

1 From awareness to action: Applying Q 2 Methodology to understand local government 3 perspectives to deliver climate resilient WASH

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11

12 **Abstract**

13 Climate change presents significant threats to the sustainability of water, sanitation, and
14 hygiene (WASH) systems, particularly in low- and middle-income countries (LMICs).
15 However, adaptation efforts often overlook the perspectives of those tasked with
16 implementing change at the local level. This study applies Q methodology to explore the
17 subjective viewpoints of local government officials in Nepal and Lao PDR regarding their
18 motivations and perceived barriers to climate-resilient WASH service delivery. Data were
19 collected from 56 participants through individual Q-sorts. Analysis revealed four distinct
20 personas with varying levels of motivation, perceived responsibility, and awareness of social
21 inclusion issues. The study demonstrates the value of Q methodology in capturing localised
22 framings of climate perceptions and highlights its potential as a tool for engaging in climate
23 resilience in WASH at a local level. Findings emphasise the importance of engaging with
24 local government stakeholders to uncover and address root causes of inaction, with the
25 potential to enhance the effectiveness of adaptation planning and policy.

26 Introduction

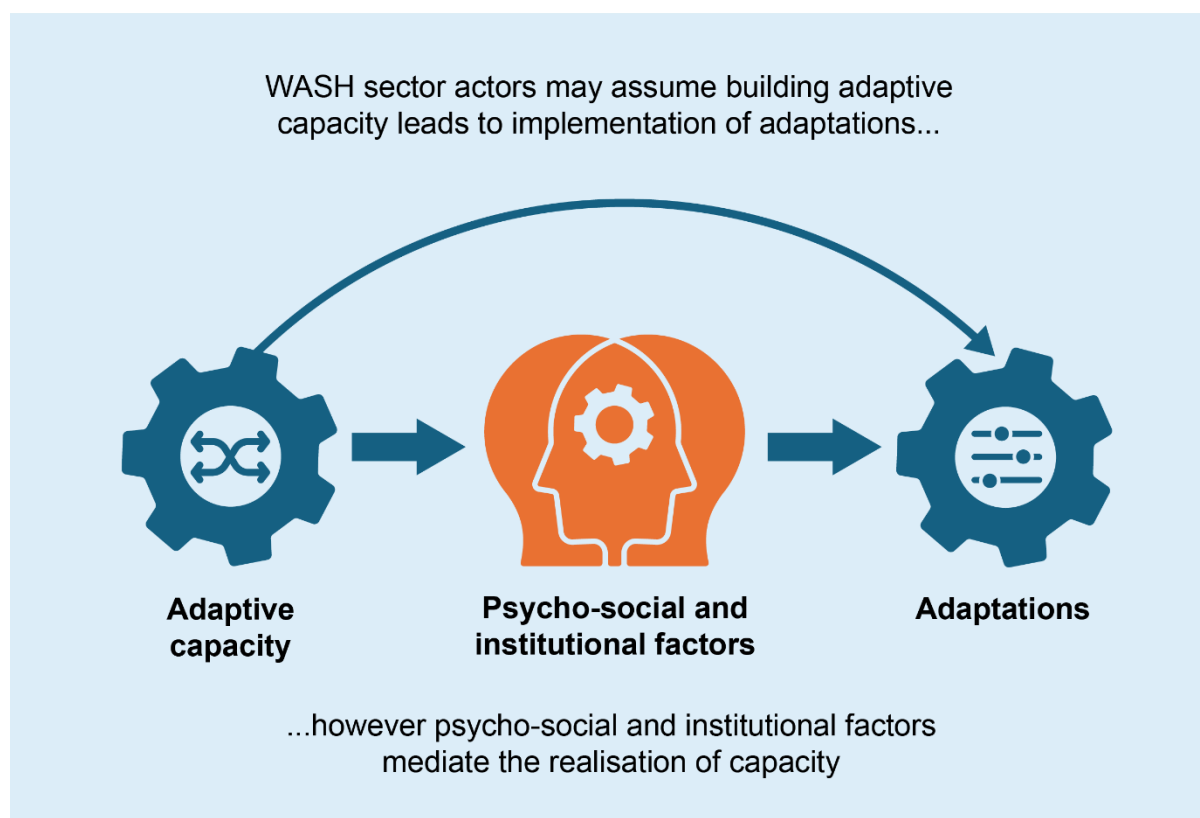
27 Climate change, along with the uncertainty and variability it brings, has become the
28 operating context for water, sanitation and hygiene (WASH) service systems in low-
29 and middle-income countries (LMICs). While the specific effects of climate change
30 vary across regions, shifts in weather patterns and climate extremes have already
31 been observed in every inhabited part of the world (1). The impacts of climate
32 hazards on WASH systems are extensive and well-documented, threatening
33 decades of progress in the sector. Numerous studies have shown that heavy rainfall,
34 saltwater intrusion, dry spells, and extreme weather events compromise water
35 quality and the functionality of water and sanitation systems (2–4). Further, these
36 hazards tend to have a differentiated and more intense impact on vulnerable
37 community members including women and girls, people with disabilities, the elderly,
38 among others (5), exacerbating existing inequities including in terms of meeting their
39 WASH needs (6,7).

40 In response, WASH sector actors, including policy-makers and practitioners, have
41 been urgently developing adaptation actions to protect WASH systems and their
42 users against climate-related threats. To identify adaptation needs, policy-makers
43 and implementers often draw on findings from assessment approaches (8).

44 Historically, these approaches have primarily aimed to assess 1) the risks of
45 biophysical impacts of climate hazards or 2) the vulnerability or adaptive capacity of
46 social groups in terms of their access to and control of different resources that they
47 can mobilise to reduce adverse outcomes (9). Based on these assessments,
48 adaptation planning typically aims to reduce biophysical risks or enhance the
49 adaptive capacity of people and systems. In the WASH sector, proposed solutions
50 often include technological or infrastructural upgrades, as well as improvements in

51 water management and governance practices and capacity-building for community
52 members (4,10,11). Consequently, there is an implicit assumption that building
53 adaptive capacity - through training, provision of financing and other resources, and
54 improved planning - will naturally lead to the implementation of climate resilient
55 solutions.

56 However, recent research suggests that even when individuals or institutions
57 possess knowledge of climate risks and capital to implement adaptations, adaptation
58 may not be practiced. This inaction is often due to psycho-social factors (e.g.
59 perceived self-efficacy, social norms) or governance-related barriers (e.g. political
60 will, coordination challenges) (12–14). Individuals may also feel constrained by the
61 broader systems in which they operate (e.g. whether their workplace allows them to
62 implement adaptations) (15). Fig 1 illustrates that such psycho-social and
63 institutional factors mediate the implementation of adaptations. Therefore,
64 assessments that explore stakeholders' willingness and perceived ability to
65 implement adaptations are also valuable for informing effective adaptation planning
66 and policy.



