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Highlights

- Understand constraints & enabling conditions for implementation of ecosystem-based adaptations.
- Reveal principle discourses within a rural, subsistence-based community in Vanuatu, using Q-Methodology.
- Gender & community residency statistically relevant to discourse alignment.
- Interventions will resonate with community if they enable natural resource management, reflect traditional knowledge, provide opportunities for generating income & promote equity in decision making.

Abstract

Communities in Pacific small island states face a range of threats to their management of natural resources, exacerbated by change-related risks, all against the backdrop of social and economic transition. Ecosystem-based adaptation (EbA) describes a class of interventions that manage climatic change-related risks, which is argued to be relevant for such communities. Understanding local constraints and enabling conditions for EbA implementation is important in informing project implementation. We used Q-methodology to reveal principle discourses within a community in Vanuatu and among stakeholders with knowledge of the challenges confronting that community. We analysed stakeholders to determine whether particularly-held discourses correlate with demographic attributes. Our research revealed three principle discourses we called *Strong Kastom*, *Kastom + Health* and *Tentative Modernity*. Perspectives from each discourse need to be taken into account when identifying and evaluating adaptation options. Our results suggest adaptation interventions are more likely to resonate with the community if they support customary natural resource management, reflect traditional knowledge, provide opportunities for generating income, and promote gender equity in decision-making. Our results also suggest

external practitioners do not necessarily consider income generation as being important to community livelihoods. Ignoring a community's perspectives, values, and priorities risks undermining the viability of EbA projects.

Keywords

Climate change adaptation, discourse analysis, Pacific Islands, natural resource management, gender issues

1. Introduction

While Small Island Developing States (SIDS) have a long history of resilience and adaptation to environmental variability (Barnett, 2001), their communities face a range of chronic threats to the sustainable management of their natural resources. These threats are exacerbated by a rapidly changing climate along with new climate-related risks such as sea level rise. While communities on Tanna Island (hereafter: Tanna), in the Republic of Vanuatu, do not face an existential threat from sea-level rise (as it is an elevated volcanic island), they are archetypal of communities and locations facing similar suites of interacting threats. The increasing impacts on their natural resources from population growth, tourism development, falling agricultural productivity and over-harvested fisheries are being magnified and compounded by climate-related impacts, including more severe tropical cyclones, ocean acidification, coral bleaching, and droughts, along with increasing coastal inundation and erosion hazards.

In this paper we identify the range of perspectives on natural resource management, and social and economic transition, in the context of environmental and climate change in Port Resolution, a coastal village community on Tanna. Our purpose is to understand constraints and enabling factors for implementation of ecosystem-based adaptation (EbA) to climate change. Revealing perspectives on natural resource management in the context of social and environmental change is a necessary first step in understanding social and cultural constraints and enabling factors for EbA (Nalau, Becken, & Mackey, 2018).

Humans and their immediate environs are integrated in complex ways (Liu et al., 2007), and no more so than on Tanna. The village communities are acutely and directly dependent on ecosystem services (ES) – the flows of benefits human populations derive, directly or indirectly, from ecosystem functions and processes (Braat & de Groot, 2012; Millennium Ecosystem Assessment, 2005). 98% of all Tanna households undertake some form of subsistence food production (Vanuatu National Statistics Office, 2009); in particular, harvesting of provisioning ES provided by coral reef fisheries and by the close-coupled subsistence gardens-forest production systems (Mackey et al., 2017; Secretariat of the Convention on Biological Diversity, 2010). Rural communities in SIDS face tight resource disturbance-supply feedback loops; therefore variability in resource scarcities are more readily noticeable (McMillen et al., 2014). Indirectly, and on a longer-term basis, regulating ES, such as erosion prevention and coastal protection services provided by key habitats, such as coastal coral reefs and tropical forests, also provide foundational services in support of community wellbeing. High-integrity ecological systems provide guardrails against environmental challenges promulgated by climate change (Colls, Ash, & Ikkala, 2009). In addition, and pertinent to Tanna, cultural ES, evidenced by the deep, community-specific spiritual attachment to country, and the management practices and ceremonies that interface with it, are of considerable value (Lindstrom, 1982, 2011; Mackey et al., 2017).

EbA describes a potentially fruitful class of interventions for SIDS. It entails the purposeful deployment of ecosystems and the services they provide to assisting communities adapt to the adverse impacts of climate change and is not simply habitat conservation for its own sake (Andrade et al., 2011; FEBA, 2018; Munang et al., 2013; Nalau, Becken, & Mackey, 2018; World Bank, 2009). EbA links ecosystem conservation and adaptive natural resource management with broader social and economic development strategies for assisting

communities to manage risks associated with climate change impacts in ways that improve community wellbeing. EbA interventions are not rigidly defined, but rather best understood in terms of their position on a continuum from 'hard', engineering-based projects such as a concrete sea wall, through 'soft' engineering options such as beach enrichment, through to those based entirely on natural ecosystems such as coral reefs (FEBA, 2018, pp. 8–10; Mackey & Ware, 2018). EbA can also be understood as encompassing activities that reduce pressures on ecosystems so that they maintain resilience and are better able to provide the valued ES benefits. EbA also encompasses the capacity building of local communities required to support such actions. EbA is thus an approach that endeavours to work *with* nature and natural processes in ways that are beneficial to people.

Particularly for SIDS, EbA presents advantages over hard adaptation approaches. Hard climate change adaptations such as seawalls can satisfactorily manage risks from very specific hazards, such as inundation during storm surges, but can cause untended negative outcomes for neighbouring locations (Mackey & Ware, 2018). EbA tends to manage hazards with less certainty, but conversely helps mitigate a wider range of hazards, whilst also providing numerous co-benefits. As such, EbA promotes social equity, as these co-benefits tend to flow indiscriminately as public goods or common pool resources to the wider community, rather than as a specific, private benefit, which potentially generates a negative externality if the investment happens to have deleterious impacts on nearby habitats and communities. For SIDS, such co-benefits are often the mainstay of agriculture, fisheries and community well-being (Mackey et al., 2017; UNDP, 2010). EbAs are potentially the cheapest, safest and easiest solutions – and sometimes the only feasible solution as they deploy culturally-appropriate technology and can be utilised in locations where specialist engineering capacity can be scarce (Munroe et al., 2011).

To identify and assess community perspectives towards natural resource management – a core element in many EbAs – we use Q-methodology (hereafter, Q). Q can be used to uncover the shared mental models, or discourses, of how people individually and collectively view the world (Donner, 2001; Loring & Hinzman, 2018; McKeown & Thomas, 1988; Stephenson, 1953). With a few exceptions (Buchel & Frantzeskaki, 2015; Hermelingmeier & Nicholas, 2017; Pike, Wright, Wink, & Fletcher, 2015), Q has thus far been little-deployed in the assessment specifically of ES (Armatas, Venn, & Watson, 2014; Sy et al., 2018) and due to logistical and potential linguistic and cultural challenges outlined below, has, to the best of the authors' knowledge, not yet been used in SIDS.

This paper is organised as follows. We first provide a relatively detailed portrait of the community, to enable the reader to appreciate the culture, social relations and preoccupations of the people of Port Resolution. We then provide a short introduction to Q, before describing our approach and justifying implementation decisions in more detail as we explain the phases of our study. We then present results, followed by discussion of our findings, highlighting where our research contributes to the literature. We conclude with summary remarks and implications for practitioners.

2. Study area and social and environmental context

The study area is a series of small hamlets, centred on Port Resolution (19°31'30.0"S 169°30'14.4"E), in the south eastern corner of Tanna, in the Republic of Vanuatu (Figure 1).

The community comprises approximately 280 hectares of land and 150 hectares of inshore coastal coral reef and in-shore lagoon. The population largely lives in traditional housing, is agrarian subsistence-based, and retains strong familial and tribal affiliations. Tanna is often referred to as the stronghold of kastom [1] – a place where people still know and revere traditional songs, can trace their lineage, and organise and participate in rituals, community decision-making processes and ceremonies. Tanna is commonly regarded as an example of a location in which kastom and modernity can coexist (Lindstrom, 1982, 2011). However, common to many Pacific islands, customary practices (both social and resource management-based) are being eroded under the influence of 'western' economic systems and philosophical traditions, such as monetary exchange, economic specialisation, and individualised expression of self (Brosi et al., 2007; Nalau, Becken, Schliephack, et al., 2018). Notwithstanding, there is a renaissance of customary practices in the management of resources across the Pacific (Friedlander, Shackeroff, & Kittinger, 2013). Tanna is a hybrid system, with formal institutions of representative democracy and the administrative state, combined with the integration of traditional structures (the Malvatu Mauri, or National Council of Chiefs, which advises on issues of culture and language), and village-level decision-making through the Nakamal, the traditional meeting place.

