economic, and socio-cultural description of the problem context; dissertation outlines the complexity of WASH in the Niger Delta and explains compounding factors; identification of academic entry points could have been stronger; dissertation does not explain fully the community, NGO, and policy contexts of the WASH sector in the Niger Delta (would have strengthened the justification for why the research is needed).
	Socially relevant research problem	2	2	2	2	2	Academic and practical gaps are identified and discussed (e.g., negative spillover effects of poor sanitation, appropriateness of WASH technologies for riverine systems are unknown, siloization of Nigeria's WASH sector); research problem is aligned with Millennium Development Goal 7; informants reflect on relevance and value of study; practical application of the findings are considered and discussed (e.g., PIND).
	Engagement with problem context	2	2	2	1	1.75	PI interacted sufficiently with the problem context to gain a breadth and depth of understanding (via personal experience as a WASH practitioner in Africa, fieldwork engaged a range of system actors); PI was well positioned to influence the context (access to Nigerian WASH networks, working at PIND), but unclear the extent to which this was leveraged (e.g., problem context engagement versus information extraction).
	Explicit theory of change	1	1	1	1	1	Not explicit or documented, but implicit in statements of hoped or intended changes; dissertation indicates opportunities to influence change via PIND or other mechanisms, though this is briefly discussed.
	Relevant research objective and design	1	1	1	1	1	Singular objective is weak (lacks specificity) and reads more as a statement of interest; research design is relevant and appropriate to the problem context and exploratory nature of the project; research accounts for and accommodates community needs/values in the design of the approach on sensitive and taboo topic.
	Appropriate project implementation	1	2	1	1	1.25	Exploratory approach appropriate considering the scope of the state objective; PI had ongoing engagement with system actors; unclear how new knowledge or reflections made during the research process were incorporated (not documented).
	Effective communication	1	1	1	1	1	No discussion is given on how communications during the research process were planned; research advisory committee commended the PI's communication of progress and feedback; multiple dissemination strategies were planned; communication of results was perceived to be accessible and well-organized by informants, though there was low awareness of results amongst informants and other actors.
Credibility	Broad preparation	1	2	1	1	1.25	Documentation conveys understanding from multiple disciplines, though the integration this knowledge could have been strengthened; various theories and models of behaviour change were reviewed; in-depth understanding of technological options available for the Niger Delta were reviewed and described; the research does not draw on enough previous research from other riverine contexts (only mentioned in passing); engagement with knowledge of former interventions in the Niger Delta was missing.
	Clear research problem definition	1	1	1	1	1	The research problem is stated in the dissertation, though broad; the grounding of the research problem in academic literature is vague.

	Clear research question	1	1	1	1	1	The research question is stated in the dissertation; appropriateness of the research question was questioned owing to its broadness; some informants critiqued the framing of the research question, feeling that it did not lend well for the project to contribute to a growth of understanding in any one area.
	Objectives stated and met	1	1	1	1	1	A singular objective is stated and appears to have been met; however, the objective is not logically or appropriately related to the problem context; a better formulation of objectives would have aided the structure and purpose of the project.
	Feasible research project	1	1	1	2	1.25	The design and resources were appropriate to the objective as stated; the project was supported by sufficient funding (Mitacs Fellowship) for fieldwork and hiring of enumerators; PI drew on existing networks through PIND and WASH practitioners; resilience of the design to accommodate opportunities or challenges is not discussed.
	Adequate competencies	2	2	2	2	2	The PI had extensive prior field experience and knowledge of Nigeria and the WASH sector; enumerators were given training to conduct the survey; informants commented on the PI's passion for the work.
	Research approach fits purpose	1	1	1	1	1	Exploratory approach fits the stated objective; rationale is given for the approach taken to collect data from the communities (accounting for stigma associated with the topic); there is clear discussion for the inclusion of methodologies, but the selection of disciplines and how they were integrated is not discussed; no discussion of paradoxes or conflicts.
	Appropriate method	1	2	1	1	1.25	Mixed methods are clearly described, systematic, and fit to the exploratory nature of the research; however, missed opportunity in the analysis to fully leverage the data collected indicates inappropriateness of the methods.
	Clearly presented argument	1	1	1	1	1	Results are clearly presented in both narrative and diagrams; analyses do not demonstrate synthesis of results, instead reading as a list of anecdotes and informant opinions; missed opportunity to draw correlations between the data for a strong argument; the recommendations are not logically connected to the results; alternative explanations are not explored.
	Transferability and generalizability of the findings	1	1	1	1	1	Findings are too specific to be transferable; informants thought the research was transferable, as sanitation is a global issue; methods would be transferable, but this is not discussed.
	Limitations stated	0	0	0	0	0	Only one brief section of the dissertation acknowledges limited data availability and difficulty in corroborating self-reported qualitative research; limitations are not meaningfully discussed in terms of the implications of results; most important limitations are not addressed.
Legitimacy	Ongoing reflexivity and monitoring	1	1	1	0	0.75	Dissertation mentions the importance of reflexivity, but it is not clear the extent to which or how reflection was done; one informant noted the survey underwent significant re-design, but this is not documented in the dissertation.
	Disclosure of perspective	0	0	1	0	0.25	Dissertation indicates an awareness of personal biases, but these biases are not openly explained or discussed in terms of the implications for the research; researcher positionality is not discussed; Mitacs funding is acknowledged; partnership with PIND is noted, but connection with Shell and Chevron are not disclosed; notes some participants were known to the PI from own work in the region.

Royal Roads University Graduate Student Research Evaluation
Evaluation Report: Sanitation in the Niger Delta Project (SNDP)

	Effective collaboration	1	0	1	0	0.5	The research is not a collaborative piece of work (evidence indicates extractive relationship); there was scope for the research to be more collaborative through the PI's professional connections to PIND and other WASH practitioners (impression that the PI separated the doctoral work from PIND work); members of the advisory committee reflected positively on their relationships with the PI.
	Genuine and explicit inclusion	1	1	1	1	1	A range of system actors were involved in the research, but specifics of their inclusion is not described; steps were taken to engage communities in an appropriate way (being sensitive to their needs and values), but not clear if done for all system actors; indications that the PI made efforts to establish a positive relationship with participants to build trust; creation of the WhatsApp group facilitated a platform for cross-pollination of ideas, perspectives, and experiences amongst WASH practitioners.
	Research is ethical	1	2	2	2	1.75	Project received ethical approval by RRU Research Ethics Board; anonymity of participants is preserved; consideration is given on how to ethically engage communities on a sensitive or taboo topic; ethical importance of reflexivity is mentioned.
Effectiveness	Research builds social capacity	1	1	1	1	1	Research capacity-building of the PI was high; enumerators received training, but their research capacity is not considered; scope for more intentional capacity-building via the project was a missed opportunity; indications from informants that they think more deeply about the topic and related issues as a result of the research (i.e., how to support development in the Niger Delta); enhanced knowledge-sharing and learning occurring in the Nigerian WASH sector, but unclear if this is a contribution of the project.
	Contribution to knowledge	1	1	1	1	1	Contributed to PI's knowledge; scope for more was a missed opportunity; research not thought to have contributed to new knowledge, but supported bridging connections in existing knowledge and expanding on what is already known.
	Practical application	1	1	1	1	1	No innovations were developed from the research; recommendations were intended for uptake, but unclear to what extent this happened; there are some indications of elements taken up by the WASH community, but unclear how and if connected to the project.
	Significant outcome	2	2	1	1	1.5	Six out of ten end-of-project outcomes were fully or partially realized, with five indicating clear contribution of the project; potential for more in the future (too early to assess social/economic/environmental benefits), but likely this will result from other processes and interventions in the context.

Appendix 8. Evidence of Outcome Realization

Legend: Outcome Realization





	Green = realized		Orange = not realized
	Light green = partially realized		Grey = insufficient evidence

Table 9. Extent of outcome realization, supporting evidence, degree of project contribution, and evidence rating

Expected Outcome	Summary of Results Realized	Evidence Supporting Results' Realization	Evidence Rating: Low (L), Medium (M), High (H) Justification
Wash Sector and Community Development Pathway			
Informants' participation in research prompts reflection on WASH [intermediate outcome]	Participation in the research has clearly prompted informants' in the SNDP's reflection on WASH. Practitioners involved in the research noted thinking more deeply on how to support the development of the WASH sector and how to handle negative sanitation practices in riverine communities (Prac4). Engagement with the PI and working together at PIND led practitioners to consider solutions that are not conventional or currently available (Prac9). The PI's work had a strong positive influence on SNDP participants and identified the need for further work into the topic of improving sanitation, as well as presenting clear recommendations which has directly affected the work of other practitioners focused on the topic (Prac9). For example, participating in the research and working with the PI affected practitioners' thinking around ensuring behaviour change is included in their everyday work and addressing market approaches, one of the recommendations presented by the SNDP. Overall, the research is noted to have contributed to the systemic change of thinking within the Niger Delta sanitation sector (Prac9). The PI themselves suggests that the process of completing the interview and discussing personal experiences may have been affirming for research participants in the participating communities. Members of the communities were not available for interview to evidence this suggestion.	<p><i>"I'm using myself as a case study. So the questions [the PI] asked me made me think deeper of how to support the development of a [comprehensive] system [...] probably when [the PI] asked me the question, I would have seen in part on the processes on the use of ash, [...] so I think [the PI's] research added base to the innovations around approaches for handling the negative riverine sanitation that we experience in the Niger Delta"</i> (Prac4)</p> <p><i>"[the PI] always, even just meeting [the PI] and talking with [the PI], and engaging with [the PI], and working with [the PI] and [their] research as well makes you try to think about solutions that are not conventional"</i> (Prac9)</p> <p><i>"[the PI's] research also has thrown a lot more light in the area of sanitation with very clear recommendations that has helped me as a person in my work. Maybe not remembering the recommendations one after the other in my brain, but in the course of my work and in the approach it is more like something that has been streamlined into my thinking so I think along those lines, 'Okay I need to make sure that behaviour change issues are dealt with, I need to know looking at market approaches'. So, it is more like, how do I put this – a systemic change within thinking within the sanitation sector"</i> (Prac9)</p> <p><i>"As I think about it, the process of thinking about things and answering questions in and of itself can be a valid experience and useful experience, so that might have had an impact"</i> (Res4)</p>	M Realized, clear project contribution No members of the communities were interviewed on their reflection on WASH. Clear evidence for reflection is given by WASH practitioners.
PIND staff gain knowledge and capacities and apply them in related work	The PI's professional role at PIND allowed for the sufficient transfer of knowledge. PIND staff are aware of the SNDP which coincides with their own work (Prac4, Prac9). The SNDP presents new lenses to explore sanitation programming	<i>"I knew about what [the PI] was doing. [The PI's] main report is of course is something that [...] capitalizes what I am doing. It coordinates with what I am doing. So I learned quite some things from [the PI], including resilience in every good project"</i> (Prac4)	H