67

68 **Fig 1. Diagram representing perceived versus actual realisation of adaptive capacity**

69 Despite this, WASH assessments in LMICs tend to focus primarily on climate risks to
70 communities or their capacity to respond, rather than on the perspectives of those
71 responsible for implementing adaptation. A review of 23 WASH focused practitioner
72 tools and resources relating to the assessment of climate risk, vulnerability and
73 resilience, found that none intentionally gathered information on the perceptions,
74 beliefs, or attitudes of stakeholders towards implementing adaptations to climate
75 change in general (16). Further, despite sectoral recognition of governments as the
76 duty-bearers of ensuring water and sanitation services are delivered (17), the review
77 found only one resource that includes a focus on assessing government
78 stakeholders. This resource takes the form of a checklist of enabling environment
79 conditions (e.g. regulation and financing arrangements) that support WASH
80 adaptation planning (18). Since it cannot be assumed that government actors will
81 automatically mobilise resources in response to climate risks, methods for assessing

82 their perspectives on adaptation would be beneficial for augmenting broader
83 adaptation planning strategies.

84 This study explores the use of Q methodology as a method to assess perceived
85 mediating factors that enable or inhibit the realisation of adaptive capacity to
86 implement WASH adaptations. It documents the application of the Q methodology in
87 two contexts: local government WASH planning in Nepal and the People's
88 Democratic Republic of Lao (Lao PDR). After describing how the Q methodology
89 was implemented and the results of the study, this paper discusses the value of
90 using the Q methodology to better understand the perspectives of local government
91 officials in informing adaptation planning in the WASH sector.

92 **Materials and Methods**

93 **The history and applicability of Q methodology, and** 94 **rationale for this study**

95 Drawing its roots from the field of educational psychology, Q methodology first
96 emerged in the 1930s (19). It was conceptualised by William Stephenson, motivated
97 by concern for the increasing use of reductionism in social science and psychological
98 research, leading to a 'desire to understand what made the individual person unique
99 rather than what characteristics could be found across large populations of
100 individuals' (20). He sought to bring the individual to the fore, offering a systematic
101 way to study subjectivity in human perceptions (21). As a result, Q methodology
102 emerged as a mixed-method approach which applies a quantitative (statistical)
103 method to analyse qualitative data. The method was 'designed expressly to explore
104 the subjective dimension of any issue towards which *different points-of-view* can be
105 expressed' (21, p.215). Therefore, its applicability in exploring perceptions on a

106 complex issue such as climate change, where varied opinions often take the
107 spotlight, seemed pertinent.

108 The value of applying Q methodology to the climate change discourse lies in its
109 ability to navigate the complexity of the issue, the broad spectrum of viewpoints on
110 the topic, the difficulty in articulating one's opinion on it due to the intractability of
111 climate change, and its seemingly abstract conceptualizations (23) and multi-faceted
112 framing. In our project, the application of Q methodology was beneficial as it helped
113 to unveil the perceived barriers and motivations of local government stakeholders,
114 which could then be addressed or leveraged respectively. For instance, our findings
115 revealed barriers related to a perception of limited mandate among local government
116 stakeholders to take climate action related to WASH, amongst their various other
117 roles, and motivators related to recognition of the differentiated impact of climate
118 change on the WASH needs of vulnerable social groups.

119 Q methodology has been widely applied across related areas of work. Within the
120 sphere of climate change adaptation (CCA), it has been used to understand social
121 perspectives and community priorities on CCA (24,25), perceptions of urban forestry
122 stakeholders towards CCA (26), and the influence of religious beliefs on CCA
123 perceptions (23). Beyond CCA, Q methodology has been applied to understand
124 perceptions of local level government institutions and stakeholders on watershed
125 management planning process (27), natural resource management (28), public value
126 profiles and value conflicts amongst public administrators. In the context of WASH, it
127 has been used to explore conceptualisations of water quality issues (29), understand
128 perceptions of hotel staff and tourists with regards to the influence of inclusive
129 WASH practices on tourists' hotel choices (30), segmentation of drinking water

130 customers (31), subjectivities in regulation of local water services (32), narratives on
131 sanitation behaviours (33), and perceptions of hand washing and hygiene
132 information in public toilets (34). This is the first known application of Q methodology
133 to explore climate change perceptions among local government with WASH
134 responsibilities.

135 **About the project**

136 Q methodology was applied as part of the research grant ‘Inspiring local government
137 heroes of climate action for inclusive WASH’ under the research-implementation
138 partnership between the University of Technology Sydney – Institute for Sustainable
139 Futures (UTS-ISF) and SNV Netherlands Development Organisation (SNV). The
140 research grant was part of SNV’s Beyond the Finish Line Programme (2018-22) and
141 was funded by the Australian Department of Foreign Affairs under the Water for
142 Women Innovation & Impact Grant. Building on the progress made under SNV’s
143 ongoing work in Nepal and Lao PDR on understanding how climate change affects
144 equitable and sustainable rural water and sanitation, this project aimed at taking the
145 next step of motivating local governments to translate awareness of climate change
146 into action. Recognising the role of local government actors as the duty-bearers to
147 uphold the community’s human rights to water and sanitation (17) and often first
148 responders to locally experienced climate events, the project sought to inspire local
149 governments in Nepal and Lao PDR to overcome barriers to addressing climate
150 change impacts within their jobs and become champions of climate action for
151 inclusive WASH.

152 **Study context**

153 The project was undertaken with local governments in the rural municipalities of
154 Sarlahi and Dailekh districts of Nepal and Atsaphone, Champone, and Phalanxay
155 districts in Savannakhet province of Lao PDR. The focus of the local governments in
156 Nepal was on rural water, and in Lao PDR it was rural sanitation.

157 **Nepal**

158 Nepal is exposed to flooding and drought, although precipitation extremes vary
159 across regions of the country. Nepal has a history of monsoon-related flooding in its
160 plains and flash floods, glacial lake outburst floods, and landslides occurring in its
161 hilly and mountainous areas (35–38). Climate change threatens to exacerbate each
162 of these hazards in some regions of Nepal through increased heavy rainfall events
163 that contribute to flash flooding and landslides, higher temperatures that increase the
164 risk of glacial lake outburst floods, and greater seasonal precipitation that contributes
165 to riverine floods (39–41). Some regions of Nepal have experienced decreasing
166 annual precipitation since 1970 (39). South Asia is projected to experience a higher
167 return period of drought over the course of the century (42).

168 Climate change has significant implications for springs in Nepal, a water source that
169 is commonly used for domestic purposes in rural areas. The phenomenon of
170 vanishing springs in Nepal is well-documented (43–46). Although the extent to which
171 climate change is contributing to the observed decline of many spring yields is
172 unclear, climate change-driven changes to precipitation in the region have potential
173 to further affect spring water quantity and quality (47).

174 **Lao PDR**

175 Much of Lao PDR is exposed to significant flooding and, to a lesser extent,
176 meteorological drought and storm activity. Most of Lao PDR is covered by

177 mountainous or hilly terrain that is susceptible to flash flooding driven by storms and
178 heavy rain and exacerbated by land use activities (48,49). Meanwhile, a large
179 proportion of the population resides in river valleys and other low-lying areas that
180 experience riverine flooding (50,51). Climate change is expected to increase the
181 frequency and magnitude of both types of flooding in Southeast Asia through its
182 influences on heavy rainfall events and river flows (52,53). The National Strategy on
183 Disaster Risk Reduction also identifies droughts and storms as significant hazards
184 affecting the country, albeit less extensively than flooding (Lao PDR Ministry of
185 Labour and Social Welfare, 2021). Future climate change may increase the return
186 period of drought in Southeast Asia (42), but decrease high wind activity (54).