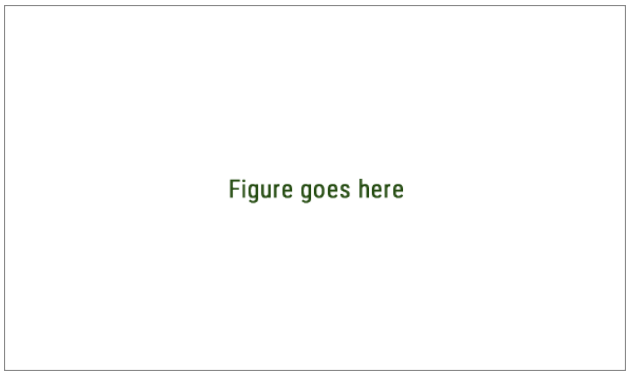

Figure 1: Location of Port Resolution, Tanna and the Republic of Vanuatu

Port Resolution depends almost exclusively on a combination of subsistence farming, animal husbandry, and artisanal fishing for sustenance and non-food product harvesting for building dwellings (Vanuatu National Statistics Office, 2009). Customary resource management practices rely on the ability of resource users to adaptively manage and understand generally tight biophysical feedback loops, and to effectively modify community-wide practices accordingly (Berkes, 2009). These customary practices are generally built on a foundation of manipulating or supporting ecological processes (Clarke & Thaman, 1993; McMillen et al., 2014). The farming system typically comprises three components: (i) a shifting cultivation system; (ii) a perennial plantation cultivation system; and (iii) a forest and aboricultural system (Blanco, Pascal, Ramon, Vandenbroucke, & Carrière, 2013; Clarke & Thaman, 1993; Thaman, Clarke, Manner, Decker, & Ali, 1993). The

[1] Pronounced 'custom' and loosely translated as such, but also encompassing a broader meaning that includes the arrangement of private relations, social and economic systems, ways of being and activities and practices in managing the landscape.

productivity of this subsistence system and integrity of the adjoining tropical forests are at the centre of a complex web of interdependencies that have an impact on overall village community well-being and resilience to climate change (Barnett, 2001, 2011). This productivity is reportedly under threat, mostly likely from shortened fallow times in the shifting cultivation system (Mackey et al., 2017). As with the land, the inshore marine areas are subject to customary ownership and allocation of access, and are both economically and cultural important to the Port Resolution community (Hickey, 2008). Marine habitats in the Port Resolution area include significant areas of shallow coral gardens and sea grass beds in some of the more sheltered areas on the lee-side of the reefs. Customary marine fisheries management have evolved to manage social relationships (closures for funerary rights, or managing relations with neighbours), rather than a need to conserve fisheries (Foale, Cohen, Januchowski-Hartley, Wenger, & Macintyre, 2011). There are no permanent freshwater streams in Port Resolution. The village's water source is a single mains pipe, which runs a significant distance (~10km) from a nearby mountain range. The flow from this source is slow but is consistent and reportedly rarely fails completely. In the main village (Ireupuow) there is a groundwater pump, which at the time of our field work was broken. A limited number of rooftop capture-water tank combinations have been installed.

Broader economic opportunities and employment specialisation are limited. Although the Ni-Vanuatu (the Indigenous Melanesian population of Vanuatu) face persistent poverty (in terms of income and risk indices), which is linked to increasing environmental and resource pressures, the *rural* Ni-Vanuatu have remained relatively immune from poverty in terms of destitution and food insecurity (Asian Development Bank, 2003), due to continuation of widespread subsistence gardening and fishing activities, and access to customarily-managed land (Gerbeaux, Kami, Clarke, & Gillespie, 2007). Where households receive cash income, the main expenditure items are rice, salt, soap and school fees. Remittances are sent by relatives who take-up employment in Port Vila (the capital) or overseas. Tourism development on Tanna is low-key, but increasing (South Pacific Tourism Organisation, 2016; Vanuatu National Statistics Office, 2018). Port Resolution has three tourism bungalow businesses, overlapping with four basic restaurants, but no equipment hire businesses, or local guiding businesses.

Under IPCC climate change scenarios, Tanna faces sufficient within-island climatic variability to require different adaptation actions between the north and the south of the island and between the coast and the uplands, particularly with respect to promoting the resilience of subsistence farming and its corollary, forest management (IPCC, 2014; Mackey et al., 2017, pp. 46–53). In addition to rising temperatures, projections suggest an overall wetting trend (largely associated with summer rainfall), an increase in tropical cyclones under El Niño conditions, sea level rise, warming sea surface temperatures, and ocean acidification. While climate change presents serious threats to the Port Resolution community and ecosystems, it is important to consider these pressures in the context of ongoing environmental changes and the drivers of these changes, particularly population growth, land use change (deforestation) and increasing pressure on the fringing coral reefs from overfishing (Mackey et al., 2017, pp. 54–56). Also important in the context of Port Resolution is the experience of Tropical Cyclone (TC) Pam, a category five cyclone that passed over Tanna in 2015 and severely affected communities on the island. It is estimated

209 that 75% of buildings on Tanna were damaged by high winds and storm surge inundation
210 (Nishijima et al., 2015). In addition, the high winds damaged crops and forests and coral reefs
211 were acutely perturbed. Although the shared memories of the socio-economic and physical
212 impacts of TC Pam are fading, it still remains salient to contemporary decision making.
213 Our research was undertaken as a component of the Pacific EcoAdapt project
214 (hereafter EcoAdapt). EcoAdapt is a multi- and cross-disciplinary program focusing on
215 evaluating the conditions conducive to and merits of EbA in the Pacific (Mackey et al., 2017).

216 # 3. Methodology

217 ## *3.1. Introduction to Q-method*

218 We used Q to identify the range of perspectives on attitudes towards natural resource
219 management and social and economic transition, in the context of environmental and
220 climate change in a subsistence gardening and fishing community. Q is considered both a
221 *quantitative* and a *qualitative*—or a quali-quantilogical— method (Stenner & Stainton
222 Rogers, 2004), based on statistical analysis of a person's subjectivity (Stephenson, 1953). It
223 sits at the intersection of empirical-analytic methods of knowledge generation, with its
224 emphasis on implied objectivity, replicability, and deduction, and discursive-contextual
225 methods of knowledge, which emphasise personal realities, and a mutual understanding of
226 shared experiences of the world (Gregory, 1978; Robbins & Krueger, 2000). Q demands
227 abductive reasoning, whereby researchers seek the most likely conclusions from an
228 incomplete set of observations (Langston et al., 2019, p. 5). Unlike R-based methods, such as
229 Likert weighting scales, Q looks for correlations amongst subjects' views, rather between
230 object variables. These correlations reflect mindsets that are analogous to the structure of a
231 discourse. Discourses are considered both external to individuals (they act *on* people) but are
232 also emergent of collective heuristics of people (people and power structures actively shape
233 them) (Dryzek, 1994, 1997). An important assumption behind Q is that there is a limited
234 number of perspectives that exist in a group of people on a given topic (Barry & Proops,
235 1999); that is, people are consistent and coherent in their viewpoints and it is likely that
236 people of a particular mindset think about distinct issues in a consistent way. However, Q is
237 not considered generalisable – it deploys strategic sampling of respondents, rather than large,
238 randomised samples (applicable to R methods), and Q-sets are based on specific contexts
239 (Amin, 2000).
240 Operationally, Q facilitates the ordering of subjective viewpoints into clusters,
241 elicited by asking respondents to sort statements (that are displayed on cards) onto a grid,
242 ranking them from most to least negative, or salient. Commonly, respondents are required
243 to sort the statements in a quasi-normal distribution, so there are fewer statements at the
244 extremes, resulting in the respondent having to apply a higher cognitive load whilst sorting.
245 Therefore, whilst a respondent may resonate positively with all statements, they are
246 nevertheless compelled to consider them in relation to one another; or as Loring & Hinzman
247 (2018) reflected from their fieldwork, a respondent stated: "they're all really important,
248 but…" (2018, p. 370). The act of sorting statements assumes a necessary level of
249 comprehension in the respondent as to the wider purpose behind task (research), a
250 reasonable level of trust between the survey team and the respondent communities, a degree

of literacy, and access to gender-appropriate translators, with the requisite inter-personal skills to capture the qualitative aspects of the data collection.

When analysing the card sorts produced by individual respondents, what is important is the relationship between the placement of the statement cards as a whole, particularly those at the extremes. Where there is sufficient correlation between respondents' sorts, this is representative of a factor, which is can be used to generate an 'ideal sort' of the statements for that factor. An ideal sort is representative of a hypothetical respondent who would 100% overlap with the factor in the statement sorting. Typically, a factor should be representative of at least 4 to 5 respondents, but repeated sampling should continue until all new sorts begin to fall into stabilised factors. These ideal sorts are then further subjectively translated into concisely-worded descriptions of the salient features by the analyst to provide rich, contextual insight into the dominant perspectives of a given inquiry. Consistent with the literature on Q our research method is broken in to five phases (Donner, 2001; Dziopa & Ahern, 2011; van Excel & de Graaf, 2005).