[intermediate outcome]	<p>which have been adopted by staff. For example, one respondent suggests that the SNDP presents the importance of including resilience in every good sanitation project which they have introduced into their own work (Prac4). Others suggest that the SNDP contributed to knowledge within PIND and has changed the way staff work on sanitation in communities who now focus more on community involvement (Res3). Survey results suggest that the SNDP has provided practitioners with a better understanding of the topic, with some practitioners using the PI's findings to improve their role as a WASH community worker.</p> <p>However, it is proposed that PIND may not have fully leveraged the contributions that the SNDP made in terms of improving sanitation in the Niger Delta. It is suggested that PIND could have embraced the SNDP more in order to have had further impact in terms of addressing appropriate sanitation technologies for the context (Prac9).</p>	<p><i>"within the WASH section [at PIND] there was sufficient transfer of knowledge excuse through [the PI's] efforts, which some of us like me and my other colleague have enveloped and we use those lenses to look at sanitation programming in different aspects of our work. But, when you look at the wider organization, the foundation in my opinion, my very personal opinion, may not have leveraged so much on the contributions [the PI] made in terms of sanitation within the Niger Delta. They have, they were able to take some of it, but if they had embraced it a lot more, I think they would have it a bit more impactful"</i> (Prac9)</p> <p><i>"In those sanitation organizations that [the PI] has been interacting with, I think the added knowledge has changed the way they work on sanitation with communities, I don't think that's too boastful a claim for [the] project"</i> (Res3)</p> <p><i>"in those sanitation organizations, [the PI] changed their views of how to interact and relate with communities because they were very top-down and very why don't they get that this is the right sanitation method, and [the PI] put that on its head"</i> (Res3)</p> <p><i>"It has made me to be more pass[ionate] about WASH. And better understanding of it."</i> (survey response)</p> <p><i>"I use some of [the PI's] findings to improve on my work as a WASH community worker."</i> (survey response)</p>	<p>Realized, clear project contribution</p> <p>Comments from practitioners and researchers verify the gaining in knowledge and application by PIND staff. However, it is suggested that PIND could have leveraged the contributions further.</p>
<p>Forum for WASH discussion grows</p> <p>[end-of-project outcome]</p>	<p>The PI played a leading role in the establishment of the WASH sector WhatsApp group (established on August 20, 2015) which brings together practitioners and different stakeholders working in the Niger Delta to share knowledge and best practices. At the time of the evaluation, there was 179 members of the WASH sector WhatsApp group. Practitioners are aware of the WhatsApp group and note that the PI continues to engage in the forum (Prac9). The majority of survey respondents (30) use the WhatsApp group 'more than once a week on average'. Respondents participate in the group in various ways including: using it to connect with other WASH practitioners (29); using information shared in the group (29); sharing information to the group (27); asking questions to the group (24); and answering other people's questions (24). Respondents also noted sharing job opportunities to the group (1), and copying the best practices of other organizations who are achieving in improving WASH including PIND and United Purpose (1).</p>	<p><i>"[the PI] still engages with the WASH sector within Nigeria. There is a WhatsApp platform where different stakeholders are represented and [the PI] is on that platform and [they] engage sufficiently"</i> (Prac9)</p> <p><i>"As the ATED program developed, implementing programs, and providing capacity building training to sector members, we hosted a WhatsApp group for people in the WASH sector to share experiences and knowledge"</i> (Doc3)</p>	<p>H</p> <p>Realized, clear project contribution</p> <p>Corroborated by practitioners within the interview data and surveys with those using the WASH sector WhatsApp group.</p>

<p>WASH sector recognizes WASH gaps, issues and opportunities</p> <p>[end-of-project outcome]</p>	<p>Practitioners suggest that the SNDP was an “eye-opener” which supported the WASH sector in recognizing gaps, issues and/or opportunities for the improvement of sanitation in the Niger Delta (Prac4, Prac5, Prac6). The PI’s work highlighted the need to explore appropriate technology and design to resolve issues with technology in Niger Delta environment (e.g., high water table), as well as the availability of materials to ensure the technology is scalable in communities (Prac5). Practitioners suggest that they have begun to prioritize the needs of individuals in the riverine communities (Prac6). The project provided a starting point and highlighted the need to collate knowledge to avoid duplication in work (Prac2). The SNDP served as a catalyst for thoughts and ideas around steps to ensure that appropriate technologies are available within the Niger Delta. For example, one organization was triggered by the SNDP to begin work on constructing a system that would comprehensively deactivate pathogens in human excrement (Prac4), while another has begun to focus on building a value chain around sanitation technologies that can be beneficial to the communities they work in (Prac5) – both are noted to have been influenced by the SNDP.</p> <p>Over half of survey respondents believe that the Nigerian WASH sector is generally more aware of WASH gaps, issues and/or opportunities now than 2 years ago (23), with only thirteen respondents disagreeing. As well as highlighting the WhatsApp group as a cause, a number of alternative explanations have been noted for this increased recognition including: increased awareness through the work of international organizations and CSOs; the implementation of the National Action Plan on WASH; increased media attention for public awareness; and the implementation of policies and attention to the issue by government. The majority of survey respondents (9) were ‘unsure’ whether the SNDP had contributed to the increased awareness of WASH gaps, issues and/or opportunities. However, the seven respondents who agreed that the SNDP had contributed to this increased recognition believed it had a direct contribution stating that PIND is using the findings to develop the WASH program, and the recommendations presented in the SNDP are being used to improve sanitation in the Niger Delta. The PI is noted to continue to share lessons and best practices that are adaptable to the Nigerian WASH context.</p>	<p>“[the project] also triggered or catalyzed thoughts around what could be done to have appropriate technologies, because without appropriate technologies, it will still be a big challenge. I think creativity around innovations, around appropriate technologies is also triggered by [the project], although we’ve not achieved a success yet. But I would say it’s in progress” (Prac4)</p> <p>“I think [the PI] commanded the positive of those forces while [they were] here. And [the PI’s] research spurred some of us into extra action on what we can contribute to address the gaps, the official gaps in Niger Delta. So that’s what I can say” (Prac4)</p> <p>“the research was an eye-opener, looking at [the project] made me realize that we have a gap in sanitation and there is need to start looking at number one, the technology, the suggestion of the design, issues that need to be resolved, and secondly, availability of the materials to be able to make this a scalable technology in the communities. Looking at the distributions, looking at the supply chain and the value chain within the sanitation sector. That [project] was an eye-opener, and as I mentioned, as a result of that and discussions with [the PI], we are now looking at sanitation and especially building a value chain around sanitation technologies that can be beneficial” (Prac5)</p> <p>“Some of the influence and some of the discussions [the PI] has had in that regard actually got some of us to begin to look at ways of prioritizing the needs of those persons in the riverine area” (Prac6)</p> <p>“One of the things that we realize as a group is that from [the PI’s] research and from [the PI’s] experience people don’t know in a really solid way where to start really. And so it really highlights the need to find a way to collate all the knowledge and the latest research that has been done and who knows what and put it in one location. So, [the PI’s] research I think highlighted some of that, that it’s really difficult to get information, it’s difficult to know which information is the best for a particular context” (Prac2)</p> <p>“I am sure now there is more information available to start looking at this seriously. Looking at the gaps, I think the gaps, for me, are very important so to be aware of the gaps and focus on the gaps. Whether there are outcomes of sector engagement, so that there is more collaboration between different sector players in the Niger Delta to coordinate some of their activities to be sure that there is no duplication” (Prac5)</p> <p>Survey themes:</p>	<p>H</p> <p>Realized, clear project contribution</p> <p>Corroborated by practitioners within interviews and over half of survey respondents. However, the majority of survey respondents were unsure as to whether the SNDP had directly contributed to increased awareness.</p>
---	---	---	--