187 Worsening climate hazards have potential to stunt progress in achieving sanitation
188 services in rural areas of Lao PDR. Since 2000, the coverage of households in rural
189 areas with access to at least basic sanitation services has increased from 17% to
190 69%, which exceeds the global average rate of increase for rural areas (55). There is
191 an absence of research evidence on the effects of climate hazards on rural
192 sanitation in Lao PDR, but studies in other low- and middle-income countries have
193 demonstrated that flood damage to latrines and water shortages can cause
194 households to revert to open defecation or use of unimproved latrines (56–58).

195 **Designing the Q methodology approach**

196 The research method was designed in collaboration between the Institute for
197 Sustainable Futures at the University of Technology Sydney (UTS-ISF), SNV Nepal,
198 SNV Lao PDR, and National University of Laos (NUoL). Design and implementation
199 of Q methodology typically involves four broad steps. First, developing a set of
200 statements which convey opinions about a particular topic. In the second step,

201 research participants rank-order the set of statements on a pyramid-shaped grid (Q-
202 board) from 'agree to 'disagree'. This exercise is called 'Q-sorting' with the resulting
203 grid called a 'Q-sort'. Individual ordering of the statements based on their own
204 opinion, with no right or wrong answers, highlights the subjective nature of the
205 exercise. The third step involves using a statistical technique called factor analysis to
206 identify patterns in the various individual Q-sorts. Finally, the various resulting
207 patterns are interpreted by the research team to reveal varied perspectives.

208 The following section describes the detailed process that was undertaken to
209 implement Q methodology in our project, following the four broad steps mentioned
210 above:

211 **Defining the concourse**

212 The first step in Q methodology involved defining the concourse, which is a set of
213 comprehensive statements pertaining to the topic in question, in our case
214 *'Motivations (or lack thereof) for addressing climate change impacts in an individual's*
215 *job (including WASH responsibilities)'*. The concourse should adequately reflect the
216 main perspectives about the topic, with a focus on subjectivity and diversity
217 (19,21,59). Our statements were developed through an iterative process informed by
218 a literature review, inputs from SNV country staff and open-ended scoping
219 interviews.

220 First, we carried out a literature review of public perceptions of climate change and
221 motivators to climate action/barriers to climate inaction. The formation of the
222 statements was also informed by self-determination theory (60) and the Making
223 Rights Real approach (17). An inductive process was followed to arrive at a set of 87
224 statements (S2 File) across five areas of enquiry covering our concourse –

225 Perceptions and opinions on climate change, efficacy of climate change responses,
226 enablers and barriers at the workplace, job responsibilities and personal capacity,
227 and gender equality and inclusion aspects of WASH (refer to Supplementary
228 material).

229 Second, an online workshop was organised within the research team to
230 collaboratively prioritise the most important and relevant statements based on the
231 local knowledge of SNV country staff and NUoL researchers.

232 Third, the research team carried out short, exploratory interviews in Nepal (5
233 interviews) and Lao PDR (4 interviews) to document the opinions of government
234 stakeholders about climate change and their motivations (or lack of motivation) about
235 addressing climate change impacts in their job. This step was intended to ensure
236 that the statements cover a wide range of opinions about why or why not the
237 government should address climate impacts on inclusive WASH, including any
238 cultural and contextual differences in opinion which may not emerge from the
239 literature. We found that the interviews did not change the Q statements and instead
240 reinforced the validity and relevance of the shortlisted statements.

241 Finally, the steps above resulted in a set of 34 statements which were selected to be
242 used for data collection (see Table 1 for the list of statements). Typically, Q
243 methodology studies recommend choosing between 20 to 60 statements to achieve
244 a balance between having a breadth of perspectives on a topic to reach a saturation
245 point of opinions and managing participant fatigue (61,62)

246 The final list of statements was translated by SNV staff to the local language and
247 back-translated to English to ensure the intended meaning of each statement was
248 retained in the local language (62).

249 **Administering the Q-sort**

250 Data were collected by SNV staff in Nepal and Lao PDR and NUoL between 01
251 November and 31 December 2021. It involved face-to-face interaction with research
252 participants in the two countries. In addition to the statements, UTS-ISF developed a
253 detailed Q-sort facilitation and interview guide and note-taking template to support
254 the data collection team. The facilitation and interview guide provided step-by-step
255 instructions to the Q-sort facilitator for conducting the activity and asking relevant
256 questions to participants. It encouraged the facilitator to probe the participant about
257 their thought-process during the activity. The guide also included some follow up
258 open questions to obtain subsidiary qualitative data on participants' experiences with
259 the Q-sort activity, perceived challenges faced and opportunities for local
260 governments to build climate resilience in WASH, and whether participants view
261 addressing climate change impacts as part of their job responsibilities.

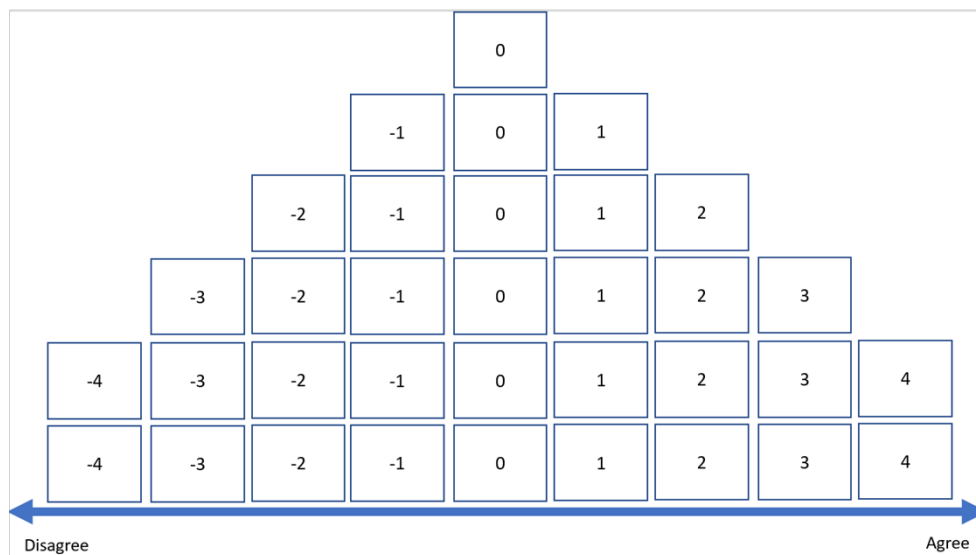
262 Informed consent was obtained verbally from all research participants, which was
263 witnessed and documented by the data collectors. Ethical clearance for the research
264 was obtained from the University of Technology Sydney's Human Research Ethics
265 Committee (UTS HREC ETH21-6538). Additionally, COVID-19 safety protocol,
266 SNV's organisational guidelines and respective country government guidelines were
267 followed. Online training on ethical data collection and the data collection tools was
268 provided by UTS-ISF to SNV Nepal and Lao PDR staff and NUoL researchers,
269 followed by piloting of the tools.