3.2. Phase 1: determine the nature of the inquiry and community of interest

The first phase of Q is to set the primer question that elicits responses in the problem domain and then to determine the respondents, who are collectively referred to as the P-set. Through a process of iteration, following conversations with members of the Port Resolution community and members of the project team, we settled on two differently-worded primer questions, depending on whether the respondent was a member of the Port Resolution community or not. To Port Resolution community members, we asked:

> *What are the most important issues in your community? While there may be lots of issues you think are important, which of the issues on these cards are the <u>most</u> important?*

For non-Port Resolution respondents, we needed to highlight that their responses should not explicitly be based on what they believed the community were concerned about, but rather what they believed to be the important issues, whether this decision was influenced by their knowledge of the community's opinions or not:

> *From your knowledge of the Port Resolution community and its people, what do you believe are the most important issues facing that community? Do not explicitly put yourself in their shoes and state what you think they believe are important issues, but instead consider the issues on these cards you believe are important.*

Q is so-called as it is an inversion of R methodology. Unlike R methods, whereby the participants represent the sample and the attributes of the survey questions are the variables, in Q, the statements are the sample and the P-set is the variable. Therefore, randomly selecting participants would be the equivalent of randomly selecting variables in a traditional survey (Stevenson, 2015; Watts & Stenner, 2012). For this reason, strategic sampling is acceptable. Selecting a reasonably diverse set of respondents provides greater opportunity to uncover more diverse viewpoints (Nguyen, Boruff, & Tonts, 2018; Webler, Danielson, & Tuler, 2009). Our P-set (Table 1) was sourced from (i) Port Resolution community members of varying demographic attributes; (ii) the EcoAdapt project team members; (iii) inter-governmental and non-governmental organisation staff; and (iv) philanthropic volunteers in the community, all of whom had direct experience of the area, or Tanna (more broadly).

293 **Table 1:** Key stakeholder groups from which our Q-methodology respondents were drawn

Table 1

294 ### *3.3. Phase 2: issue discovery, defining the concourse, determining the Q-set*

295 The scope of the issues that will eventually form the set of statements is referred to as
296 the 'concourse', or "domain of subjectivity" (Robbins & Krueger, 2000, p. 638) – the sum
297 of things people *say* and *think* about a particular issue. The term 'concourse' suggests a
298 crowded public space where (perhaps) a range of voices are attempting to be heard in order
299 to articulate semi-structured concepts. This is an advised metaphor, as the goal of forming
300 the concourse is to elicit as many viewpoints as possible, through a deliberative, mixed-
301 method approach (Kenter et al., 2016; Kenter, Hyde, Christie, & Fazey, 2011). Our concourse
302 was generated from the following series of activities. Firstly, we audited existing findings
303 from the project team, gleaned from numerous formal and informal interviews from
304 previous field trips to the Port Resolution community (between 2016 and 2018) and
305 subsequent published papers (Hafezi, Sahin, Stewart, & Mackey, 2018; Mackey et al., 2017;
306 Nalau, Becken, Schliephack, et al., 2018). Secondly, we undertook focus group discussions
307 (FGD) with the EcoAdapt team (representing 'expert' opinion), which included canvasing
308 judgements on climatic, oceanic and land-use impacts, which described modelled long-term
309 impacts of climate change, including the likelihood of more extreme weather, sea level
310 inundation, and coastal erosion. Thirdly, we carried out two FGDs in Port Resolution; one
311 with the women of the village (n=15) and a second with the men (n=10). The purpose of the
312 gender-determined nature of the FGDs was to ensure the concerns of women were not
313 constrained by prevalent gender imbalances in power relations that remain pervasive in the
314 Pacific (Malvatumauri National Council of Chiefs, 2012; UNFPA, 2011; WHO, 2003). Both
315 Port Resolution-based FGDs were purposefully facilitator-led, rather than conducted from
316 the 'ground-up' – that is, the concourse from expert opinion (the first two rounds of
317 discovery) was presented to the groups as a starting point for discussions and the process was
318 equally focussed on eliciting further issues not so far detected as well as on ensuring language,
319 tone and phraseology of the existing draft statements were appropriate for subsequent stages.
320 At the conclusion of phase two, we had developed a concourse of 50 statements. We
321 then further filtered our concourse, taking account of three requirements. Firstly, taking
322 advice from Donner (2001), we ensured that, from a content perspective, statements avoided
323 near duplicates, extreme statements, either positive or negative, as it is likely *everyone* will
324 prioritise this card in the same way, and exact opposites. Secondly, we ensured that
325 statements represented the range of ES types from each category: (i) provisioning;
326 (ii) regulating; and (iii) cultural (Haines-Young & Potschin-Young, 2018; UN Statistical
327 Division, 2018). Thirdly, we ensured our Q-set included at least one statement phrased in a
328 way to ensure that collectively they could fulfil the elements of a complete discourse,
329 according to Dryzek & Berejikian (1993) and Ockwell (2008); that is, they included
330 statements that were: (i) ontological; (ii) referred to agents and their motivations; and
331 (iii) had assumptions regarding natural relationships between assumed entities. In later
332 analysis, we also teased-out some of the key metaphors associated with each discourse (see
333 Table 2).

334 **Table 2:** Elements of discourse represented in our Q-set. To enable a final factor to fulfil the requirements of a
335 discourse we ensure statements were phrased in such a way as to meet the required elements of a discourse
336 (Dryzek, 1994; Dryzek & Berejikian, 1993)

Table 2 contents

337 After this process, 34 statements remained. These were translated into Bislama and
338 alpha-tested with a Ni-Vanuatu subject, from Tanna, known to the authors. Numerous
339 languages are spoken across Tanna (Nehrbass, 2012), however it was impractical to procure
340 translation of the statements into the local language. Further, we employed an illustrator to
341 sketch the key concepts and activities associated with each statement. The sketches were
342 shown on the statement cards, designed to assist community members with lower literacy
343 and to perform the role of *aide memoir*, particularly when the respondent needed to shift
344 statements that had already been placed on the sorting distribution. The illustrations also
345 contributed towards creating a game-playing aesthetic, not necessarily 'gamified' (Deterding,
346 2012), in an attempt to make the activity accessible and engaging. Our final set of statements
347 (known as the Q-set) is in Table 3, classified into the following categories: (i) provisioning
348 ESs; (ii) regulating ESs; (iii) cultural ESs; and (iv) social and health. In this context, we define
349 cultural ES as either a value that already emanates from the community's association with an
350 ecosystem (habitat) or a latent demand from the community for capturing the value from
351 the natural environment through developing recreation and tourism opportunities. A
352 selection of our statement cards, showing the illustrations, is in Appendix 1.

353 **Table 3:** The 34 Q-statements used in our Q method study. Our primary categorisation was framed around the
354 ecosystem services classification scheme from the Millennium Ecosystem Assessment (de Groot et al., 2012;
355 Millennium Ecosystem Assessment, 2005) in addition to two further categories for 'Social' and 'Health' issues.
356 Health was extracted from the Social category as (specifically) health issues were key distinguishing statements in
357 Factor 2. In our classification, cultural ecosystem services also include issue statements that reflect an affinity to
358 activities that rely on cultural ecosystem services; namely earning money from tourism based on eco-tourism
359 principles. The ideal factor score is weight given to that statement (from -4 to +4) if an ideal representative of that
360 perspective had completed the Q-sort.

Table 3

361 *3.4. Phase 3: Data collection*

362 The majority of our Q-sorts were carried out *in-situ* in Port Resolution using a large
363 'playing mat' for the sorting (Figure 2). Again, we tried to maintain the game aesthetic. We
364 undertook additional sorts in Port Vila in Vanuatu and with the project team. Each of the
365 respondents' sorts was placed on a quasi-normal distribution containing 34 placements from
366 +4 to -4 in order of salience. Data collection took place over a period of four days; done by a
367 team of three. We recruited two (previously known) research assistants from Port Resolution
368 to act as translators and interlocuters. Recruitment of respondents was done through a
369 combination of actively seeking-out participants (visiting their house, or school, for
370 example) and strategically positioning ourselves in a busy location in the main village
371 (Figures 3 and 4). Additional sorts, for IGO/NGO participants, development workers and
372 project team members were carried out in more controlled environments, with
373 appointments made at specific times.

An important aspect of Q is the capacity for quantitative assessment through observation of respondents' sorting strategies and asking them to articulate their thought processes. This assists with the formulation of the rich text descriptions of each of the key factors. Whilst the sorting strategies of the respondents could be ascertained through simple observation of the mechanics in laying down the cards, a free-flowing, two-way discussion of the thinking behind the sorts proved difficult. Respondents were generally quiet in setting about their tasks and in most cases discussion could only effectively be made through interpreters. Nevertheless, some useful observations were made, either through watching the card sorting, or from key elements of dialogue captured during the process. Sorting strategies from community members did not vary much. Predominantly, respondents laid all the cards out, read them carefully, then started placement from the most important (+4), working backwards and shuffling cards backwards when fine-tuning their sorts. Non-community respondents were more confident in assessing each card on its merit and placing each card as it arose from the pack. However, as more cards were revealed, their certainty often dissipated and was replaced by wry smiles as the complexity of the task became more apparent.

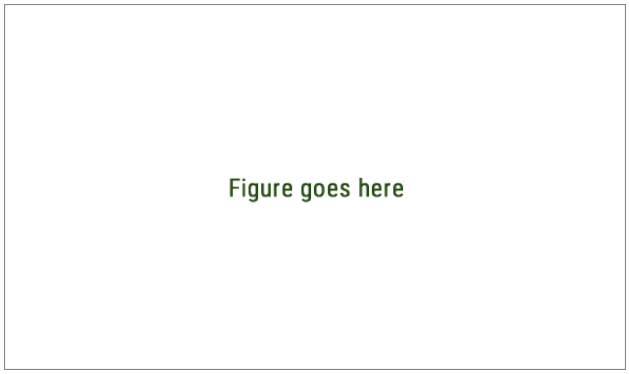

Figure 2: Q-method scoring board. To serve the game aesthetic, our ranking board was brightly coloured, with clear use of a well-understood colour scheme and use of smiley and sad faces. The ranking board was printed on durable vinyl. It also contained areas for pre-sorting, enabling respondents to sort the cards into generally favourable, generally unfavourable and neutral categories, before more detailed placement.