		<ul style="list-style-type: none"> • Greater information sharing in the sector (Survey42) • Policy makers are signing law to support safe WASH (Survey9, Survey34) • Increased allocated budget in the WASH sector to address WASH issues (Survey17, Survey13, Survey34) • Increased focus and planning on achieving ODF status in Nigeria (Survey26, Survey27) • Media is creating awareness through campaigns (Survey13) • International organizations are creating awareness through their work on the topic (Survey2, Survey9) • PIND is using information/recommendations from the SNDP to develop a WASH program (Survey42) • CSOs working in WASH are now engaging with community and policymakers (Survey14) 	
<p>Nigeria's WASH sector has capacity for enhanced knowledge sharing and learning</p> <p>[end-of-project outcome]</p>	<p>Prior to the SNDP, the Nigerian WASH sector was working in silos. However, it is suggested that the need for collective engagement across the relatively small WASH sector was highlighted before the start of the SNDP by UNICEF and United Purpose (Prac9). The SNDP is noted to have supported this need for enhanced knowledge sharing and learning by emphasising the need for greater engagement and encouraging partnerships within the sector. With the sector being relatively small, information should in theory be shared rapidly in terms of best practices and lessons (Prac11). Practitioners suggest that the research has contributed to outcomes of sector engagement so that there is increased collaboration between WASH sector actors to coordinate activities and minimise duplication, subsequently resulting in a better return on work by emphasising the collaboration gap and forming relationships through the WhatsApp group (Prac5). If the SNDP had not been conducted, it may have taken longer for the sector to get to the point where they are having discussions on riverine sanitation in Nigeria – the SNDP was successful at highlighting issues and starting conversations on the topic (Prac6). Outcomes related to increased knowledge sharing and learning include increased partnerships with the Centre for Water and Sanitation Technology for training programs and the annual roundtable on sanitation (Prac9). However, some practitioners remain sceptical of knowledge sharing practices as some WASH organizations are unaware of other work that is underway in</p>	<p><i>"I am sure now there is more information available to start looking at this seriously. Whether there are outcomes of sector engagement, so that there is more collaboration between different sector players in the Niger Delta to coordinate some of their activities to be sure that there is no duplication, so there is better return from the work that is being done from government, from different stakeholders like NGOs and private sector"</i> (Prac5)</p> <p><i>"It would have taken a bit longer for us to get to the point where we are having active discussions on riverine sanitation in Nigeria, so, the fact that it highlighted the issues related to sanitation and got people talking about it about riverine sanitation for me is a plus"</i> (Prac6)</p> <p><i>"Before now, no. People were working in silos, a lot of people are working in silos. But, eventually, people began to understand that there's a lot of learning points from different organizations and there was a need for us to have a collective engagement. So, I think [the PI] was one of those who was able to influence the sector to buy into partnerships with the centre for the water sanitation technology in Canada to develop some training programs and try to see how this sector can be more engaging, how to see how different stakeholders can begin to collaborate. So, that has helped us to be more engaging, so there's more of knowledge sharing now. We now have, though not solely effort but I think [the PI] contributed, we now have the roundtable on sanitation that happens I think once every year, where all stakeholders come together to share knowledge and then agree</i></p>	<p>H,</p> <p>Realized, unclear project contribution</p> <p>corroborated by practitioners within interviews and the majority survey respondents. However, the majority of survey respondents were unsure as to whether the SNDP had directly contributed to increased awareness as some had not heard of the SNDP.</p>

	<p>the sector. It is also suggested that the sector is good at sharing positive outcomes, but lessons learnt are rarely shared (Prac4). The majority of survey respondents (20) agree that WASH practitioners in Nigeria share information with and learn more from each other more now than they did two years ago. However, respondents (10) were unsure as to whether the PI's research contributed to greater information sharing between Nigerian WASH practitioners stating that they were not aware of the SNDP. Of the seven respondents who stated that the SNDP had contributed to increased knowledge sharing, they suggested the SNDP had provided useful recommendations and increased their knowledge of the Niger Delta regions. One survey respondent suggests that there remains no strong synergy among WASH practitioners and other key players in the sector.</p> <p>Alternative explanations include the six Nigerian universities across six geographical regions that have also implemented their own knowledge sharing and learning programs which are federally funded (Res2). There has been an increased number of practitioners and key actors in the WASH sector, with increased sharing by NGOs (survey results). Lastly, respondents also note the CLTS roundtable which is a sanitation platform for knowledge sharing between different stakeholders (survey results).</p>	<p><i>on issues, so I think there is more of knowledge sharing now"</i> (Prac9)</p> <p><i>"We are working more as an integrated team now in that space. We're working now as an integrated team in that space. Again, we also have here at PIND, we also have what we call an ATED Centre"</i> (Prac4)</p> <p><i>"PIND has a demonstration centre with the intention that it becomes a resource centre within that community in the Niger Delta, providing both trainings and demonstrations on suitable technologies in sanitation. So that's the one I'm aware of through PIND"</i> (Prac5)</p> <p><i>"[the PI] is sharing lessons on the PIND initiated WASH group. [The PI] also shares lessons at WEDC conference and some regional conferences."</i> (survey response)</p> <p><i>"There is no strong synergy among the WASH practitioners and other key players in the WASH Sector"</i> (survey response)</p>	
<p>WASH sector explores technologies in high water table contexts</p> <p>[end-of-project outcome]</p>	<p>Practitioners suggest that the SNDP triggered creativity around innovations involving appropriate technologies for the Niger Delta region, with other projects beginning to explore methods of deactivating pathogens in human excrement (Doc4, Prac4, Prac9). Some projects have even begun to look at sanitation technologies for other parts of Africa with similar contextual issues (Prac5). For example, UNICEF has released an RFP for the exploration of suitable technologies in the Niger Delta region and a member of PIND has shown an interest in solving the technology problem – however, it is unclear to what extent the SNDP directly affected this. The bio-digester technology presented at the PIND ATED Demonstration Centre is beginning to gain traction due to partnerships between PIND and academic institutions exploring how technology can be promoted on a large scale to increase adoption rates (Prac3). However, it is noted by informants that success is not yet achieved – it remains a work in progress (Prac3). The PI also continues to work with non-</p>	<p><i>"Since completing the exploratory study, [the PI] has been working with non-government groups, governments and communities to develop safe, locally made and environmentally suitable toilets for the Niger Delta. [The PI] works with university students in the United States to develop a low-cost, durable toilet suitable to the Niger Delta"</i> (Doc4)</p> <p><i>"So I think creativity around innovations, around appropriate technologies is also triggered by [the project], although we've not achieved a success yet. But I would say it's in progress"</i> (Prac4)</p> <p><i>"[the project] was what triggered what the project I told you we are doing now on constructing a system that would comprehensively deactivate pathogens in human excrement"</i> (Prac4)</p> <p><i>"In fact, one of the [people] that they hired at PIND, I have talked to [them] about it, [they have] read [the dissertation] and [they are] also really interested in trying to solve that problem"</i> (Res4)</p>	<p>M</p> <p>Partially realized, unclear project contribution</p> <p>Interviews and surveys suggest that a reasonable number of projects have begun to explore technologies in high water table context. However, it is unclear to what extent the</p>

	<p>governmental groups, governments and communities to develop safe, locally made and environmentally suitable toilets for the Niger Delta (Doc4). The PI collaborates with university students through their role at TI to develop a low-cost, durable toilet suitable for the environmental context.</p> <p>The majority of survey respondents (9) were neutral when it came to whether the WASH sector is exploring technologies that are appropriate for high water table contexts. However, more respondents agreed (6 somewhat agreed; 6 agreed), rather than disagreed (6 somewhat disagreed; 2 disagreed; 1 strongly disagreed). Respondents (6) were unsure as to whether the SNDP had contributed to the exploration of WASH technologies for high water table contexts. However, five respondents suggest that the SNDP had contributed to this exploration to a reasonable extent.</p> <p>One practitioner within the interviews suggests that this outcome has yet to be achieved due to the fact that the sector is “young and naïve” resulting in few technologies being developed locally and little adoption of appropriate technologies (Prac11).</p>	<p><i>“I think based on [the PI’s] research also [the PI] has influenced key organizations like UNICEF to look at technology options for the Niger Delta, looking at focusing more on dealing with sanitation issues within the Niger Delta, so I think it has contributed quite a lot” (Prac9)</i></p> <p><i>“With the support of [the PI] and [their] organization, Transform International, we’ve now also ventured into sanitation and are now currently piloting a sanitation product that will improve sanitation for part of western Kenya where we are working” (Prac5)</i></p> <p><i>“the sector being young and naïve, that means that there hasn’t been a lot of technologies developed locally, there’s not a lot of innovation there, nor have they effectively brought in many technologies, in fact they are only really beginning to do that recently. In fact, there are only really a few examples of technologies coming into Nigeria and most of them haven’t been promulgated very, duplicated, or taken to scale in a meaningful fashion or with any success” (Prac11)</i></p> <p><i>“Because there is lack of technology advancement and new innovations to improve the WASH Sector in the country” (survey response)</i></p> <p><i>“I do not know to what extent this research is going on. This is not made public” (survey response)</i></p>	<p>SNDP affected this.</p>
<p>WASH sector take up and implement recommendations</p> <p>[high-level outcome]</p>	<p>It is suggested that the WASH sector in Nigeria has taken up and implemented some of the PI’s recommendations in the approach to improving sanitation in the Niger Delta (Prac4). The sector has begun to develop a small number of appropriate, affordable and durable sanitation options through a research consultant that was commissioned to develop technology options for the Niger Delta and train artisans to build such options (Prac9). Other INGOs have focused their work on an understanding of market approaches (Prac4). Improved coordination and knowledge sharing are noted to be underway including through the CLTS roundtable and experts sharing knowledge and training on appropriate sanitation technologies (Prac9). CLTS has also been reviewed in Nigeria and has now been rebranded as CLTS++ which has been taken up by the WASH sector showing an extension on behaviour change approaches (Prac9). The private sector is also playing a more leading role in regard to developing innovative options for appropriate technology (Prac9). The recommendation to encourage significant improvements at government level has</p>	<p><i>“one of the INGOs working here in Nigeria [...] they are changing [...] now, though they are not solely based in the Niger Delta. They operate in two major states in the country; one of course is the Niger Delta. [...] So I think part of their success, you know, leverages on understanding the central market and who should come into that space. [...] I believe [...] they would have also learned from [the PI’s] reports. Yeah, but United Purpose have had some success in Nigeria now, I believe they learned from [what the PI] did and what others did in the sector, they learned from what is all integrated” (Prac4)</i></p> <p><i>“the first [recommendation] which is to develop a small number of appropriate, affordable and durable safe sanitation options, that the sector has taken up. [...] there was a research consultant that was commissioned to develop technology options for the Niger Delta and be able to train artisans that can build these technology options. The second recommendation which is to improve coordination and knowledge sharing, it is happening now, there is the CLTS roundtable [...] for the first time in Nigeria we had an expert for affordable water sanitation</i></p>	<p>M</p> <p>Partially realized, unclear project contribution</p> <p>Although there is corroboration between the interviews and survey data that recommendations have been taken up and implemented, it is unsure to what extent the research had a</p>