270 The Q-sort exercise was undertaken with a total of 56 participants - 23 in Lao PDR
271 and 33 in Nepal, identified using purposive sampling as we wanted to include both
272 government officials and elected representatives with responsibilities related to
273 WASH in the areas where SNV works. Participants in Nepal included representatives
274 from the Ministry of Water Supply, Department of Water Supply and Sewerage
275 Management (national level), and Ministry of Energy, Irrigation and Water Supply
276 (province level). At the rural municipality level, participants comprised
277 representatives from the technical and administrative section; the women, children,
278 and senior citizens section; the health, education, and planning sectors;
279 representatives of organisations of people with disabilities; and elected officials of
280 the rural municipality. In Lao PDR, at the district level we included representatives
281 from youth unions, labour office, women's union, governance office, education and
282 sports office, health office, and planning and investment office. At the provincial level
283 participants were from the department of Health Promotion and Environmental
284 Management, Ministry of Health, department of education and sport and the People
285 with Disabilities Association. The sample size and selection approach aligns with
286 standard Q methodology studies where the intent is to cover the diversity of opinions
287 such that the results are considered sufficiently generalisable as they capture the
288 range of possible perspectives within the population, rather than have a sample
289 which is representative of the population (32,33,63). The research participants
290 included 42 male and 14 female officials from the rural municipalities, district,
291 province and national level. The average age among participants was 38 years and
292 the group represented a diversity of ethnicities, government departments and job
293 titles.

294 The Q sort involved each participant placing the 34 statements on the Q board, with
295 qualitative comments by the participants elicited while they were doing the exercise,
296 and a follow-up interview to discuss participants' choices and reasoning while
297 placing the statements on the board. On average, the Q-sort process lasted for 60
298 minutes. A detailed description of how Q methodology was carried out can be found
299 in UTS-ISF and SNV (2022) (64).

300 **Analysing the data**

301 The Q methodology data was systematically coded, analysed, and interpreted using
302 factor analysis to identify shared viewpoints among participants. Each statement was
303 assigned a number in the order they were presented to participants (see Table 1)
304 with a corresponding score based on where the statement was placed on the Q-
305 board. For instance, the two statements that a participant 'most agreed' with were
306 assigned a score of 4, whereas the 'least agreed' with statements were assigned a
307 score of -4, and so on (Fig 2). The 5 statements in the middle of the Q-board were
308 assigned a score of 0. The results of the 56 Q-sorts were transferred to a csv file,
309 presented as a matrix where each column indicated a statement and each row
310 indicated an individual participant. The cells in the matrix indicated each participant's
311 scores based on their respective Q-sort.



312

313

Fig 2. Q-board with corresponding scores

314 Q Method Software (65), a dedicated computer software for Q analysis, was used to
315 analyse the data. The .csv file was uploaded to the software, along with a list of the
316 34 statements as a text file. The software conducts a factor analysis to analyse and
317 explain relationships among a large set of variables by drawing patterns among
318 individuals who had similar Q-sorts and grouping them together. It does this by
319 reducing the data to “mathematically create a few new variables that explain
320 variation in many variables....the variables are the Q-sorts where the factor analysis
321 attempts to bring the complexity of multiple individuals’ Q-sorts down to a simpler
322 picture.” (25). By examining the patterns of correlations between how the different
323 participants responded, factor analysis can identify which individuals are strongly or
324 weakly associated with one other.

325 The software undertakes a factor analysis by applying a set of sequential statistical
326 steps to arrive at four factors. A factor represents a cluster of shared viewpoints
327 among participants. The steps included correlation (to measure the relationships
328 between different Q-sorts), factor extraction using principal component analysis

329 retaining four factors (aligning with our research significance) (25), and factor
330 rotation using Varimax (to understand the distinctiveness of each factor).

331 The theory behind Q methodology is that even when everyone has diverse and
332 complex opinions about a topic, in a sufficiently large data set people start to form
333 shared sets of beliefs with each other. The quantitative analysis aided by the
334 software helps identify these connected clusters of viewpoints. The goal of factor
335 analysis is to reduce the complexity and diversity in opinions about a particular topic,
336 in our case multiple varied perspectives on climate change and the motivators
337 (barriers) to action (inaction), to a smaller number of factors, which we describe in
338 our project as 'personas'. A persona is a hypothetical construct or fictional character
339 that represents shared beliefs of a sub-set of the participant group (66) but does not
340 directly relate to the characteristics of any one individual in our participant group.

341 In the case of our data, four perspectives or 'personas' were extracted from the data
342 set using the results of the statistical analysis. While in an ideal scenario, interpreted
343 factors should be validated through interaction with respondents (67), the
344 collaborative sense-making exercise helped to capture the SNV country teams'
345 perspectives from working with the participant groups for several years. The persona
346 development template was created which included demographic characteristics, the
347 persona's motivations, what they care about in their job, beliefs about climate
348 change, obstacles faced to address climate change, motivations to take action,
349 information related to what the persona cares about in his/her job, their attitude in
350 relation to GEDSI aspects, direct quotes to express their strongest feelings, etc. The
351 country teams' filled out the template as a group using the software results,
352 qualitative data, their insights while conducting the Q-sort, and their own experiences
353 working with local government. This was followed by a series of sensemaking

354 meetings, in which the team further refined the four personas. The qualitative
355 interview post the Q-sort provides valuable information to understand the reasoning
356 of the ranking in the context of their background (59). Each persona included
357 demographic characteristics, beliefs about climate change, motivations to take
358 action, information related to what the persona cares about in his/her job, obstacles
359 faced to address climate change and GEDSI issues, support sought, etc. The four
360 personas are described in the Results and Discussion section.

361 **Limitations**

362 While the Q statements were translated and back translated to ensure quality, the
363 statement “The seriousness of climate change is exaggerated” was mistranslated in
364 Lao language to a phrase meaning “Climate change is very severe”. This was
365 accounted for in the development of the personas, however, it may have influenced
366 participant responses to this specific statement.

367 **Results and Discussion**

368 The following section presents and discusses our findings across four themes. First,
369 we compare and contrast the four personas that emerged from the study and their
370 implications. Second, we discuss the value derived for both participants and
371 facilitators of Q methodology. Next, we talk about the value of using Q methodology
372 with government participants. Finally, we consider the type of information that Q
373 methodology can bring up in the context of climate resilient WASH service delivery
374 approaches.

375 **Comparing and contrasting between personas**

376 A key finding from our study was the emergence of distinct personas for the two
 377 countries. The Q methodology analysis grouped participants based on shared
 378 viewpoints, revealing that nearly all participants from Nepal and Lao PDR clustered
 379 into separate groups. Persona 1 and Persona 4 consisted entirely of participants
 380 from Nepal and Lao PDR, respectively. Persona 2 included all Nepalese participants,
 381 with the exception of one from Lao PDR, while Persona 3 was primarily composed of
 382 participants from Lao PDR, with two from Nepal. This distribution highlights
 383 significant contextual differences in how local governments in the two countries
 384 perceive climate risks related to inclusive WASH. These differences underscore the
 385 importance of designing tailored support strategies that are responsive to each
 386 country's specific context.