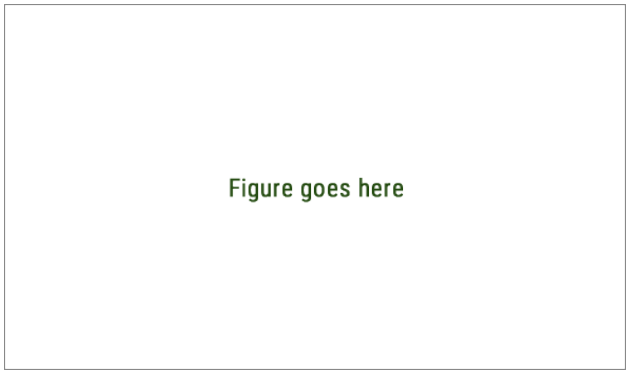

Figure 3: Undertaking Q-method with the women of Port Resolution.

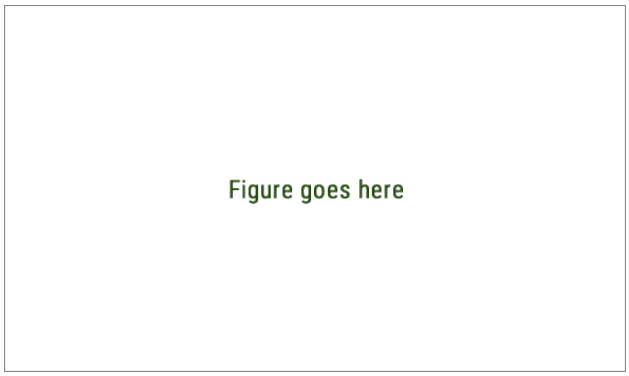

Figure 4: Undertaking Q-method with the men of Port Resolution.

3.5. Phase 4: statistical analysis

For our statistical analysis we used the web application Ken-Q Analysis (Banasick, 2018). We calculated the correlations between the participants' Q sorts to create a 'correlation matrix', which is then subject to factor analysis. Considerations of statistical significance should not preclude qualitative judgements about appropriate factor solutions; that is, when using Q, it is feasible, based on expert judgement or from earlier consultative activities, to have *a priori* insight into the likely factors. The factor analysis can produce a number of statistically relevant outputs, however, through an iterative process, which included consistently asking the questions: (i) is the candidate factor statistically relevant, with an Eigenvalue greater than 1; (ii) are there more than two participants who are highly correlated within one factor and no other; and (iii) do the participant clusters agree with qualitative data and observations from interviews and FGDs (Stevenson, 2015). High factor stability is considered to have been achieved when a dozen-or-so respondent sorts load into a factor. Moderate stability is when 6 to 8 load into a sort (Kerr & Swaffield, 2012). Confounding sorts (respondents who load into more than one factor) and null sorts (respondents who do not load into any factor) are discarded, however these sorts are included in the analysis of consensus statements (section 4.2) and low-scoring statements (section 5.3).

4. Results and analysis

We collected 55 responses, 35 from women and 20 from men. Statistical analysis of these responses revealed three dominant factor loadings, with one factor particularly strongly evident and two somewhat less prominent, followed by a long tail, with less significant differences between them (see Figure 5). The three dominant factors were extracted via Varimax Rotation; together these factors explained 40% of the total variation, which meets the threshold of 35%-40% suggested by Kline (1994) (see Table 4). Respondents were assigned into factors with p value of < 0.05, using Ken-Q Analysis auto-flag function. Of the 55 respondents, 42 loaded into the three rotated factors; 11 were found to be confounding (loading into more than one factor) and a further 2 were discarded for not loading into any factor. Factor 1 contained 18 respondents, however two were split-off into a Factor 1b that was bipolar (that is, the factor is defined by positive and negative viewpoints). Factor 1b was subsequently discarded as it contained only two members. Factor 2 contained 17 respondents and Factor 3 contained nine. The ideal sorts for Factors 1a, 2 and 3 are shown in Figure 3. An ideal sort is the pattern expected if a respondent loads 100% into that factor. (In reality, the

highest loading respondent into Factor 1a loaded at 0.8566, Factor 2 at 0.7686, and Factor 3 at 0.6572.) The correlation between the each of the three rotated factors is shown in Table 4.

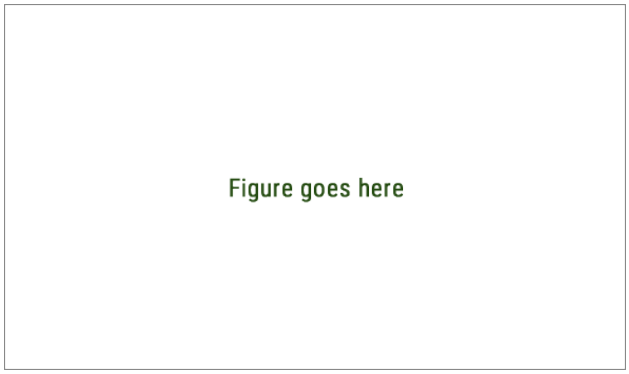

Figure 5: Scree plot of Eigenvalues of principal components from our factor extraction. We retained three factors for Varimax rotation, concluding that within the 'long tail' (from factor 4 onwards), there is insufficient variation and explanatory power.

Table 4: Results of our Q-methodology factor analysis, showing Eigenvalues, cumulative percent of explained variance, number of defining sorts in each extracted factor (respondents who fit the factor) and the correlations between these factors.

Table 4

4.1. Phase 5: Factor qualification

Factor analysis is a qualitative process of interpreting and describing the rotated factor arrays. This can be based on assessments of shared positive, negative or neutral sorts, particularly at the extremes. We also consider distinguishing statements for each factor – those statements that load into one of the factors in a position that is significantly different from the other factors. Distinguishing factors are labelled in Figure 6. To assist with our determination of the key attributes of each factor we displayed each factor in a spie chart showing the position-derived score given by respondents in each of the statement categories in Table 3 – for provisioning ES, regulating ES, cultural ES and more general social issues (see Figure 7). In our process of analysis, two social issue statements (S26 and S32) associated specifically with health were further isolated, demonstrating Q's capacity to reveal non-hypothesised concepts. These two statements were particularly prevalent in Factor 2 and also generated a significant point of difference with Factor 1a (S32 was a distinguishing statement). Our qualitative assessment and description of each of the factors is below. For each statement we deploy the approach of Dryzek (1997) in summarising the key elements of a discourse.

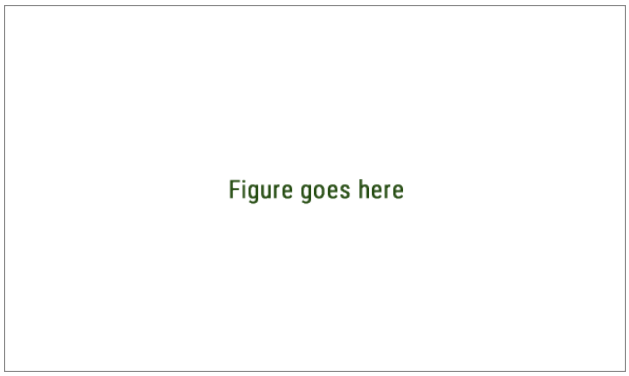

Figure 6: The ideal sorts from each of our three rotated factors. An ideal sort is the sort expected if a respondent loads 100% into one of the factors. (In reality, the highest loading respondent into Factor 1a loaded at 0.8566, Factor 2 at 0.7686, and Factor 3 at 0.6572.). Distinguishing statements are labelled and marked with * where the distinguishing significance is at $P < 0.05$ and ** where the distinguishing significance is at $P < 0.01$. Distinguishing statements are also marked with a ◀ where their score is lower than in all other factors and a ▶ where their score is higher than in all other factors.

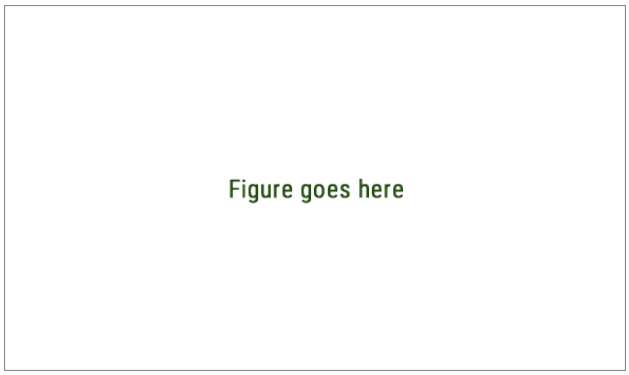

Figure 7: Factors represented as spie charts, indicating the representation of each statement in our initial categorisation of (i) provisioning ecosystem services; (ii) regulating ecosystem services; (iii) cultural ecosystem services; (iv) health; and (v) social issues. The relative share of the pie is a representative of the number of statements in each category. The concentric scale is representative of the score given to that statement in each of the factors. So that all values are positive, the scores have been re-assigned as: -4 = 1; -3 = 2; … +3 = 8; +4 = 9.