	<p>also seen progression with national government attempting to motivate regional governments to focus on the issue of improving sanitation (Prac9). However, it is unclear to what extent the PI directly contributed to these changes. It is also suggested that United Purpose learnt from the PI and what others have done in the sector and integrated these learnings (e.g., the need to explore appropriate sanitation technologies while implementing behaviour change frameworks) into their own work (Prac4).</p> <p>Survey respondents suggest that the SNDP provided recommendations which are improving WASH sector issues, particularly in the Niger Delta. In particular, the recommendations on sanitation technology options in the Niger Delta are stated as a great lesson for the region, with some WASH workers using the findings to improve their work on WASH.</p>	<p><i>technology coming to train on affordable and appropriate latrine options in the Niger Delta. So, I think [the PI's] recommendations have been taken up by the sector [...] CLTS has been reviewed and there is also the opportunity to have the CLTS++ that has been taken up by the sector. [...] market-driven approaches that is very strongly done now, we have the private sector coming in with very innovative options in terms of sanitation. And encourage significant improvements at the government level, yeah this is happening at the national level, and the national level is trying to motivate the different regional governments, so I think all of [the PI's] recommendations are being taken up at one point or the other"</i> (Prac9)</p> <p>"[the PI] provided some recommendations from [their] studies that is improving WASH sector issues, particularly in the Niger Delta" (survey response)</p> <p>"The recommendations on sanitation technology options in the Niger Delta is a great lesson for the region" (survey response)</p> <p>"I use some of [the PI's] findings to improve on my work as a WASH community worker." (survey response)</p>	<p>direct affect on this.</p>
<p>Master trainers improve their WASH training skills (DEWT)</p> <p>[high-level outcome]</p>	<p>One practitioner discusses a training that was supervised by the PI while they were completing the SNDP in the Niger Delta which focused on the effectiveness of the training of trainers. There is evidence suggesting that the training of trainers was taking place, but there is insufficient evidence to discuss whether these trainers were improving their skills, or to qualify which skills were developed.</p>	<p><i>"the content of [the project report], to me, would lead my mind back to one of the trainings [the PI] supervised when [the PI] was here. [...] we had one of the WASH advisors then – a Nigerian facilitator – the training was on delivering effective WASH training"</i> (Prac4)</p>	<p>L</p> <p>Insufficient evidence</p> <p>Trainers were not accessible to interview, and other informants were unable to speak to this outcome.</p>
<p>Visitors to ATED learn and gain more awareness about WASH issues</p> <p>[high-level outcome]</p>	<p>Practitioners suggest that visitors to ATED are learning and gaining more awareness on WASH issues, particularly around appropriate technology options such as the bio-digester and bio-san filter which are on display at the centre (Prac3, Prac5). The centre also provides trainings and demonstrations on suitable technologies for safe sanitation within the Niger Delta context which would not otherwise be available (Prac5). It is suggested that it is through the PI's direct efforts that the ATED Demonstration Centre has the appropriate technology options for people to view and learn from (Prac9). It is also suggested that there has been the adoption of some bio-digester technologies, but not without struggles (Prac3). The</p>	<p><i>"PIND has a demonstration centre with the intention that it becomes a resource centre within that community in the Niger Delta, providing both trainings and demonstrations on suitable technologies in sanitation [...] and they've set up what they call a CTC, a community transformation centre, community members have access to information that inevitably wouldn't be available on number one – the different technologies available in sanitation, especially those technologies that are suited to the Niger Delta. Secondly, those who want training on those types of technologies can receive those trainings, which is important"</i> (Prac5)</p>	<p>M</p> <p>Realized, clear project contribution</p> <p>Corroboration between the interviews, however, visitors to ATED Demonstration Centre were not</p>

	<p>ATED Demonstration Centre has over 1,500 visitors who are carefully selected to raise awareness of issues around sanitation and technologies. For example, the centre focuses on inviting academic institutions who are most likely to share the information with students and teach on the subject. Professional bodies are also invited due to the possibility of them implementing the technology into their activities and change attitudes (Prac3). Evidence from the SNDP also suggests that participants in the SNDP expressed great interest in technologies displayed at the ATED Demonstration Centre (Doc3).</p>	<p><i>“It was through [the PI’s] effort that the [PIND] foundation has an appropriate technology bio-digester technology option that is a model for people to come and see how waste can be transformed into energy within the Niger Delta, so I think that’s a good one” (Prac9)</i></p> <p><i>“for the visitors it does actually attract quite a lot of interest and it creates a lot of awareness as to one way of curbing sanitation issues in the Niger Delta with the biodigester, and then another way of saying that you can address sanitation issues by getting clean water through the bio-san filter [...] and there has been slight adoptions of those” (Prac3)</i></p> <p><i>“Those two [technologies] are beginning to create those changes of the awareness, the fact that they are on display at the ATED Centre, everyone who comes to the ATED Centre and the centre has had over 1,500 visitors and the visitors are carefully selected, so they are getting more awareness around issues of sanitation and technologies that can actually solve those sanitations” (Prac3)</i></p> <p><i>“If an academic institution comes for a visit they are most likely to take advantage of the students and take it to their university environment and talk about it, teach about it [...] if we talk about professional bodies, they can go back to their professional bodies and say ‘Hey, if we are constructing an energy efficient home in the future maybe we need to start thinking about having some kind of renewable energy biodigester or biogas which is a renewable energy’ [...] they are more likely to take the information out and use it to change attitudes as they go along” (Prac3)</i></p> <p><i>“When asked about bio-digesters, a participant, who had seen the bio-digester at the ATED Centre in Warri (PIND) expressed great interest” (Doc3)</i></p>	<p>available for interview.</p>
<p>Niger Delta communities’ thinking around sanitation is stimulated to encourage receptivity to new technologies and WASH practices and shift cultural norms</p> <p>[high-level outcome]</p>	<p>The SNDP is suggested to have supported the education of the local community and organizations with which the PI was associated (Prac1). The SNDP shifted the attitudes of the people within the Niger Delta by presenting the need for affordable solutions to help solve the sanitation problem in the region (Prac4). Evidence suggests that a progressive attitudinal change has been achieved because of the PI’s work within the region as communities now believe that there are appropriate technologies/solutions, although solutions may not be reached soon (Prac4). The ATED Demonstration Centre is also assisting in stimulating the thinking of</p>	<p><i>“I think [the PI] was helping to educate the local community and organizations that [the PI] was associated with” (Prac1)</i></p> <p><i>“for [communities] to now believe that here could be an affordable solution, I think that is quite commendable [...] So I would say there are the progressive attitudinal change because of what [the PI] did because the people believe there are technologies or they believe that there are solutions somewhere, although it may not be reached soon, but there is a solution” (Prac4)</i></p> <p><i>“So, those two [technologies] attract quite a lot of interest in the WASH areas, for the visitors it does actually attract quite a lot</i></p>	<p>M</p> <p>Partially realized, unclear project contribution</p> <p>Some interviewees suggest that there has been a change in thinking,</p>