387 Table 1 presents the list of Q statements and how each persona ranked them.

388 **Table 1. Final list of Statements, with each Persona's ranking**

Statement	Persona 1 Score	Persona 2 Score	Persona 3 Score	Persona 4 Score
S1. Climate change adaptation is enormously difficult.	-4	2	1	-2
S2. Climate change will have a large impact on the people in my community.	1	4	3	1
S3. I am worried about the impacts of climate change on WASH.	-1	3	1	0
S4. Local government efforts to address climate change impacts on WASH will make a difference to the community.	1	-1	-1	1
S5. My department will only address climate change impacts on WASH if higher levels of government or donors encourage us to.	-1	0	-3	-1
S6. There is sufficient funding available for us to start working on climate change adaptation for WASH.	-3	-4	-2	-3
S7. Climate change in WASH is not a priority compared to other problems that local government is facing.	-3	-1	-4	-1
S8. Local government should take more action to address climate change impacts on WASH.	2	4	4	0
S9. My department knows how to plan for WASH systems that are resilient to climate change.	-2	-3	0	-4
S10. It is important for me to learn new skills in my job.	2	1	-1	2
S11. I would like to do something in my job to address climate change impacts on WASH.	1	-2	2	-1

S12. I'm not sure where to begin to address climate change impacts on WASH.	-3	-1	-4	-2
S13. My individual action can make a big difference in addressing climate change impacts on WASH.	2	-4	0	-1
S14. Addressing climate change impacts on WASH is part of my job responsibility.	0	-3	3	0
S15. I will encourage others to address climate change impacts on WASH only if my line authority tells me to.	-2	-2	-3	-2
S16. In regard to WASH, marginalised people are affected worse than others when there is extreme weather.	4	3	-2	0
S17. It is important to have women contribute to decision-making when it comes to WASH.	3	1	-1	1
S18. My department needs more data on climate change to make informed decisions.	0	-2	0	2
S19. My department has the authority to plan activities to address climate change impacts.	-2	-3	2	1
S20. The effects of climate change are not always predictable for planning or investment in WASH.	-1	0	-2	3
S21. The seriousness of climate change is exaggerated.	-4	0	-3	-3
S22. Community cooperation can make a big difference in addressing climate change impacts on WASH.	1	2	2	0
S23. I discuss the consequences of climate change with my colleagues.	-1	-1	3	1
S24. Community members should participate in decision making about addressing climate change impacts on WASH.	2	1	1	4
S25. In regard to WASH, women are affected more than men when there is extreme weather.	3	1	-2	-2
S26. I always pay attention to marginalised groups in coming up with solutions.	0	-1	1	4
S27. My department knows how to design WASH infrastructure that is resilient to climate change.	-2	-2	0	-3
S28. My district is already feeling the effects of climate change on WASH.	0	2	0	-4
S29. Climate change creates uncertainty for existing WASH services.	0	0	-1	3
S30. I contribute to solving WASH issues in my community.	-1	0	1	0
S31. In order to reach everybody, local government needs to focus first on those who are poor and marginalised.	3	2	-1	3
S32. My job gives me opportunities to show how capable I am.	1	0	0	-1
S33. Climate change is primarily caused by air pollution from humans.	0	3	4	2
S34. The benefits of addressing climate change impacts on WASH are worth the investment for all.	4	1	2	2

389 A distinguishing statement is a statement that significantly differentiates one persona
390 from others. These statements help explain what makes each persona unique in
391 terms of their perspectives. Every persona is characterised by their respective

392 distinguishing statements (Table 2) that articulate their narratives based on their
 393 stated priorities.

394 **Table 2. Distinguishing statements for each persona**

Persona 1	<ul style="list-style-type: none"> • In regard to WASH, marginalised people are affected worse than others when there is extreme weather (more likely to agree) • It is important to have women contribute to decision making when it comes to WASH (more likely to agree) • My individual action can make a big difference in addressing climate change impacts on WASH (more likely to agree) • Climate change adaptation is enormously difficult (less likely to agree) • The seriousness of climate change is exaggerated (less likely to agree)
Persona 2	<ul style="list-style-type: none"> • My department knows how to plan for WASH systems that are resilient to climate change (more likely to agree) • Addressing climate change impacts on WASH is part of my job responsibility (more likely to agree) • In regard to WASH, marginalised people are affected worse than others when there is extreme weather (less likely to agree) • It is important to have women contribute to decision making when it comes to WASH (less likely to agree)
Persona 3	<ul style="list-style-type: none"> • I am worried about the impacts of climate change on WASH (more likely to agree) • My individual action can make a big difference in addressing climate change impacts on WASH (less likely to agree) • Addressing climate change impacts on WASH is part of my job responsibility (less likely to agree)
Persona 4	<ul style="list-style-type: none"> • Community members should participate in decision-making about addressing climate change impacts on WASH (more likely to agree) • Local government should take more action to address climate change impacts on WASH (less likely to agree) • My district is already feeling the effects of climate change on WASH (less likely to agree)

395 The results in Table 1 along with the distinguishing statements and sensemaking
 396 meetings. were used to derive the persona descriptions. Table 3 and 4 present the
 397 personas from Nepal and Lao PDR respectively.

398 **Table 3. The two personas with participants predominantly from Nepal**

Persona #1: Highly motivated and confident to address climate impacts (Nepal)	Persona #2: Holds a sense of responsibility to address climate impacts, but low awareness of GEDSI issues (Nepal)
An energetic and positive person from Nepal (average age of 37 years) working in a technical department who is deeply concerned about climate impacts on his local community and is confident and motivated to address the same. While this persona has some ideas to address climate change, they feel restricted by the lack of supportive policy environment and limited prioritisation of climate resilient WASH by elected representatives. This persona seeks technical training on planning for and implementing climate change initiatives, as well as dedicated budget allocation for climate change. They are a strong advocate for meaningful participation of women and marginalised groups in decision making on climate	A person in a senior administrative role in Nepal (average age of 42 years, and more likely to be a man) who is aware about the human-induced causes of climate change including its impact on water and sanitation in his community. He feels that local government, including his department, is a powerful authority, and can play an influential role in addressing climate change impacts on WASH at the local level. He considers this part of his job responsibility and is already discussing the issue with his colleagues. At the same time he believes no action can be achieved without community cooperation and urges their increasing awareness and sensitisation on this critical issue. This persona

resilient WASH initiatives as they understand the disproportionate impacts of climate change.	has a relatively limited understanding on how climate change differently impacts the WASH needs of women and marginalised groups compared to more powerful groups. Barriers that prevent this persona to address climate change include lack of clarity on implementation of policies at the local level by the central government, and strong influence of elected representatives on budgets and programs resulting in unfair allocation.
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399 **Table 4. The two personas with participants predominantly from Lao PDR**