4.1.1. Factor 1a

Respondents associated with this perspective emphasise traditional and customary practices and a preoccupation with concerns around the sustainability of provisioning ecosystem services and, to a slightly lesser extent, regulating services. All statements placed in the +2, +3, and +4 positions are in some way associated with kastom decision-making and kastom resource management. The statements connected with passing natural resources, knowledge, and customs down to future generations (S12, S13, and S15) and concerns around garden productivity and managing fisheries were highly salient. Conversely, Factor 1 places low emphasis on economic development opportunities associated with monetising cultural ESs and the infrastructure that supports this, and with further elements of modernity, such as access to financial services, electricity and voting and health. Statements related to childhood education were ranked neutrally. For these reasons we labelled this factor as *Strong Kastom.*

Box 1: Discourse analysis of Strong Kastom

Box 1

4.1.2. Factor 2

Respondents who hold this perspective again emphasise traditional and customary preoccupations but have a generally lower concern with the sustainability of provisioning ecosystem services. However, importantly, they demonstrate a strong affiliation with the two statements associated with modern health care (S3 and S4) and the two associated water, sanitation and health ('WASH') statements (S2 and S3). A single economic development statement appears at +2, indicating this perspective is a little more open to exploring income-generating opportunities, but not strongly so. This factor placed the highest salience on concern for extreme weather, associated with climate change. Three key kastom-related statements associated with sustaining traditional practices in the management of resources and practices remained salient (S12, S13 and S18). Similar to *Strong Kastom*, respondents show less affiliation with statements associated with broader social change, such as access to information and financial services, economic development and voting. Statements related to childhood education were ranked neutrally. Given broader similarities to *Strong Kastom* and the strong association with health and sanitation statements, we labelled this factor as *Kastom + Health*.

Box 2: Discourse analysis of Kastom + Health

Box 2

4.1.3. Factor 3

Our third factor still demonstrates a strong affinity to certain elements of kastom and customary management of resources, with both +4 positions occupied by kastom statements (S1 and S15). However, one of these kastom-related statements (S15) is related to more ceremonial cultural practices associated with retaining knowledge of dances and songs, rather than social relations between contemporaries. Distinguishing this factor is the greater affinity with cultural ES, demonstrating a desire to capture monetary value from nature, through tourism opportunities. The one outlier to this was S28 (borrowing money to invest in tourism services or for monetising fisheries). The two health-related statements together also ranked relatively highly. In addition, and importantly, two female emancipatory statements (S20 and S34) are ranked highly. The emancipatory statements are associated with further influencing decisions in the village and with a concern for greater gender equality in the share of domestic work. Regulating services are generally ranked lower. The affinity to economic development and emancipatory concepts signifies a desire for modernisation towards an exchange-based economy, however, the connection to kastom shows this affiliation is tentative. Statements related to childhood education were ranked neutrally. We labelled this factor *Tentative Modernity*, intending to convey the openness of this factor to concepts of monetary exchange and economic specialisation, and a resistance to determining ones' role

in the community based on gender, whilst retaining a tendency towards traditional cultural practices and a pre-occupation with concern for kastom forests.

Box 3: Discourse analysis of Tentative Modernity

Box 3

4.2. Consensus statements

Consensus statements are statements shared by all factors within a single score of each other. Consensus statements are relevant as they can represent potential starting points for community engagement and project development; in lieu of advocating for potentially strongly-held (by some), but nevertheless more divisive, views. Our analysis revealed six consensus statements, of relatively diverse subject matters (see Figure 10 for factor score congruence as a guide). The most highly ranked of these were S8 (protecting reefs by catching fish further out to sea) and S2 (access to sufficient drinking water). Other consensus statements (in order of increasing mean z-score) were S27 (costs of secondary school), S7 (non-biodegradable waste disposal), S33 (personal safety) and S28 (access to micro-finance). Whilst we could not decipher any particular general sentiment common to these consensus statements, individually they represent opportunities for potentially useful and discreet community development projects in support of EbA, such as improving sea-faring capabilities and drinking water facilities; implementation of which could benefit from consensus support (from within the community and across the wider stakeholder group).

5. Discussion and emerging issues

Our paper seeks to reveal the range of perspectives on natural resource management in the context of environmental and social change in rural communities on Tanna in order to understand potential constraints and enabling factors for implementation of EbA. In this section we analyse our discourses vis-à-vis a series of demographic attributes, then look specifically at how climate change-related statements (adaptation-based and impact-based) are positioned in each factor, so that we can make a judgement on the prospects for EbA. We also look at broader emerging issues, including assessing specific low-scoring cards and, finally, we reflect on our methodological approach in a SIDS context.

5.1. Correlations based on demographic features

Limited demographic information was collected from each respondent, but this data nevertheless provides valuable additional insight into the propensity for different attributes to correspond to each factor. We collected information on the participants' gender, whether they earned *some* income, and whether they lived in the Port Resolution community. Income for Port Resolution community members is earned from either owning a tourism establishment (restaurant or holiday bungalows), working at the school or as a medical professional, or from casual employment from labouring. To understand the propensity of each of these attributes to be associated with each factor, we normalised the value of membership of each factor by calculating how many respondents would load into each factor if the sample was equal for each pairing (male/female, waged/non-waged and community

member/non-community member); that is, if the respondent set contained 27.5 men and 27.5 women, for example, how would each discourse be constituted. The results are in Table 5. This represents a *ceteris paribus* predisposition for a demographic attribute to belong to each factor; on the assumption that each demographic variable is independent of each other. Notwithstanding the generally small samples inherent in Q, we also tested both the significance of these relationships and any interdependencies, using a multinomial logit regression, with factor membership as the dependent variable (all independent variables are categorical in nature) [2]. The predictive capacity and significance of the regression results are discussed in the relevant sections below.

Table 5: Weighted factor membership for selected demographic information. The scores are weighted as such to indicate how many respondents would load into each factor if the number of respondents in each factor was equal (27.5).

Table 5

5.1.1. Gender

By gender, *Strong Kastom* was significantly skewed towards men (M:F | 12.4:5.5); *Kastom + Health* was weighted relatively equally; and *Tentative Modernity* was skewed towards women (M:F | 1.4:6.3). This infers that men have a higher affinity to traditional and kastom aspects of village life, and women have a greater affinity towards change and the opportunities economic development presents. To further explore this dichotomy, we undertook additional categorisation of our statements and placed them into three new categories: (i) traditional; (ii) economic development and emancipatory; and (iii) others. We then mapped these categories in a spie chart (see Figure 8). Statements categorised as 'others' were put aside for the purposes of this analysis. Though all discourses showed an affinity towards tradition, *Strong Kastom* had a significant skew towards traditional statements (unsurprisingly) and very low affiliation with economic development and emancipatory statements. Conversely, *Tentative Modernity* had a greater affinity with economic development and emancipatory statements. Gender differentiation in tasks, access to resources and community decision-making is still prevalent in Tanna and the role of kastom in arbitrating community outcomes is not considered universally positive (Malvatumauri National Council of Chiefs, 2012; UNFPA, 2011; WHO, 2003). This is particularly relevant in Tanna where men dominate community and household decision-making and hold many entitlements to traditional stories and knowledge of traditional weather indicators, while women do most of the gardening, food preparation, and water collection (Nalau, Becken, Schliephack, et al., 2018). Without overplaying the role of researchers as emancipatory agents, an ethical trade-off exists where researchers must remain objective observers (to enable method replication), but at the same time must ask probing questions to tease out concerns and then test individual preferences that may lay hidden behind power relations, and which *may* create the potential for change. The dual qualitative-quantitative and deliberative-

[2] This represents a similar approach to that used to identify potential individual specific characteristics as drivers of preference group membership in latent class analysis of choice experiment data (Hensher & Greene, 2010; Roeder, Lynch, & Nagin, 1999).

individual nature of Q can begin to open some cultural norms to discussion and potential change (Rubin, 2016). We conject that women see economic activity associated with monetising the comparative advantages of Port Resolution's cultural ES as an emancipatory strategy, which could potentially recalibrate their role in the community. However, attachment to the tenets of kastom still remain influential in this factor. In our multinomial logit regression, gender was a driver of factor membership of *Tentative Modernity* over both *Strong Kastom* and *Kastom + Health*, though it was only statistically significant (p=0.077) in the case of the former.

Our research revealed activities that support economic development and further female emancipation, which *might* challenge some elements of kastom, may experience differences in community support based on gender. This suggests a gender-based fault line between the discourse of emancipation from traditional decision-making and divisions of labour through the vehicle of economic development, and the contrasting preoccupation with kastom and kastom management of natural resources as a discourse in the service of maintaining pre-existing power structures. Though our Q did reach definitive or comprehensive conclusions through a regression model (this was not the objective; Q uses strategic sampling), it does, at least, point to potentially critical inter-sectional perspectives that demand further investigation in research or in project development.