	<p>communities to encourage receptivity to new technologies and WASH practices. For example, the bio-digester is attracting a lot of interest, has been promoted by PIND partners and academic intuitions, and is generating increased awareness as to methods of solving sanitation issues in the Niger Delta (Prac3). Due to the engagement of local people within the research, it can be expected that they would gain knowledge from the two-way exchange process which would have led to attitudinal change to safe WASH practices (Res1). No community members were available for interview to evidence this claim.</p> <p>However, it has been a struggle to get new technologies adopted with informants unsure as to why (Prac3). Informants note the “community of issues” facing the Niger Delta resulting in difficulties of getting people to buy-into new technologies due to the history of donor hand-outs (Prac11). Although CLTS has been used to support attitudinal change, the history of donor hand-outs in terms of providing financial aid has led to a reluctance to invest in latrines. If communities do build their own latrines, they are likely to be unsafe and not meet the SDG targets due to the lack of available materials (Prac11). These changes in attitude and mindset are noted to take a considerable amount of time (Prac3).</p> <p>There are several alternative explanations presented for the stimulated thinking of communities to encourage receptivity to new technologies and WASH practices. For example, there have been a number of radio and television programs addressing the issue of open defecation that have helped to contribute to slow and gradual changes (Prac3). Other NGOs in the area have also been working on sanitation challenges including hygiene promotions, sanitation marketing, and sanitation financing (Prac6).</p>	<p><i>of interest and it creates a lot of awareness as to one way of curbing sanitation issues in the Niger Delta with the biodigester, and then another way of saying that you can address sanitation issues by getting clean water through the bio-san filter” (Prac3)</i></p> <p><i>“[the Niger Delta has] a specific community of issues which is they are used to a donor hand-out which means it is very hard to get people to buy-into technologies [...] processes of CLTS of course conflict with that donor hand-out that they are used to in the Niger Delta, so that means they are unlikely to invest in latrines furthermore CLTS says build your own [...] if you build your own toilet in those environments they’re not going to be safe latrines, they are very far going to be safe, from safe sanitation systems which is demanded of the SDGs” (Prac11)</i></p> <p><i>“When you introduce something new or something that is a solution to a challenge it takes longer for people’s minds to be open to it and then it takes a bit of time to have that change in attitude before you see some kind of adoption or some kind of replication and adaptation of that recommendation. So, I think it is a slow thing, to embrace it such opportunities or technologies or solutions ...there’s been some slow, gradual changes, people are beginning to get aware of it and there has been a lot of radio programs and television programs addressing the issue of open defecation” (Prac3)</i></p> <p><i>“I can speculate that when you get good technological research, technology-based research that has a really strong social component, it can’t help but change things and I’m sure [the PI’s research] has. By definition it has to because [the PI] worked with local people and they gained experience [...] [the PI] taught them and they taught [the PI] and they would have to be able to change their behaviour somewhat” (Res1)</i></p>	<p>however the extent of direct contribution by the SNDP is unclear. It is also noted that changes in attitude and behaviour can take a considerable time to manifest.</p>
<p>Communities in Niger Delta have access to appropriate, affordable and safe technologies to address WASH</p> <p>[high-level outcome]</p>	<p>There is limited evidence to suggest that the SNDP had a direct influence on communities in the Niger Delta having access to appropriate, affordable and safe technologies to address WASH. It was not a primary objective of the SNDP to contribute to the identification of new technologies. However, through prompting SNDP informants to reflect on WASH and highlighting the gaps in appropriate technology solutions, it is likely that the SNDP triggered others to explore and pilot appropriate and affordable technologies with the objective to increase community access.</p>	<p><i>“So the people now [...] they were still looking for designable, to improve on the design, at least the biosand filter could have removed the contaminants from the water. And then, ‘Okay, we’re going to pilot this, we’re going to pilot that’. So I would say there are the progressive attitudinal changes because of what [the PI] did because the people believe there are technologies or they believe that there are solutions somewhere, although it may not be reached soon [...] they can remedy the situation while a kind of permanent solution which is preventive arrives” (Prac4)</i></p>	<p>M</p> <p>Partially realized, unclear project contribution</p> <p>Practitioners suggest alternative explanations for the particle</p>

	<p>A number of alternative explanations are presented that support the partial realization of this outcome. For example, pilots have been completed by other NGOs working in the topic specifically looking at reducing appropriate technology costs (including sourcing local materials) (Prac4). There has also been an increased focus on the topic of improving sanitation with a number of new actors entering the sector to provide facilities to reduce the rates of open defecation (Prac4). The increased presence of “front-runners” in the discussions, and the recent dedication to ending open defecation has focused activities on finding a solution for appropriate sanitation technologies for communities in the Niger Delta (Prac6). One survey respondent suggests that there has been increased knowledge and access to adequate water and sanitation facilities – however, it is not determined to what extent this is related to the SNDP.</p> <p>Some evidence suggests that this outcome has not yet been realized. For example, the sector is viewed as “young and naïve” with few appropriate technologies being developed locally and with high costs (Prac11). With minimal innovation occurring, few technologies have been successfully implemented in the region. Other NGOs have not focused on the sanitation aspect of WASH but have instead focused on providing access to clean water (Prac3). On a macro scale, practitioners suggest that the appropriate infrastructure is not yet in place to support the implementation of appropriate technologies within these communities (Prac3). It is also noted that there has been little advancement in technology as the resources are inadequate and not in place (survey). Although there have been increased discussions on the topic, there has been little adoption due to the changes in attitude and mindset required which is a slow and gradual process (Prac3, survey).</p>	<p>“[the topic] <i>has found its way into the [...] the front runners when it comes to discussions on sanitation improvement in this sector. Before now, not too many persons were maybe not aware or about that of finding solutions for the Niger Delta. I think the recent vibes around ending open defecation and prioritizing, rather than focusing on latrine construction, people are now beginning to put more emphasis on ending open defecation, that has really drawn a lot of attention for as long as there is no solution in terms of latrine technology options for people living in those wetlands, then stopping open defecation in such environment will remain difficult, if not impossible</i>” (Prac6)</p> <p>“UNICEF was running pilots when I was at Bayelsa state, and each eco-salle latrine facility cost about 400 000 naira [~\$1100 USD]. I led a team that, for that localized unit, and the unit cost dropped to about 70 000 naira [~\$200 USD] which is also yes, making it more affordable [...] because the materials can be locally [...] we saw that different households began constructing quality latrines” (Prac4)</p> <p>“there hasn’t been a lot of technologies developed locally, there’s not a lot of innovation there, nor have they effectively brought in many technologies, in fact they are only really beginning to do that recently [...] there are only really a few examples of technologies coming into Nigeria and most of them haven’t been promulgated very, duplicated, or taken to scale in a meaningful fashion or with any success” (Prac11)</p> <p>“We haven’t really gone deep into the sanitation aspect of WASH, so we are focusing more on access to clean water in our WASH project” (Prac3)</p> <p>“[the open defecation problem is] a combination of people not actually getting the infrastructure that is required into those communities and the lack of technology [...] it is just getting the resources or getting the right kind of people to make sure those infrastructure gets to those communities [...] there has been a lot of talk about it, but I am yet to see some adoption coming out of it [...] I think there are a lot of changes in attitude and changes in mindset, so it takes much longer [...] So, I think it is a slow thing, to embrace it such opportunities or technologies or solutions” (Prac3)</p> <p>“Increased knowledge and access to adequate water and sanitation facilities” (survey response)</p>	<p>realization of this outcome.</p> <p>However, it is unclear to what extent the SNDP contributed to this partial realization.</p>
--	---	--	--

		<p>“There are no new knowledge or technology to advance or achieve the WASH sector because we don't have resource centers for WASH like library” (survey response)</p> <p>“Attitudes is [sic] difficult to be changed” (survey response)</p>	
Government Policy and Practice Pathway			
<p>Local governments have enhanced capacity for improved policy and effective WASH practice</p> <p>[end-of-project outcome]</p>	<p>Due to the inaccessibility of government informants, there is limited evidence from the interviews to support the realization of this outcome. However, a number of alternative explanations have been suggested. For example, efforts have been made by agencies such as UNICEF to train RUWASSA and build their capacity (Doc3). Six federally funded universities across six regions of Nigeria have created capacity-building programs for citizens, civil servants and NGOs to share WASH knowledge and training (Prac8). The federal government is trying to incentivise states to take action in putting sanitation as a priority and encourage capacity building for staff (Prac8). Survey respondents also note that there has been some building of partnerships between the government and civil society to intervene in the WASH sector. From federal to LGA leadership, there is now the understanding of what ending open defecation means, with greater focus by LGAs of ending open defecation. However, it is unclear to what extent the SNDP supported these developments due to the number of other interventions under way in the Niger Delta WASH sector.</p> <p>Although efforts have been made by international NGOs to build capacity, there remains no regional resource that government staff or community members can turn to for information, certification or skills development (Doc3). As noted by the PI, having this regional source of knowledge and training, with levels of certification, could be very beneficial (Doc3). The majority of survey respondents suggest that a lack of political will and commitment at the sub-national level is one of the main challenges facing the improvement of WASH in Nigeria. It is noted within the survey that local governments are not prioritizing WASH in their development agenda leading to poor funding and the inability to implement WASH projects. Capacity-building at the grassroots level, including LGA and communities, should be intensified to ensure the sustainability of WASH developments (survey).</p>	<p>“Efforts have been made by agencies such as UNICEF to train RUWASSA staff and build their capacity” (Doc3)</p> <p><i>“I just talked about capacity-building programs for example – if that starts in Nigerian universities [...] there will be six universities across the six regions, these are federally funded universities, we expect the states to sponsor all and encourage their citizens, their civil servants, their NGOs to attend these programs because there are no staff that federal government wants to send to these programs for example in the Niger region. So, the state governments of the Niger region must think that this is a use for them and send their staff or their citizens to these universities. They themselves can also adapt these programs within their state universities for example if they wish. So, the federal government is trying to incentivise the states to take action”</i> (Prac8)</p> <p>“Although efforts are made by international NGOs to build capacity, there is no regional resource that government staff or community members can turn to for short courses, resource information, or certification of their skills. Having a regional source of knowledge and training, with levels of certification, could be very beneficial” (Doc3)</p> <p>“Lack of political will at the sub-national level” (10 survey responses)</p> <p>“inability of government to implement WASH projects” (survey response)</p> <p>“Lack of funding from government” (2 survey responses)</p> <p>“To WASH in Nigeria, capacity building at the grassroots level (LGA WASH and the community) should be intensif[ied] to ensure sustainability.” (survey response)</p> <p>“From minister down to the LGA, leadership now understand what ending open defecation means and some LGAs are now working towards ending OD, the country now a guiding protocol for verification, certification and validation of ODF. More LGAs now advancing toward reaching LGA wide ODF” (survey response)</p>	<p>M</p> <p>Partially realized, unclear project contribution</p> <p>Government informants were not available for interview. However, survey data suggests some improvements have been made, but the connection to the SNDP remains unclear.</p>