Persona #3: Worried about the impacts of climate change, but disempowered to take action (Lao PDR)	Persona #4: Prioritises the needs of marginalised people, but views climate change as a distant problem, secondary to more immediate concerns (Lao PDR)
A person in a technical role in the local government of Lao PDR (average age 35 years) who is deeply concerned about the consequences of climate change for their district, especially for those who are most vulnerable. This persona believes in the importance of community engagement over individual action in addressing climate impacts on WASH, but feels disempowered to act due to limited knowledge and skills and perceived lack of a direct mandate in their job and department. They would benefit from clear policy directives from the sub-national level, learning how they can support meaningful adaptation efforts at the local level, and increased community awareness and mobilisation on climate change and WASH.	A young and dynamic person in a technical role in the local government of Lao PDR (more likely to be a woman) who is passionate about promoting gender equality at the local level. She works towards the empowerment of women, is sensitive about the differentiated impacts of climate change on marginalised groups, including on their WASH needs, and is a strong advocate for involving diverse voices in decision-making on issues impacting the community. Barriers faced by this persona include limited prioritisation of climate action by their department and lack of knowledge, skills and resources to plan and implement climate resilient WASH systems. She also finds it difficult to prioritise climate change at present, viewing it as an important but distant problem secondary to more immediate concerns faced by the community.

400 Further, personas 1 and 2 have the strongest correlation (0.49), suggesting they
 401 share closer perspectives coming from the same country. Personas 3 and 4 have the
 402 weakest correlation (0.24) indicating more divergent perspectives even though they
 403 both represent perspectives from Lao PDR. Overall, all personas were positively
 404 correlated indicating a convergence of participant viewpoints on the concourse of
 405 statements. This implies that their opinions, while representing divergent
 406 perspectives, are not entirely opposite to each other (59). Overall consensus was on
 407 views related to seriousness of climate change ([S21](#)), responsibility of local
 408 governments to take action on climate impacts on WASH ([S8](#)), and lack of sufficient
 409 local level funding to plan activities on climate change ([S6](#)).

410 The development of personas based on the results of Q methodology allowed
411 individual priorities to be grouped into clusters of shared perspectives, systematically
412 highlighting the most relevant ones by the group as well as preserving the group's
413 diversity. This process in turn, can help identify local priorities associated with a
414 complex topic such as climate change (24) with potentially important implications for
415 framing local adaptation needs.

416 This kind of information can be used to identify and create targeted interventions to
417 address immediate priorities for local stakeholders, leveraging identified motivations
418 and addressing perceived barriers of local government staff towards preparing for
419 climate change impacts on water and sanitation. In Nepal, personas were motivated
420 and capable to address climate change impacts. However, they felt they do not have
421 professional responsibility to do so (persona 1) ([S19](#), scored -2) and had low
422 awareness of the unequal impacts of climate change based on gender and other
423 social vulnerabilities (persona 2) ([S16 and S25](#), both scored -2). Therefore, for
424 participants in Nepal, the project conducted a workshop to share national and local
425 strategies and policies (such as the National Adaptation Plan, Nationally Determined
426 Contributions, National Climate Change Policy 2019, Local Government Operation
427 Act 2017) that mandate all local government staff to address climate change.
428 Further, this included training participants in basic climate risk assessment activities
429 relevant to their current roles and raised awareness of the differing impacts of
430 climate change on water and sanitation for women and men.

431 In contrast to Nepal, participants in Lao PDR seemed to feel less empowered to take
432 climate action (persona 3) (S13, scored -4) or felt climate change was a distant
433 problem removed from everyday concerns of communities (persona 4) (S28, scored
434 -4). In response to these barriers, for the group in Lao PDR, the team designed

435 workshop activities to train participants on community resilience building activities
436 that utilise their existing skillsets and do not require large budgets, and disseminated
437 information on localised impacts of climate change.

438 **Value in the process**

439 Beyond the results it generates, Q methodology is a valuable tool for fostering
440 learning and reflection among both the participants and research team.

441 **Insights for participants**

442 Despite its seemingly simple, game-like format, the Q sort activity proved to be an
443 intellectually stimulating exercise. It encouraged participants to engage deeply with
444 complex and relevant issues, prompting critical reflection. For many local
445 government staff, the process itself was a learning experience. Participants
446 described the activity as interesting, enjoyable, and thought-provoking. It provided a
447 space for self-reflection on their beliefs and perceptions regarding their role in
448 addressing climate change impacts. The content of the statements, the prioritisation
449 process, and the opportunity to reposition statements as their understanding evolved
450 all helped participants contextualise local issues within their professional roles. It
451 motivated them to take action by raising pertinent local issues in meetings with
452 senior leaders and in discussions with community members. The use of ranking
453 encouraged participants to think about their views in relation to one another, rather
454 than in isolation. When asked about what are some things that the activity made
455 them think about, a participant commented:

456 *"It's a great activity because it gives us the opportunity to learn and compare what is*
457 *important and what is not so important in the context of our district." - Participant from Lao*

458 *PDR*

459 The Q sort process also prompted participants to consider the intersection of climate
460 change, WASH, and gender equality, disability, and social inclusion (GEDSI)—a
461 combination many had not previously reflected on. By stimulating critical thinking at
462 an individual level, Q methodology offers greater value than traditional extractive
463 data collection methods such as interviews or focus group discussions, fostering
464 mutual learning for both the researcher/practitioner and the participant.

465 **Insights for facilitators**

466 A distinctive strength of Q methodology is that the value lies in the interpretation of
467 the researcher (32), which contrasts with conventional quantitative analysis
468 techniques which tend to focus on testing a hypothesis or inferring a cause-effect
469 relation. Therefore, it is valuable to involve a diverse team, not only for data
470 collection but also for designing the research process and developing the personas.
471 In this project, the persona development team included WASH researchers and
472 NGO practitioners from Nepal and Lao PDR, enriching the analysis with local
473 insights. All team members reported enhanced knowledge, skills, and confidence in
474 applying this novel method. Additionally, key learnings shared by SNV country teams
475 during piloting and data collection contributed to refining the research design and
476 process. One facilitator commented:

477 *“Participating in this research using the Q methodology was an engaging and insightful*
478 *experience. This approach helped us gather meaningful perspectives from government*
479 *officials, advancing collaboration with local governments on climate resilience. The research*
480 *enhanced our understanding of climate change and priorities, with UTS-ISF playing a pivotal*
481 *role in building our capacity and ensuring the effective application of the methodology. It*
482 *highlighted the value of structured dialogue and participatory methods for tackling complex*
483 *issues”.* - Q methodology facilitator, SNV Nepal

484 **Using Q methodology with government participants**

485 Another motivation to use Q methodology for this study was in consideration of the
486 project's aim and the nature of the participants involved. The research sought to
487 develop a nuanced understanding of the motivators and constraints faced by local
488 government authorities in addressing climate change impacts on inclusive WASH.
489 These officials occupy a unique position—accountable to community members while
490 also influenced by local elected leaders and sub-national governance structures.
491 Within this complex operating environment and their multiple competing priorities
492 compounded by the uncertainties of climate change, local government may not be
493 accustomed to articulating personal questions on critical consciousness, workplace
494 responsibilities, or self-efficacy with reference to climate change through traditional
495 open-ended methods such as interviews or focus group discussions.