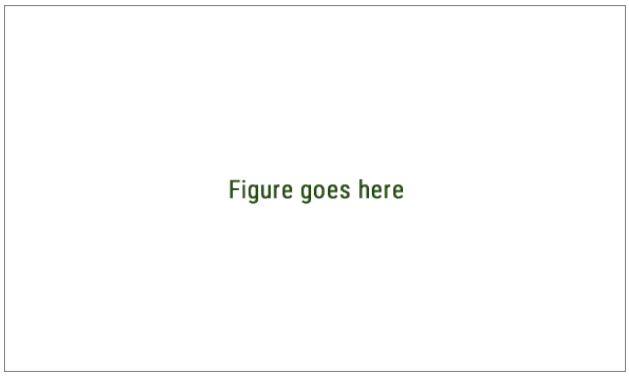

Figure 8: Factors represented as spie charts, indicating the propensity for traditional and economic development / emancipatory statements to be associated with each extracted factor. Traditional / Kastom statements are: 6, 12, 13, 15, 16, 17, 18 and 23. Economic development / Emancipatory statements are: 14, 20, 21, 22, 24, 25, 26, 28, 31, 33, and 34. The relative share of the pie is representative of the number of statements in each category. The concentric scale is representative of the score given to that statement in each of the factors. So that all values are positive, the scores have been re-assigned as: -4 = 1; -3 = 2; ... +3 = 8; +4 = 9.

5.1.2. Income

The second demographic attribute we examined was whether earning income led to a propensity to load into a particular factor. In this instance we used a very basic measure of earning *some* income, regardless of its quantum, or whether this income was permanent. In Table 5, only *Kastom + Health* revealed any potential association with this attribute, with respondents who earn some income dominating this factor. *Tentative Modernity*, with its generally greater focus on economic development through monetising cultural ES, was slightly better representative of purely subsistence members of the community. Putting these two relationships together we can conject that members of the community who already have

some income are ambivalent about further economic development or emancipatory concepts, seemingly enjoying the best of both worlds. In our multinomial logit regression, income was not a significant driver of the allocation of respondents to factors.

5.1.3. Community status

The third demographic attribute we examined was the contrast between community members and respondents from outside the community (from NGOs, IGOs, and academia). Community members had a substantially stronger affiliation to *Strong Kastom* than non-community members, whilst non-community members had a conversely stronger affiliation to *Kastom + Health*. However, most significantly, there were no non-community members identifying with *Tentative Modernity*. This suggests there is a discord between outsiders' understanding of the view community members (especially women) take on the role economic development plays in improving well-being. This suggests non-community members (including external experts and programme officers from IGOs/NGOs) are reluctant to consider prosaic economic development pathways towards a cash-based, labour-specialised exchange system as a completely positive pathway. In our multinomial logit regression, non-community membership was a significant driver of factor membership of *Tentative Modernity* over *Strong Kastom* ($p < 0.001$) and over *Kastom + Health* ($p < 0.001$).

Whilst the propensities for particular sorts referred to above provide evidence that different classes of respondents load into factors, using Q we cannot necessarily deduce with significant statistical certainty that this will be the case in all instances. Whilst we learned that *Strong Kastom* and *Kastom + Health* weighted towards men, we also learned there is a significant gender-based discourse that is sympathetic to the economic development opportunities that can capture cultural ES benefits provided by the attractive natural ecosystems of Port Resolution and which has an affinity towards emancipatory concepts. We also learned there is a potential blind spot amongst non-community members for this discourse and that programme design in support of community development that is dominated by the views of 'experts' risk ignoring the role of economic development and, by virtue of this, ignoring opportunities for women. Though Q is not considered generalisable (the statements are often specific to the P-set), our multinomial logit regression analysis did suggest that auxiliary regression analysis of Q-derived discourses could be a potentially useful approach for identifying predictors of discourse membership for a wider population, based on a broader set of demographic and attitudinal attributes. Therefore, notwithstanding strategic sampling, using Q, can (and did) lead us to form useful hypotheses on which further research can be based (see Conclusions section).

5.2. Constraints and enabling factors for ecosystem-based adaption

Our research demonstrated that there is an affinity towards provisioning and regulating ES across the dominant discourses. The role of ES in community well-being on Tanna is well documented and confirmed (Mackey et al., 2017). As such, *prima facie* EbA would not likely face social and cultural constraints in the Port Resolution community and EbA implementation would simultaneously address ecosystem adaptation and livelihood improvements (Nalau, Becken, & Mackey, 2018). In Figure 9, we identify and plot

statements that are aligned explicitly with EbA (n=5) and statements that suggest a pre-occupation with climate change impacts, such as a warmer and drier climate and more extreme weather events (n=3). *Strong Kastom* shows the most positive alignment for climate change concerns and EbA. *Tentative Modernity* shows the least alignment.

Q is not designed to determine preferences for specific adaptations at a project level, however it does reveal the coherent discourses present amongst stakeholders, which can be used to start to define constraints and enabling factors, and thus the feasibility and utility, of EbA projects. For example, a statement card that ranked highly in any or all of the factors should not necessarily be used in isolation as a template for the design of projects. In our study, there is a reasonable level of congruence between the factors in the (high) ranking of statement S1 (protecting forests from being cut to make way for gardens). This suggests that project design for a climate adaptation project should be cognisant of the role that customary management of forests plays in each of the discourses and could potentially use this as a starting point for engagement with the community. In addition, as suggested in the previous section, program design that considers the role of economic development through tourism is likely to appeal to women as a pathway towards greater engagement in shaping the community's future.

Based on our Q results, EbA projects at Port Resolution should consider income generating activities and guard against solutions that maintain the exclusion of women in decision-making. These findings are supported by Djoudi & Brockhaus (2011) who argue that women can be hindered from realizing the potential of any new economic development opportunities in developing world contexts (Djoudi & Brockhaus, 2011, p. 123) that point to women's vulnerability to climate change increasing in the short-term; however, if economic activities can be harnessed, and power and resource entitlements follow, the longer-term prognosis is more positive.

Fundamentally, however, our research shows that interventions must be sensitive to the importance of kastom resource management and knowledge. Knowledge is contested between multiple stakeholders in complex social-ecological systems across scales. If project implementers are to succeed in development activities, it must be understood that knowledge is held by different stakeholders with a range of motivations, aspirations, concerns and frames of reference, which, if not coordinated, can lead to zero-sum outcomes (Langston et al., 2019; van Noordwijk, 2017). We recognise Indigenous Traditional Knowledge (ITK) remains important to Tanna communities and can be employed successfully in responding to climate threats (Nalau, Becken, Schliephack, et al., 2018). If the view is taken that ITK is one, albeit rich, layer in "nested knowledge systems" (Nalau, Becken, Schliephack, et al., 2018, p. 851), our Q research lends itself to the concept of co-produced knowledge, as envisaged by Díaz et al. in the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services framework (2015, 2018). As ITK is held and accumulated collectively, EbA has potential to be fully integrated into the community actions and interests – a common factor of success.

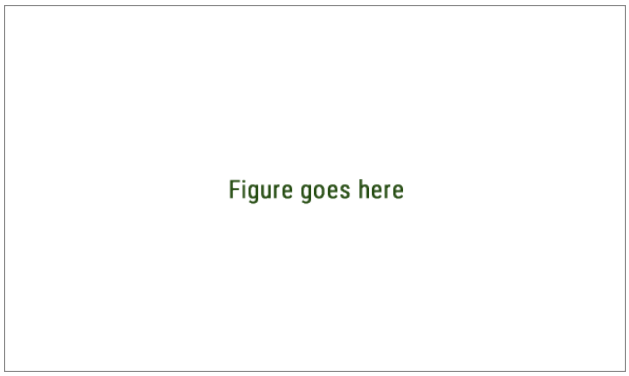

Figure 9: Sentiment towards climate change adaptation statements and climate change impact statements for our three factors. Adaptation statements were S1, S8, S9, S10, and S11. Impact statements were S3, S4, and S19.

5.3. Low scoring statements

Whilst the purpose of Q is not to consider statements in isolation (as if it were a R-type survey) the process of doing so can elicit useful information. Two statements scored consistently low: S11 (cooking with an alternative to firewood) and S22 (free to vote in elections), which had mean z-scores of -1.28 and -1.68 respectively. In addition, there was relative consensus in this low scoring (see Figure 10). The very low mean score associated with voting in elections suggests there is little interest in the formal institutions of representative government in being able to meet the challenges faced by rural, subsistence communities. Local decision-making, at the *Nakamal*, the traditional village civic meeting place, is of greater importance. For example, the area's roads are dirt tracks not maintained by the Provincial government and are sometimes impassable even to 4-wheel drive vehicles, yet the community feels empowered to make the decision to fix the road with their own labour, at the time of their choosing. However, from prior field trips taken just after national elections in 2018, the authors noted localised concern, particularly amongst village matriarchs, for the lack of fairness and openness in the voting process.

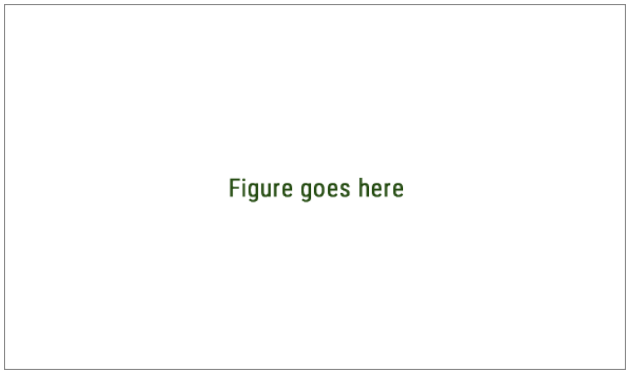

Figure 10: Factor score congruence for statements. Statements (x axis) are ranked in order of standard deviation (lowest on the left to highest on the right) of the mean score from each factor. The y axis is the mean score for each factor for that statement. Statements to the left of the chart have high congruence, statements to the right have low congruence between the factors. Therefore, statement 28 has the highest level of congruence between the factors, but has a generally negative salience. Factor 2 has a third ranked congruence *and* has a generally positive salience.