<p>Local governments recognize WASH gaps (issues and opportunities) and have enhanced commitment to action on WASH</p> <p>[high-level outcome/impact]</p>	<p>Due to being unable to access government informants, there is limited evidence from the interviews to support the realization of this outcome. However, a number of alternative explanations have been presented. For example, the National ‘Clean Nigeria: Use the Toilet’ campaign was launched on November 19, 2019, by the Vice President of Nigeria (Prac8). On November 20, 2019, the President signed an executive order backing the campaign. A number of state National Action Plans or State Master Plans are in development to comply with the executive order (Prac8). The Warri Economic Summit was also held in 2019 where the challenges of sanitation were a major topic for discussion, which some local governments are pushing for (Prac8). However, it is unclear as to whether the SNDP contributed to these developments.</p> <p>Survey respondents suggest that there has been low commitment to action on WASH at all levels, with more needing to be done. However, it is suggested that all levels of government now understand what ending open defecation means, with some LGAs working towards and promoting this goal by implementing financial commitments. The Society of Water and Sanitation (NEWSAN), is currently building capacity to create more awareness in states and communities.</p>	<p><i>“So one of the things that we’ve done like I said is preparing the National Clean Nigeria ‘Use the Toilet’ campaign. So, we have prepared a proposal on that and that was launched only a week ago, [...] by the vice president. And on the second day [...] the President signed an executive order which is a kind of executive law backing the Clean Nigeria campaign [...] in one or two states I am supporting them to prepare national action, state action plans or state master plans” (Prac8)</i></p> <p><i>“We recently had something called the Warri Economic Summit where the challenges of sanitation were a major topic for discussion, so part of it was they are now going to try and see how they are going to try and deal with the sanitation [...] I know that [WASH] was something major on the agenda because a team of them did come to see the biodigester at the ATED Centre [...] So again, it is the local government in this instance that was pushing for this” (Prac3)</i></p> <p>“Low commitment by government at all levels.” (survey response)</p> <p>“From minister, down to the LGA leadership, now understand what ending open defecation means and some LGAs are now working towards ending OD, the country now a guiding protocol for verification, certification and validation of ODF. More LGAs now advancing toward reaching LGA wide ODF” (survey response)</p> <p>“Also some state governments have made financial commitment to promote WASH in their states such as Cross river and Benue States. Finally, the society of Water and Sanitation (NEWSAN) in Nigeria is building the capacity of her members to create more awareness and interventions in their states and communities.” (survey response)</p>	<p>M</p> <p>Partially realized, unclear project contribution</p> <p>Government informants were not available for interview. However, evidence from interviews and surveys suggests some improvements have been made, but the connection to the SNDP remains unclear.</p>
<p>Local governments seek evidence-based information/solutions for WASH decision-making</p> <p>[high-level outcome/impact]</p>	<p>Due to being unable to access government informants, there is limited evidence from the interviews to support the realization of this outcome. Alternative explanations include the National Action Plan to revitalise the WASH sector in Nigeria. The Minister and Director of Water and Sanitation are advised by consultants on the implementation of the action plan. Consultants provide technical assistance, support the clarification and formulation of strategies and implementation steps to fulfill the targets identified in the plan which include achieving SDG 6 by 2030 and an open defecation free Nigeria by 2025 (Prac8). Other reports exploring the issues around sanitation have been sponsored by state government,</p>	<p><i>“I presently advise the federal government [...] I am facilitating and coordinating what is called Nigeria’s national WASH plan. The national WASH plan is officially called the National Action Plan to revitalise the WASH sector in Nigeria. It was launched by President Buhari in November 8, 2019 and an office was set up in December 2019, [...] I advise the Minister and the director in charge of water, and the director in charge of sanitation on the roll out of this action plan. So, basically I coordinate an office that supports states providing them technical assistance, helping the central government to clarify and formulate strategies and implementation steps to rule out and fulfill the targets settled in this plan which is a national plan to achieve SDG 6 by 2030 [...]</i></p>	<p>L</p> <p>Insufficient evidence</p> <p>Government informants were not available for interview to support the realization of this outcome.</p>

	supporting the notion that local governments are seeking evidence-based information and solutions for WASH decision-making (Prac3).	<p><i>one of the proposals that has come out of the National Action Plan is to prepare steps to achieve an open defecation free country by 2025 in Nigeria” (Prac8)</i></p> <p><i>“a colleague and a friend who has done something around sanitation recently [...] it was a very in-depth [...] sort of like a stakeholders meeting, but it went into the terrain, into the communities getting information as to the challenges and the issues around sanitation [...] it was sponsored by WaterAid and the state government” (Prac3)</i></p>	
<p>Local governments take up and implement policy for effective WASH practice</p> <p>[high-level outcome/impact]</p>	<p>Due to being unable to access government informants, there is limited evidence from the interviews to support the realization of this outcome. Alternative explanations include the ‘Clean Nigeria: Use the Toilet’ campaign which is now underway and backed by an executive order signed by the President of Nigeria. Consultants have been assisting the preparation of the National Action Plan to support the implementation of this campaign (Prac8). Consultants note having used research from WaterAid as evidence in decision-making for the implementation of the National Action Plan (Prac8).</p> <p>Survey respondents suggest that some states have started to implement WASH policy and have even passed it into law, and are approving budget (e.g., the Open Defecation Free Road Map and implementation guidelines). Respondents note the policy formulation by the Federal Government of Nigeria which has been domesticized by some state governments. However, some survey respondents suggest that policymakers lack the will to enforce the implementation of WASH policy leading to poor policy implementation.</p>	<p><i>“one of the things that we’ve done [...] is preparing the National Clean Nigeria ‘Use the Toilet’ campaign [...] we have prepared a proposal on that and that was launched [...] last week [...] by the vice president [...] the President signed an executive order which is a kind of executive law backing the Clean Nigeria campaign [...] in one or two states I am supporting them to prepare [...] state action plans or state master plans, for example, so working with governments directly [...] So, those are some of the kind of things that we support government and all the government partners to deliver” (Prac8)</i></p> <p><i>“The policymakers lack the will to enforce the implementation of the policy of the WASH.” (survey response)</i></p> <p><i>“Poor funding and policy implementation” (survey response)</i></p> <p><i>“Some states have started implementation of WASH policy at the sub-national level and have it passed into Law.” (survey response)</i></p> <p><i>“Policy formulation by Federal Government of Nigeria and Domestication of some policies by State Government” (survey response)</i></p> <p><i>“Policy makers are signing law and approving budget.” (survey response)</i></p>	<p>M</p> <p>Partially realized, unclear project contribution</p> <p>Government informants were not available for interview. However, evidence from interviews and surveys suggests some policy has been implemented, but the connection to the SNDP remains unclear.</p>
Professional Development Pathway			
<p>PI’s professional development enhanced by research experiences</p> <p>[intermediate outcome]</p>	<p>The SNDP placed the PI in a position of being viewed as a WASH expert. Informants note that the PI has an advisory role and is a resource for information on WASH (Prac2, Prac5, Res3). Survey respondents also suggest that the PI is an “<i>encyclopedia for the WASH sector</i>” (survey40). The SNDP provided the PI with more motivation to discuss sanitation as an urgent issue and a key priority for organizations. The contextual nature of the research being in a difficult area, somewhat dangerous and politically controversial had a positive effect on the PI who is now able to complete research</p>	<p><i>“Although [research has] barely scratched the surface in making an impact, the depth of [the PI’s] understanding and approaches to interventions have been permanently changed” (Doc3)</i></p> <p><i>“[the PI’s] time in the Niger Delta [was] a life-changing experience [the PI has] been inspired and touched by so many” (Doc3)</i></p> <p><i>“I would say [the PI] being a WASH expert is completely plugged in” (Prac2)</i></p>	<p>H</p> <p>Realized, clear project contribution</p> <p>Corroboration across interviews, documents and surveys that the PI’s professional</p>