496 This challenge became evident during exploratory interviews conducted to develop
497 the Q statements. Participants often defaulted to describing their job responsibilities
498 rather than sharing personal beliefs or perspectives. Q methodology proved to be a
499 powerful tool to overcome this limitation. Because there is no “right” or “wrong” way
500 to sort the statements, the method empowered the participants to easily convey their
501 views about sensitive topics in a more indirect and comfortable manner and
502 overcome the likelihood of acquiescence and social desirability bias.

503 Q methodology also made it easier for participants to identify and articulate
504 perceived barriers, which may be difficult to express in open-ended formats. For
505 instance, participants in Persona 3 from Lao PDR expressed lower agreement with
506 potentially sensitive statements such as ‘addressing climate change impacts on
507 WASH is part of my job responsibility’ (scored -3) and ‘my individual action can make

508 a big difference in addressing climate change impacts on WASH' (scored -4). In
509 Nepal persona 1 identified a lack of authority to plan activities to address climate
510 change impacts as a key barrier (S19, scored -3). As such, our results helped to go
511 beyond the commonly cited barriers of limited resources and explore the root causes
512 of inaction specific to staff in each country, and can offer context-sensitive
513 interventions to address the identified barriers (67).

514 Alignment to social norms is a psycho-social influencer of climate adaptation
515 readiness, compounded by the conflict between injunctive norms (what others
516 approve of) and descriptive norms (what people do) (68). By asking about a
517 particular topic in different ways, Q methodology offered a creative way to overcome
518 participant adherence to injunctive norms and tap into their mindsets and
519 worldviews. The exercise forced participants to truly reflect on what matters to them,
520 helping them prioritize different issues, even when all seemed important and
521 relevant. Unlike focus group discussions or interviews, where social desirability may
522 lead participants to rate everything as high priority to align with injunctive norms, the
523 structured sorting process made such broad agreement less feasible. Additionally,
524 the non-verbal, interactive format reduced bias and encouraged deeper
525 introspection. For instance, several statements related to the impact of climate
526 change on vulnerable groups (S16, S17, S25, S26, S31) required participants to
527 engage in a cognitively demanding process of weighing and ranking, reinforcing this
528 reflective effect.

529 **The type of information that Q methodology can reveal**

530 The findings of this study align with existing assertions that psycho-social and
531 institutional aspects can act as barriers to implementing adaptations (12,14).

532 Government actors in Nepal and Lao PDR who feel climate change adaptation is
533 outside their professional responsibility, doubt the impact of their actions, or do not
534 perceive climate change to be affecting WASH in their area and may be unlikely to
535 adopt climate risk management tools and approaches unless these are addressed.
536 While this study did not conduct a cause-effect analysis to confirm these beliefs were
537 actually inhibiting action, existing research highlights the significant role of perceived
538 self-efficacy and authority in enabling or constraining climate adaptation efforts
539 (13,69,70).

540 As such, Q methodology can be valuable for questioning conventional
541 understandings of climate risks and uncovering previously overlooked narratives
542 (67). These findings emphasise the need for caution when applying generic
543 adaptation approaches to diverse local contexts. While there is growing consensus
544 that climate change is a global problem with localised impacts requiring tailored
545 solutions, the findings further highlight that contextual psycho-social motivators and
546 barriers should be considered in the design of adaptation approaches. Engaging with
547 the perceptions of local government stakeholders – rather than assuming that
548 climate action is a priority for them – can address the root causes of inaction.
549 Further, localized framings of climate challenges and solutions can be fostered
550 through an interrogation of the root causes of inaction by facilitating local
551 government actors to articulate their own beliefs about the issues at hand. Hence, by
552 challenging or validating assumptions, Q methodology provides a creative approach
553 to reframing problems and envisioning solutions (29).

554 There are several notable limitations to using Q Methodology to inform the
555 implementation of adaptation or climate risk management approaches for WASH
556 services in an LMIC context. One significant limitation is that it is a time-intensive

557 method. In this study, each Q-sort session lasted approximately one hour, including
558 the time to explain the activity and discuss the results. Because the results are only
559 representative of the people who participated, many Q-sorts may be required to
560 account for the diverse perspectives of various government actors with WASH
561 responsibilities. Additionally, the results may also lose validity over time as staff
562 turnover occurs. Another challenge was the translation of Q-statements that included
563 climate change terms into local languages, which required careful attention to ensure
564 accuracy and relevance. Finally, the study relied on team members with quantitative
565 data analysis skills to operate the Q methodology software and interpret the results –
566 skills that may not always be available among WASH sector professionals within
567 implementing organisations at the national and subnational level. For a more
568 comprehensive discussion of potential Q methodology challenges in an LMIC
569 context, readers should refer to (67).

570 Overall, Q methodology strongly complements traditional risk, vulnerability, and
571 resilience assessments for WASH by providing insights into foundational barriers
572 and enablers. While it does not replace the need for such assessments, it offers a
573 deeper understanding that can help make subsequent solutions more relevant and fit
574 for purpose.

575 **Conclusion**

576 Our research aimed to develop a nuanced understanding of motivators and constraints for
577 local government authorities in addressing climate change impacts on inclusive WASH.
578 Climate change is a multifaceted and complex global problem with local impacts, warranting
579 localised solutions. The use of Q methodology in our research revealed local government
580 participants in Nepal and Lao PDR to have distinct perceived barriers and motivations to

581 climate adaptation action. This understanding was foundational for the design of
582 interventions that resonated with, and were actionable for, targeted users in local
583 government. Importantly, the findings helped bridge a critical gap between awareness of
584 climate change and the practical implementation of adaptive measures. They also reinforced
585 the value of decentralised approaches in advancing effective climate adaptation at the local
586 level.

587 Funding

588 This work was supported by DFAT's Water for Women Fund under the grant SNV Beyond the
589 Finish line WfW030.

590 Acknowledgments

591 The author team is grateful for the contributions of SNV team members, Shova K.C., Ambika
592 Yadav, Ram Prakash Singh, and staff of local support partners Everest Club, Dailekh and
593 Rural Women Upliftment Association (RWUA), Sarlahi who supported data collection in
594 Nepal. Thanks to government participants from eight Rural Municipalities in Nepal
595 (Dungeshwor, Mahabu, Gurans, Thantikandh in Dailekh and Parsa, Ramnagar, Kaudena,
596 and Chandranagar in Sarlahi), and three districts in Lao PDR (Palanxay, Champone and
597 Atsaphone in Savannakhet province), for their time and enthusiasm to undertake the Q-sort
598 exercise.