5.4. Reflections on carrying out Q-method on Tanna

We conclude that Q is a viable method of enquiry for SIDS and less-economically developed communities, more broadly. Participants exhibited a high level of interest and comprehension, even though literacy levels are low, resulting in successful data collection from community stakeholders. Our use of a game-playing aesthetic (see Appendix 1), proved engaging for both community and non-community participants. During sorting, respondents felt fully-comfortable swapping cards if they felt they needed. However, occasionally, after prompting for conformation, they reflected again on the purpose of shifting cards more than one unit of scale (generally backwards), simply because that was where the gaps remained. Women in the village felt fully engaged and universally were comfortable in fulfilling the task. However, groups of women participating tended to demotivate men from joining-in and vice versa. Men were initially more sceptical, but once the statements were absorbed, their engagement and care with placement increased. In general, levels of Bislama literacy was strong. As anticipated (and mitigated by the deployment of the illustrations) a few of the older women (adjudged to be more than 40 years old) heavily relied on the spoken translations and supervision of the female research assistant. As an aside, the productivity of the data collection in the community increased each day, as word-of-mouth spread and our presence and the activity became progressively demystified. On reflection, the main limitation of our study is typical of the principle weakness of Q in its necessity to reduce often complex and nuanced issues down to single statements. Q is, by nature, discursive in its execution and unless there is sufficient shared understanding of statement meaning, the explanatory power of Q is eroded. In this instance, this reduction is potentially amplified by the discursive, cultural and linguistic distance between the interviewer and the respondent.

6. Conclusion

Our study set out to identify the range of perspectives towards natural resource management and social and economic transition, in the context of environmental and climate change in rural communities on Tanna, to understand constraints and enabling factors for implementation of EbA. By using Q, we approached this research problem indirectly, using discourse analysis of stakeholders. We identified three dominant perspectives ('discourses'), which explained 40% of all variance in our sorts: (i) *Strong Kastom*; (ii) *Kastom + Health*; and (iii) *Tentative Modernity*. In each of these perspectives, there was a strong affinity to provisioning and regulating ES that reflected the omnipresent role of kastom in arbitrating social relations and customary management of natural resources. However, *Tentative Modernity* had significantly greater openness to economic development opportunities associated with monetising cultural ES, which was noticeably absent from *Strong Kastom* and *Kastom + Health*. Whilst our Q did not reveal any strong weighting towards specific climate change concerns, it did reveal that attitudes in the community will likely be receptive to EbA, as it supports community reliance on provisioning ES and kastom-related ecosystem functions.

A key step in adaptation projects is identifying a candidate set of adaptation interventions for an identified climate risk. The dominant perspectives captured by *Strong Kastom*, *Kastom + Health* and *Tentative Modernity* suggest that for this case study,

interventions are more likely to resonate with the community if they enable natural resource management, reflect traditional knowledge of ecosystems and related Kastom practices, provide opportunities for generating income, and promote equity in decision making. Our results also suggest that external practitioners do not necessarily prioritise the need for income generation, such as through eco-tourism, reflected in the *Tentative Modernity* discourse, as being as important to community livelihoods. Ignoring a community's perspectives, values and priorities risks undermining the integrity of EbA projects.

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Revealing the dominant discourses of stakeholders towards natural resource management in Port Resolution, Vanuatu using Q-method

Andrew Buckwell, Christopher Fleming, Maggie Muurmans, James C. R. Smart, and Brendan Mackey.

Figure 1: Location of the Republic of Vanuatu, Tanna and Port Resolution.

a) Republic of Vanuatu and location of Tanna

b) Tanna and the location of Port Resolution

c) Location of Port Resolution

Table 1: Key stakeholder groups from which our Q-methodology respondents were drawn

Stakeholder group	Sub-group	Description
Port Resolution community	Subsistence	Subsistence farmers and fishers.
	Fixed income workers	Fixed-income employees, such as nurses and teachers.
	Business owner	Port Resolution community members who run businesses, such as restaurants and holiday bungalows.
	Temporary waged workers	Occasional waged labourers, but majority subsistence gardens
International organisation		Professionals working in Vanuatu or Tanna for quasi-governmental organisations who had familiarity with Port Resolution or Tanna.
Development worker		Philanthropic development workers who had repeated visits to the Port Resolution.
Independent scientist		Australia-based scientists and social scientists with significant knowledge of the Port Resolution community

Table 2: Elements of discourse represented in our Q-set. To enable any factors to fulfil the requirements of a discourse we ensure statements, as a whole, were phrased in such a way as to meet the four required elements of a discourse, in addition to key metaphors deployed

Element of discourse	Description	Exemplar statement or key term
Ontological	The basic entities respondents recognise (institutional or individual).	Kastom knowledge of resource use and the land is being forgotten. Our forests, freshwater and marine resources are important to kastom. It's important that we can hand them down to our children and grandchildren in good condition
Motivational	Respondents' understanding of basic motivations of themselves or others.	Neighbouring tribes sometimes encroach on our kastom land and marine resources without permission. I worry that young people don't want to stay in the village, as there are more opportunities in Lenakel and Port Vila
Agency	Respondents' understanding of the degree of agency institutions or individuals have.	It is important for me to influence decisions about the village. People should vote for who they want to in elections.
Assumptions regarding natural relationships	What are the understood relationships between respondents, institutions or the environment	If more tourists stayed in Port Resolution, or came on a cruise ship, I worry that there would not be enough food, water, and waste facilities to cope with them. I would be able to spend more time in my community if there was a more equal share of housework between men and women.
Key metaphors	Metaphors and rhetorical devices deployed or understood	Tourists as 'outsiders' coming into the community. 'Our forests' and reefs as customary land and resources 'belonging' to the tribe. Kastom as a nebulous term that can define communitarian parochial social relations, as well as adaptive management of natural resources.

Table 3: The 34 Q-statements used in our Q method study. Our primary categorisation was framed around the ecosystem services classification scheme from Millennium Ecosystem Assessment (de Groot et al., 2012; Millennium Ecosystem Assessment, 2005) in addition to two further categories for 'Social' and 'Health' issues. Health was extracted from the Social category as (specifically) health issues were key distinguishing statements in Factor 2. In our classification, cultural ecosystem services are defined as issues that reflect an affinity to activities that rely on cultural ecosystem services; namely earning money from tourism based on eco-tourism principles. The ideal factor score is weight given to that statement (from -4 to +4) if an ideal representative of that perspective had completed the Q-sort.

Category	Statement and number		Ideal factor score (Section 4.1)		
			1a	2	3
Regulating ecosystem services	1	We need to better protect our forests better, as they are being cut down to make way for gardens.	+4	+2	+4
	3	There are more natural disasters happing now, like Cyclone Pam.	-1	+1	-4
	5	We do not have enough toilet, washing and cleaning facilities for all the people in the village.	0	+3	-4
	7	Our community lacks a place to throw away rubbish, like bottles, cans, and plastic.	0	0	-1
	19	Our rivers and streams are drying-up more frequently.	+1	-1	-3
Provisioning ecosystem services	2	In my community I do not get enough good drinking water.	+1	+2	+1
	4	The changing weather makes it too warm and dry, and sometimes too wet, to grow our usual crops, like sweet potato, cassava and manioc.	+1	0	-1
	6	If more tourists stayed in Port Resolution, or came on a cruise ship, I worry that there would not be enough food, water, and waste facilities to cope with them.	-2	-2	0
	8	I would like to catch fish further out to sea, to reduce pressure on the reef fisheries.	+2	+1	+2
	9	My garden is producing less food than it was before.	+3	+1	-2
	10	It is important to get more cattle, pigs and chickens into the village to provide more food.	0	-3	-2
	11	I would like better ways to cook food, so I don't have to use firewood from the forest.	-2	-2	-3
	16	Neighbouring tribes sometimes encroach on our kastom land and marine resources without permission.	+2	0	+1
	17	There are less traditional medicinal plants than there used to be.	+2	-1	0
	18	Kastom knowledge of resource use and the land is being forgotten.	+3	+2	+1
	31	I would like to earn a bit more cash by selling food I grow, of fish that I catch.	0	-3	-1
Cultural ecosystem services	12	Our forests, freshwater and marine resources are important to kastom. It's important that we can hand them down to our children and grandchildren in good condition.	+4	+3	+3
	13	We should do more to prevent kastom places from falling into disrepair.	+3	+4	+1
	14	Tourism offers many good opportunities for small businesses in Port Resolution.	-1	+2	+3
	24	Improving the road to the volcano will bring new tourism business opportunities.	-4	0	+2
	25	Building an airport near to Port Resolution will bring opportunities to earn more money.	-3	-3	0
Social	28	If I could borrow a small amount of money, I would be able to invest in a small business, such as holiday bungalows, or selling fish.	-3	-2	-3