	<p>in similar environments (Res1). Academically, it is suggested that the PI became very quickly adept at research communication, including developing a sustained argument, and learnt how to make room for other perspectives within the international development realm (Res3, Res4).</p> <p>The PI suggests that the SNDP was a life-changing experience which has permanently changed their depth of understanding and their approach to interventions (personal communication). The PI's professional and practitioner role was improved, deepened, broadened and heightened by completing the SNDP, which included expanding their professional networks (Res4). The SNDP also provided the PI with a level of credibility in the topic, with the build-up of knowledge and expertise based on project experiences providing the PI with more tools for their future work on the topic (Res4).</p>	<p><i>"having done the research puts [the PI] in a position where [the PI] becomes a very good advisor and good resource for us as an organization"</i> (Prac5)</p> <p><i>"[the project] put [the PI] on a pedestal where [the PI] has more motivation, I would say, to talk about sanitation as a key priority for organizations to look at. And that then comes up in discussions we had with [the PI], and from that and the insights from [the] research, we have been able to learn of the urgency and priority level that is required"</i> (Prac5)</p> <p><i>"[The PI] did research in a difficult area, somewhat dangerous and certainly politically controversial, not everybody likes outsiders there, so I am sure that [the PI] probably changed for the better because I know that [the PI] could go there or anywhere else in the controversial world and do research"</i> (Res1)</p> <p><i>"having completed the doctorate on this topic [the PI is] surprised at the credibility it has given [them]"</i> (Res4)</p> <p><i>"how important it is to make room for other people's points of view and how positionality can really blind you to understanding [...] having that really healthy dose of scepticism and space for other perspectives is, especially in international development, is a really important skill or ability, so I think that is something that has come out of all of this"</i> (Res4)</p> <p><i>"[The PI] became very adept at...research communication. And other than that, very quick and dirty research communication, [the PI] had to learn how to develop a sustained argument and [the PI] did, very quickly"</i> (Res3)</p> <p><i>"there is no doubt that people recognize [the PI's] experience and their competence"</i> (Res3)</p> <p><i>"In fact [the PI] is an encyclopedia for the WASH sector"</i> (survey response)</p>	<p>development was enhanced by the experience.</p>
<p>The PI has deeper understanding of issues in WASH and how to approach working in challenging contexts</p> <p>[end-of-project outcome]</p>	<p>Insights that are captured within the SNDP, as well as other insights that have arisen out of the research process, have put the PI in a position where they are able to provide useful ideas, support and insights into collaborations in sanitation in terms of designing solutions, filling gaps and uncovering challenges before identifying solutions (Prac5). The build-up of knowledge and expertise from the research experience reinforced the PI's understanding of the topic and has provided them with more tools when working in regions outside of the Niger Delta who face similar sanitation</p>	<p><i>"the depth of [the PI's] understanding and approaches to interventions have been permanently changed"</i> (Doc3)</p> <p><i>"There are insights that are captured within the research itself...but I'm sure there are other insights that have come about as a result of [the PI] doing the research and then put [the PI] in a position when in discussions and collaborations [the PI has] been able to provide very useful ideas and support and insights into the work that we do in sanitation in terms of designing it, designing solutions, in terms of looking at filling the gaps that exists in terms of carrying out our own assessments within our</i></p>	<p>M</p> <p>Realized, clear project contribution</p> <p>Corroboration between interviews and documents.</p>

	<p>challenges which has permanently changed the PI's depth of understanding and approaches to interventions (Doc3). The process provided the PI with an opportunity to explore an area which they were passionate about and spend time focusing on a topic which has proven invaluable.</p>	<p><i>local context, and finding what the challenges are before we have to get into the solutions"</i> (Prac5)</p> <p><i>"Papua New Guinea faces a number of the same issues [as the Niger Delta]. [The PI] has been approached by an individual working in the Gulf State of Papua New Guinea to complete their WASH assessment. [The PI] suggests that this build-up of knowledge and expertise based on the experiences [the PI] has had has provided [the PI] with more tools and a different starting place when [the PI] visits a new environment"</i> (Res4)</p> <p><i>"Those were things that [the PI] had experienced just as a practitioner in the field in [the PI's] work, but it was reinforced through [the PI's] doctoral work and just talking to different people in different situations"</i> (Res4)</p> <p><i>"[The project] absolutely informs what [the PI] think[s] and feel[s] because [...] doing the degree and doing the research was a fantastic opportunity to dig into something that [the PI] was passionate about anyway, we don't often get that opportunity. So, it really let [the PI] dig and spend the time and that's been absolutely invaluable"</i> (Res4)</p>	
<p>Knowledge network of scholars and practitioners share development knowledge and facilitate knowledge-to-practice transformation (TI)</p> <p>[end-of-project outcome]</p>	<p>The PI is now the executive director of the non-governmental organization Transform International (TI), which has a primary focus on WASH (Doc4). This is one of the most substantial outcomes of the SNDP which has contributed to the knowledge and understanding of what is needed in a local context to support international development (Prac2). TI identifies regional NGOs in developing countries that are succeeding, but want to expand or improve, and invites them to join a network of similar NGOs. TI works with this network of NGOs to plan, identify resources, and provide advice on how to sustain growth and ensure the NGOs are better equipped to serve their region. TI connects these networks to create a forum for the sharing of best practices (Prac7). TI is noted to align organizations working on similar topics to ensure there is no overlap and duplication, and that gaps are not left (Prac2). TI is also currently working with university students in the United States to develop low-cost, durable toilets suitable to the Niger Delta context using global connections and practitioner knowledge. The PI uses their knowledge gained from the SNDP within TI's current work.</p> <p>The PI turned their knowledge on safe WASH into action through TI projects and continues to share their knowledge through TI with other practitioners working in different</p>	<p><i>"[The PI] is now the executive director of the non-government organization Transform International, which focuses on water sanitation. [The PI] works with university students in the United States to develop a low-cost, durable toilet suitable to the Niger Delta"</i> (Doc4)</p> <p><i>"[TI has] a country liaison report and [TI] have about ten countries that [the organization] are working in right now, one of them being the Niger Delta. [The PI] gives [their] report, [others] give it on Malawi and Papua New Guinea as an example, others give it on Kenya, Tanzania and Bolivia and the other ones that [TI] are working in. When anyone of [TI] give a report, [they] do so on a monthly basis and provide an update, in doing so [...] when [TI] worked in Niger Delta, here's how [TI] approached that problem, so [TI] are basically constantly sharing success stories and examples"</i> (Prac1)</p> <p><i>"So, it is sharing success stories [through TI] in equal amounts of ways that makes the big change"</i> (Prac1)</p> <p><i>"[The PI] started TI as a result of [their] research"</i> (Prac2)</p> <p><i>"WASH [...] is one of the primary focuses of TI – so most, if not all, most of the organizations or projects that [TI] support have in some way, shape or form a WASH-related activity or project"</i> (Prac2)</p>	<p>H</p> <p>Realized, clear project contribution</p> <p>Strong corroboration between interviews and documents.</p>

	<p>regions (e.g., Malawi, Papua New Guinea, Kenya, Tanzania, Estonia, and Bolivia) through a two-way knowledge exchange of best practices. TI are the conveners, the facilitators and the organization that brings knowledge and skills together to facilitate conversation and build a collective vision (Prac2). The PI's knowledge base and inclusive ideas ultimately guide the organization which creates a firm foundation for collaborators work and sets the tone for the organization as a whole (Prac7). Without the SNDP, it is unlikely that TI and its associated networks would have been formed (Prac7).</p> <p>TI also contributes to capacity-building by providing WASH training, behavioural training, technical training, and workshops to local organizations to contribute to sustained change (Prac2). With the support of the PI and TI, other organizations have begun to explore the topic of sanitation and have begun pilots on appropriate technologies (Prac5).</p>	<p><i>"[TI] really was born of [the PI's] work in the Niger Delta in WASH [...] So, TI is really an attempt by seasoned professionals to create an organization that has just a slight twist of how [TI] do things in order that [TI] address some of those gaps"</i> (Prac2)</p> <p><i>"[TI] did a series of workshops [...] that [members] selected from a suite of expertise that [TI] carry that is more of a supportive role that allows local organizations to effect change more effectively"</i> (Prac2)</p> <p><i>"it's that infrastructure that TI brings to table which is that knowledge sharing, that connectivity and really trying to find ways to convene people who are doing similar things, similar work, in different parts of the world or a region even and bringing them together to help them in ways that they didn't even know were possible. Sparking ideas and sharing information in a network style"</i> (Prac2)</p> <p><i>"[TI has their] fingers on lines of communication and lines of information around the world and that's what I think, you know, [TI] need to hone it, but that is what TI is all about it's being a hub for those kinds of information and being a hub where people can go to get that information and people come to, to share that information"</i> (Prac2)</p> <p><i>"I would say the biggest nugget is the fact that [the PI] created Transform International [...] what it is [TI is] trying to address in that unique twist that Transform International has which is, you know, you need a local vision if you want local input. You need local communities that understand their own community nuances if you want to really avoid some of the unintended consequences that international development is so famous for whether it is WASH-related or otherwise"</i> (Prac2)</p> <p><i>"[The PI] has turned [their] knowledge into action in the form of TI, [the PI] has brought people together and others that have been practitioners for decades, and bringing younger people with younger non-profits onto the team and getting the rest of [TI] to network"</i> (Prac2)</p> <p><i>"With the support of [the PI] and [the] organization, Transform International, we've now also ventured into sanitation and are now currently piloting a sanitation product that will improve sanitation for part of western Kenya where we are working"</i> (Prac5)</p> <p><i>"[WASH is] one of the three main subject area roles, the strongest of the three by far. So Transform International identifies regional NGOs in developing countries that are doing</i></p>	
--	---	--	--