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776 **Supplementary information**

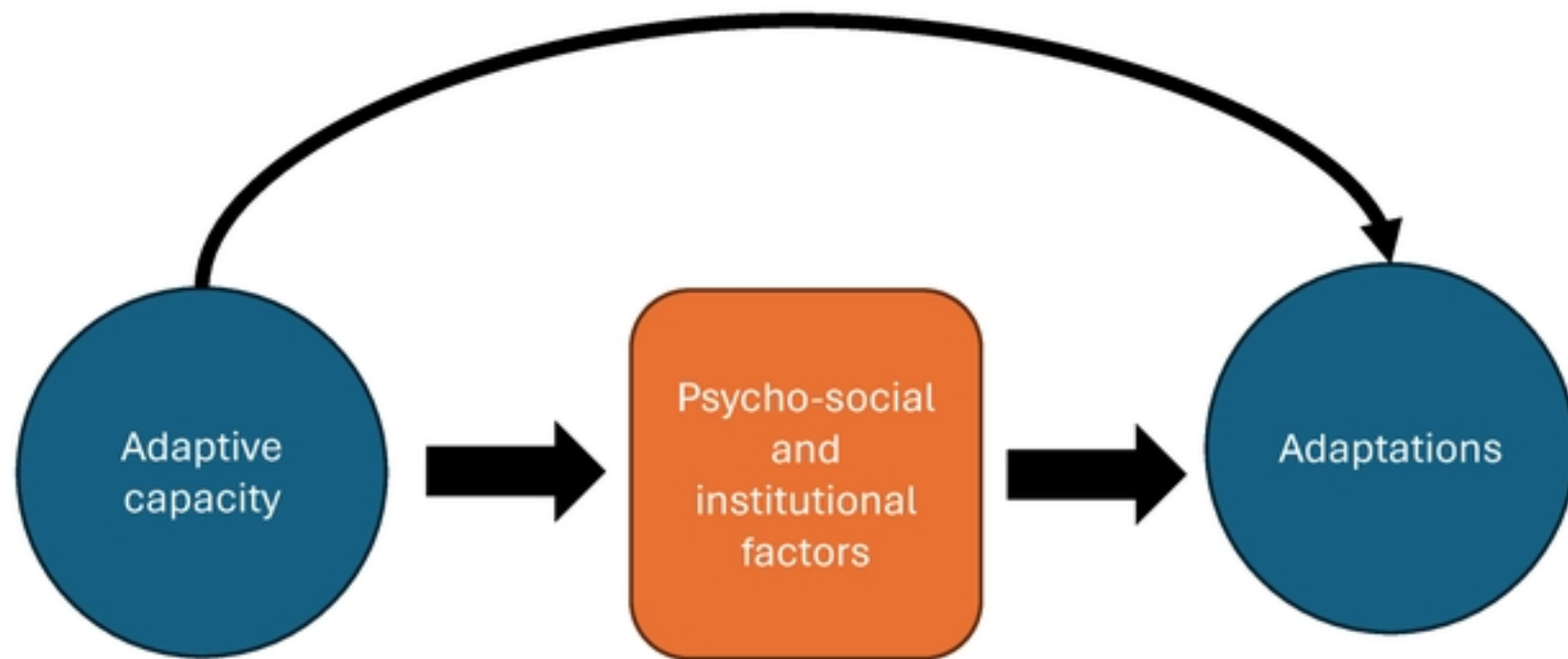
777 **S1 File. Translated list of statements**

778 **S2 File. List of 87 Q statements**

779 **S3 Data. Raw data from Q sorts**

780 **S4 Data. Q-software output results**

WASH sector actors may assume
building adaptive capacity leads to
implementation of adaptations...



...however psycho-social and
institutional factors mediate the
realisation of capacity

Fig 1. Diagram representing perceived versus actual realisation of

Q-board with corresponding scores

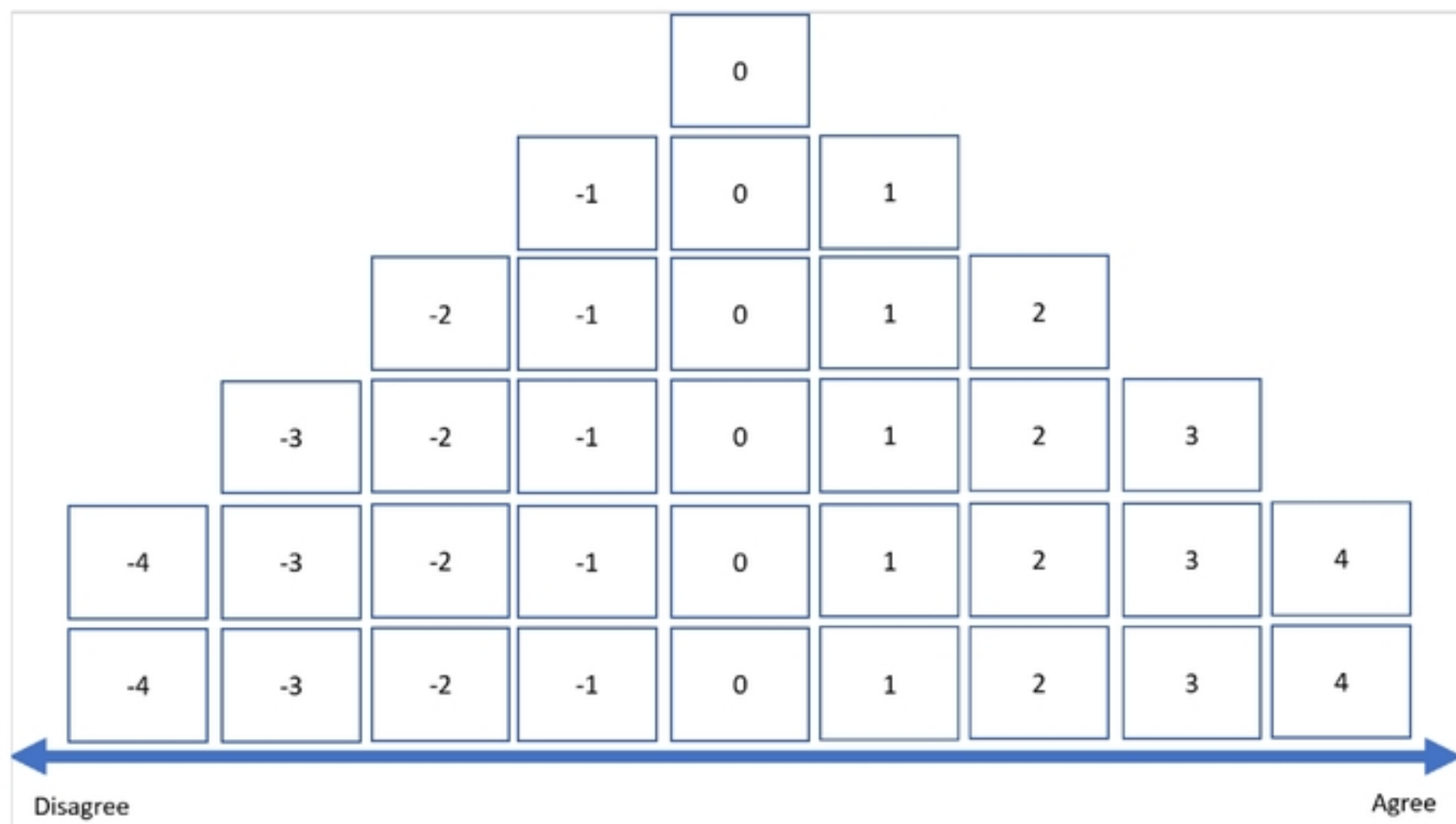


Fig 2. Q-board with corresponding scores