		<p><i>pretty well but want to grow or expand or improve, and then [TI] assess[es] them. If they fit [TI's] model, [TI] invite them to join a network of similar NGOs and then try to bring them the planning, the resources, the advice that they need to make that growth happen and make them stronger, better equipped to serve the region. And then [TI] try and connect the various networks to each other so that they can share, learn what they're good at, their practices and so on"</i> (Prac7)</p> <p><i>"Certainly with [the PI] being the Executive Director, [the PI's] knowledge base and [the PI's] inclusive ideas guide the organization, [which provides] a firm foundation on which to work [...] [without the PI] there's no chance that TI would have been formed. And that the regional work that [TI] doing and the connection of [TI's] network would not have happened if [the PI] hadn't done this research"</i> (Prac7)</p> <p><i>"[The PI] is now the executive director of the non-government organization Transform International, which focuses on water sanitation. [The PI] works with university students in the United States to develop a low-cost, durable toilet suitable to the Niger Delta"</i> (Doc4)</p> <p><i>"there's definitely more eyes focused on [the topic] in a more productive framework, a more understanding that we need to have a collective vision if we want to move this forward so there's the gradual understanding of that [...] So that really, if you think of the smaller projects as little metal filings, then TI could become a bit of a magnet that helps everybody align in the same direction so that they are not overlapping, they're not repeating, and they are not leaving gaps"</i> (Prac2)</p>	
<p>PI continues work in Niger Delta WASH sector and beyond</p> <p>[high-level outcome/impact]</p>	<p>Through their work at TI, the PI continues to work in the Niger Delta WASH sector and beyond. Due to continuing to work in the field, the PI has made their work more accessible by sharing their knowledge in continuing projects (Res3). By working as a consultant at TI, the PI uses their approach to community work which is the legacy of the SNDP (Res3). The PI has also been drawn into discussions outside of TI's network due to the PI's knowledge and connections on the topic. This has resulted in a Nigeria specific focus group for sharing information and best practices which are expected to improve collaboration opportunities and resource efficiency instead of duplication (Prac2). The PI continues to be involved in a PIND program focused on WASH in schools. One of the sponsors of this program worked closely with Global Citizen</p>	<p><i>"You know [the PI's] a consultant now and so does, and so even if [the PI] doesn't share a lot of the specific details, you know the approach and the way [they] work with communities that's all, you know, a legacy of this project and of [the PI's] work before [they] did this project, I don't want to give all credit to [the PI's] thesis"</i> (Res3)</p> <p><i>"Well because [the PI] is still working in the field [the project is] quite accessible, all anyone has to do is pick up the phone and phone [the PI]"</i> (Res3)</p> <p><i>"One of the programmes that PIND is doing, they are the implementing partner on this, a programme [the PI] started when [they were] there which is a WASH and schools programme with thirty schools. [The PI is] still involved in managing that and that's provided an opportunity to provide them in how they work</i></p>	<p>M</p> <p>Realized, clear project contribution</p> <p>Corroboration across interviews that the PI continues to work in the sector.</p>

	<p>(an advocacy awareness organization) who has been attempting to ensure Nigerian state governors pledge budget commitments to water and sanitation (Res4). A National Geographic series (Vid1) attended one of the PIND schools to cover progress on their WASH program in which the PI played a role to develop. However, it is noted that the PI's previous work in the Niger Delta contributed to this continued success, it is not a sole contribution of the SNDP.</p>	<p><i>and improve their work, some of which is definitely based on [the] research and what [the PI] learned [...] one of the sponsors of that programme is Proctor and Gamble and they have been working with Global Citizen who are an advocacy awareness raising organization [...] They have been trying to get state governors in Nigeria to pledge budget commitments to water and sanitation. They have had an event in South Africa on Mandela's 100th birthday and they are doing a series on National Geographic. One of them will be on water and they are coming to Nigeria to film [a] school" (Res4)</i></p> <p><i>"I drew [the PI] into that discussion because of [their] WASH expertise and because of Transform International's area there [...] I think one of the things that has come out of that is a Nigeria specific focus group within that global health forum network [...] this little group now has, is motivated to start doing some of that work, sort of gathering that information together then finding funding together in order to address some of the more research related issues so that others who are doing this kind of work, whether your with other organizations or NGOs, or whether you're with TI you know where to start, you know where somebody else has done something, it's worked, why bother doing it there, why not collaborate with them and draw your boundaries together instead of overlapping or instead of leaving huge gaps in between" (Prac2)</i></p>	
--	---	---	--

Appendix 9. References

- Agee, J. (2009). Developing qualitative research questions: a reflective process. *International Journal of Qualitative Studies in Education*, 22(4): 431–447. <http://doi.org/10.1080/09518390902736512>
- Belcher, B. (2017, January 12-13). Evaluation with and evaluation of ToC: Lessons from FTA. Invited presentation to CGIAR Independent Evaluation Arrangement Symposium on Use and Evaluation of Theories of Change, Rome.
- Belcher, B. (2020, January). Research for changemaking: Concepts and lessons for research effectiveness. Keynote presentation to Canadian Changemaker Education Research Forum. Toronto, Canada. January 15th, 2020.
- Belcher, B. M., Claus, R., Davel, R., Jones, S., & Ramirez, L. F. (2018). Glossary of SRE terms. Retrieved from https://researcheffectiveness.ca/wp-content/uploads/sites/7/2019/04/SRE-Glossary_April2019_FINAL.pdf
- Belcher, B. M., Rasmussen, K. E., Kemshaw, M. R., & Zornes, D. A. (2016). Defining and assessing research quality in a transdisciplinary context. *Research Evaluation*, 25(1): 1-17.
- Bhandari, H. and Yasunobu, K. (2009) What is social capital: A comprehensive review of the concept. *Asian Journal of Social Science*, 37: 480-510.
- Cairney, P. 2013. Policy Concepts in 1000 Words: The Advocacy Coalition Framework. Retrieved from <https://paulcairney.wordpress.com/2013/10/30/policy-concepts-in-1000-words-the-advocacy-coalition-framework/>
- Chevron. (2017). Roots of change: Chevron's model community program in the Niger Delta. Retrieved from <https://www.chevron.com/stories/niger-delta-model-community-program>
- Earl, S., Carden, F., & Smutylo, T. (2001). Outcome mapping: Building learning and reflection into development programs. Ottawa, Canada: International Development Research Centre.
- Flick, U. (2014). *An Introduction to Qualitative Research* (5th ed.). SAGE Publications Ltd.
- Freeman, A. (1984). Developing Stakeholder Theory. *Journal of Management Studies*, 39(1): 1–21.
- Forss, K., Marra, M., & Schwartz, R. (Eds.). (2011). Evaluating the Complex: Attribution, Contribution, and Beyond (Vol.1). New Jersey: Transaction Publishers.
- Geertz, C. (1973). *The Interpretation of Cultures: Selected Essays*. New York: Basic Books.
- Gilbert, N. (2017). Improved Sanitation in the Niger Delta. (Doctoral Dissertation). Retrieved from https://viurrspace.ca/bitstream/handle/10613/4896/Gilbert_royalroadsdoc_1313E_10032.pdf
- Halimanjaya, A., Belcher, B., Suryadarma, D. (2018). Getting forest science to policy discourse: a theory-based outcome assessment of a global research programme. *International Forestry Review*, 20(4): 469-487.
- Hoffmann, S., Thompson Klein, J., & Pohl, C. (2019). Linking transdisciplinary research projects with science and practice at large: Introducing insights from knowledge utilization. *Environmental Science and Policy*, 102: 36-42.
- Kingdon, J. W. (1984). *Agendas, Alternatives and Public Policies*. Boston: Little, Brown and Company.
- Landry, R., Amara, N., & Lamari, M. (2001). Utilization of social science research knowledge in Canada. *Research Policy*, 30: 333-349.
- Mayne, J. (2001). Addressing attribution through contribution analysis: Using performance measures sensibly. *Canadian Journal of Program Evaluation*, 16(1): 1-24.
- Mayne, J. (2012). Contribution analysis: Coming of age?. *Evaluation*, 18(3): 270-280.
- McCombs, M. E., & Shaw, D. L. (1972) The Agenda-Setting Function of Mass Media. *Public Opinion Quarterly*, 36(2): 176-187.
- National Action Plan for the Revitalization of Nigeria's WASH sector (2018). Federal Ministry of Water Resources. Retrieved from <https://waterresources.gov.ng/policy-documents/>
- National Bureau of Statistics. (2012, February 13). The Nigeria Poverty Profile 2010 Report Press Briefing. Retrieved from <https://reliefweb.int/sites/reliefweb.int/files/resources/b410c26c2921c18a6839baebc9b1428fa98fa36a.pdf>
- PIND. (2019). *About Us*. Retrieved from <https://pindfoundation.org/about-us/>

- Putnam, R. D. (2000). *Bowling Alone: The Collapse and Revival of the American Community*. New York: Simon and Schuster.
- RRU. (2019a). Mission, Vision, Goals & Values. Retrieved from <http://www.royalroads.ca/mission-vision-goals-and-values>
- RRU. (2019b). Doctor of Social Sciences. Retrieved from <http://www.royalroads.ca/prospective-students/doctorsocial-sciences>
- RRU. (2019b). Doctor of Social Sciences. Retrieved from <http://www.royalroads.ca/prospective-students/doctorsocial-sciences>
- RRU. (2005). Royal Roads University Research Policy. Retrieved from https://www.royalroads.ca/sites/default/files/reports_files/Board_Reports/Approved_Policy_-_C1000_-_Research_15_nov_05.pdf
- Stachowiak, S. (2013). Pathways for Change: 10 Theories to Inform Advocacy and Policy Change Efforts. Retrieved from https://www.orsimpact.com/DirectoryAttachments/132018_13248_359_Center_Pathways_FINAL.pdf
- UNICEF. (2019). *Programme: Water, Sanitation and Hygiene*. Retrieved from <https://www.unicef.org/nigeria/water-sanitation-and-hygiene>
- Vogel, C., Moser, S. C., Kasperson, R. E., & Dalbelko, G. D. (2007). Linking vulnerability, adaptation, and resilience science to practice: Pathways players, and partnerships. *Global Environmental Change*, 17: 349-364.