	15	It is important to pass down kastom knowledge of dances, songs and ceremonies to my children and grandchildren.	+2	0	+4
	20	It is important for me to influence decisions about the village.	+1	-1	+2
	21	I would like to know more about what is happening in Vanuatu and the rest of the world.	-1	-4	0
	22	People should vote for who they want to in elections.	-3	-4	-2
	23	I worry that young people don't want to stay in the village, as there are more opportunities in Lenakel and Port Vila.	-2	0	-2
	27	The costs of secondary school make it difficult for me to send my children there (fees, books, equipment).	0	+1	+1
	29	Sending children away to secondary school causes a lot of disruption to family life.	-1	-2	-1
	30	I would like to use electricity for lights, cooking and refrigeration.	-4	+1	0
	33	I worry about my personal safety in my home and in my community. †	0	-1	-1
	34	I would be able to spend more time in my community if there was a more equal share of housework between men and women.	+1	-1	+3
Health	26	If the road was improved, we would have better access to Lenakel hospital for childbirth and health emergencies.	-1	+4	+2
	32	I would like better access to modern medicines.	-2	+3	0

Figure 1: Q method scoring board. To serve the game aesthetic, our ranking board was brightly coloured, with clear use of a well-understood colour scheme and use of smiley and sad faces. The ranking board was printed on durable vinyl. It also contained areas for pre-sorting, enabling respondents to sort the cards into generally favourable, generally unfavourable and neutral categories, before more detailed placement.

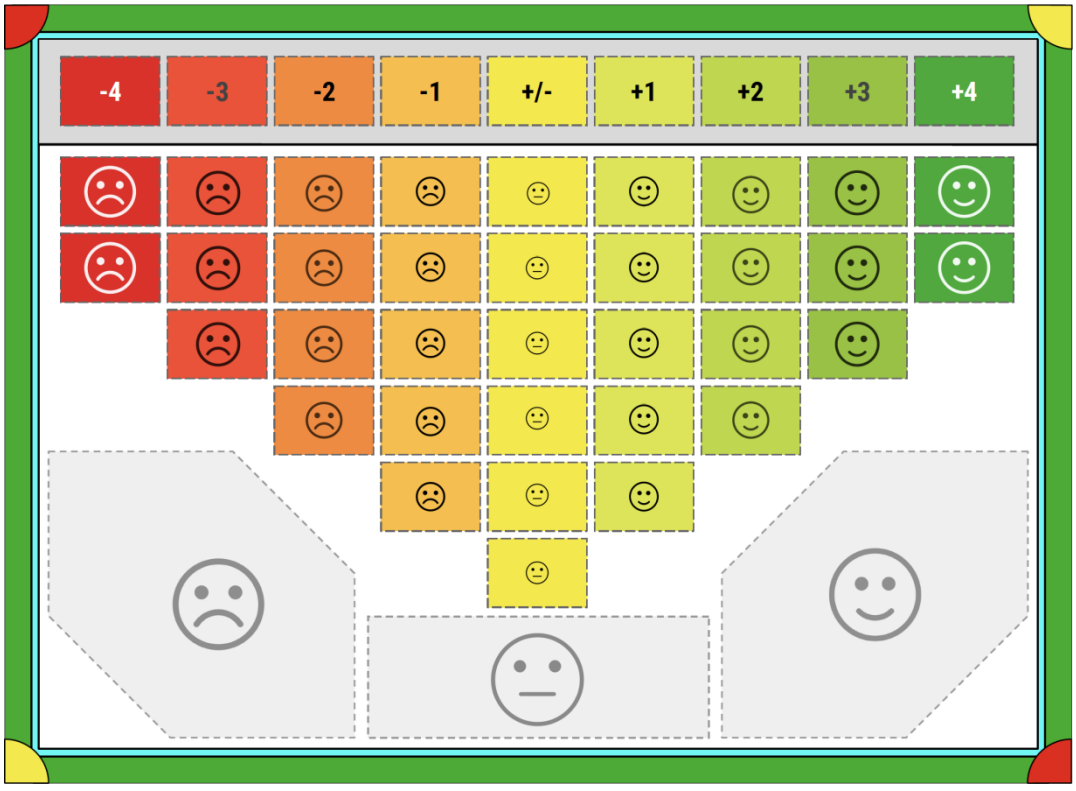

Figure 2: Undertaking Q method sorts with the women of Port Resolution

Figure 3: Undertaking Q method sorts with the men of Port Resolution

Figure 4: Scree plot of Eigenvalues of principal components from our factor extraction. We retained three factors for Varimax rotation, concluding that within the 'long tail' (from factor 4 onwards), there is insufficient variation and explanatory power.

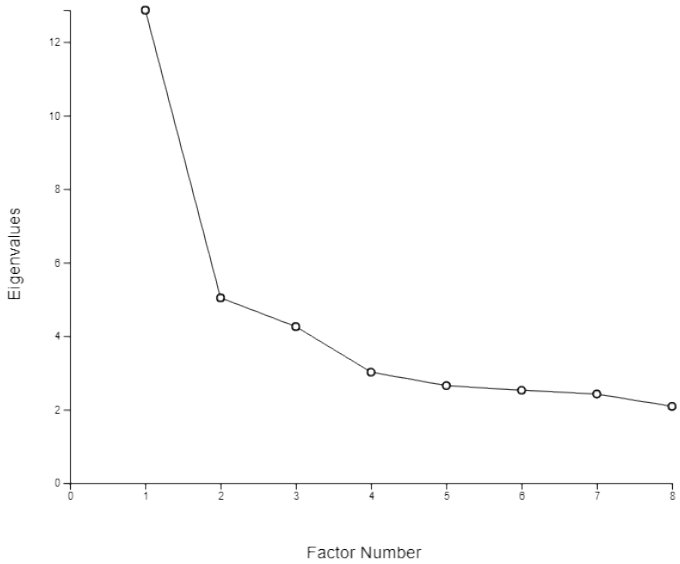

Figure 6: The ideal sorts from each of our three rotated factors. An ideal sort is the sort expected if a respondent loads 100% into one of the factors. (In reality, the highest loading respondent into Factor 1a loaded at 0.8566, Factor 2 at 0.7686, and Factor 3 at 0.6572.). Distinguishing statements are labelled and marked with * where the distinguishing significance is at $P < 0.05$ and ** where the distinguishing significance is at $P < 0.01$. Distinguishing statements are also marked with a ◄ where the z-score is lower than in all other factors and a ► where the z-score is higher than in all other factors.

a) Factor 1a

-4	-3	-2	-1	0	1	2	3	4
***◄ 30	28	11	* 3	**► 10	4	8	18	**► 12
***◄ 24	25	23	14	7	34	15	13	1
	22	***◄ 32	29	33	19	***► 16	9	
		**◄ 6	** 21	5	2	17		
			***◄ 26	27	** 20			
				31				

b) Factor 2

-4	-3	-2	-1	0	1	2	3	4
21	31	* 6	** 19	7	* 8	14	*** 32	26
22	10	28	33	23	*** 3	1	12	13
	25	29	34	*** 15	9	2	*** 5	
		11	** 17	4	27	18		
			** 20	24	30			
				* 16				

c) Factor 3

-4	-3	-2	-1	0	1	2	3	4
*** 5	28	23	29	*** 21	2	26	14	*** 15
*** 3	*** 19	22	4	25	*** 13	*** 20	*** 34	1
	11	10	33	* 32	27	8	12	
		*** 9	7	30	*** 18	24		
			31	6	** 16			
				17				

Table 4: Results of our Q-methodology factor analysis, showing Eigenvalues, cumulative percent of explained variance, (both for reported unrotated factors), number of defining sorts in each extracted factor (number of respondents who fit the factor) and the correlations between these factors.

Factor	Unrotated		Varimax rotated			
				Correlations between factor scores		
	Eigenvalues	Cumulative % of explained variance	Number of defining sorts variables	Factor 1a	Factor 2	Factor 3
Factor 1a	12.86	23	16	1	0.3947	0.319
Factor 2	5.04	32	17		1	0.3168
Factor 3	94.26	40	9			1

Box 1: Discourse analysis of Factor 1a: Strong Kastom

Basic entities recognised or constructed	**Agents and their motives**
• Kastom and taboo • Natural cycles of resource management • The tribe	• Homogenous communities • Co-operative local tribes • Parochial communitarianism

Assumptions about natural relationships
• Traditional roles of men and women in decision making, income generation, domestic activities • Pragmatic approach to community decision-making; no radical changes • Outside world of limited value

Box 2: Discourse analysis of Factor 2: Kastom + Health

Basic entities recognised or constructed	Agents and their motives
• Kastom and taboo • Natural cycles of resource management • The tribe	• Homogenous communities • Co-operative tribes • Parochial communitarianism
Assumptions about natural relationships • Traditional roles of men and women in decision making, income generation • Pragmatic approach to decision making; change is expected, but should be slow, on our own terms • An outside world that adds some value to our community, specifically through health services	

Box 3: Discourse analysis of Factor 3: Tentative modernity

Basic entities recognised or constructed	Agents and their motives
• Kastom and tradition • Economic specialisation and exchange	• Parochial communitarianism
Assumptions about natural relationships • Women's roles not defined by men, but based on utility	

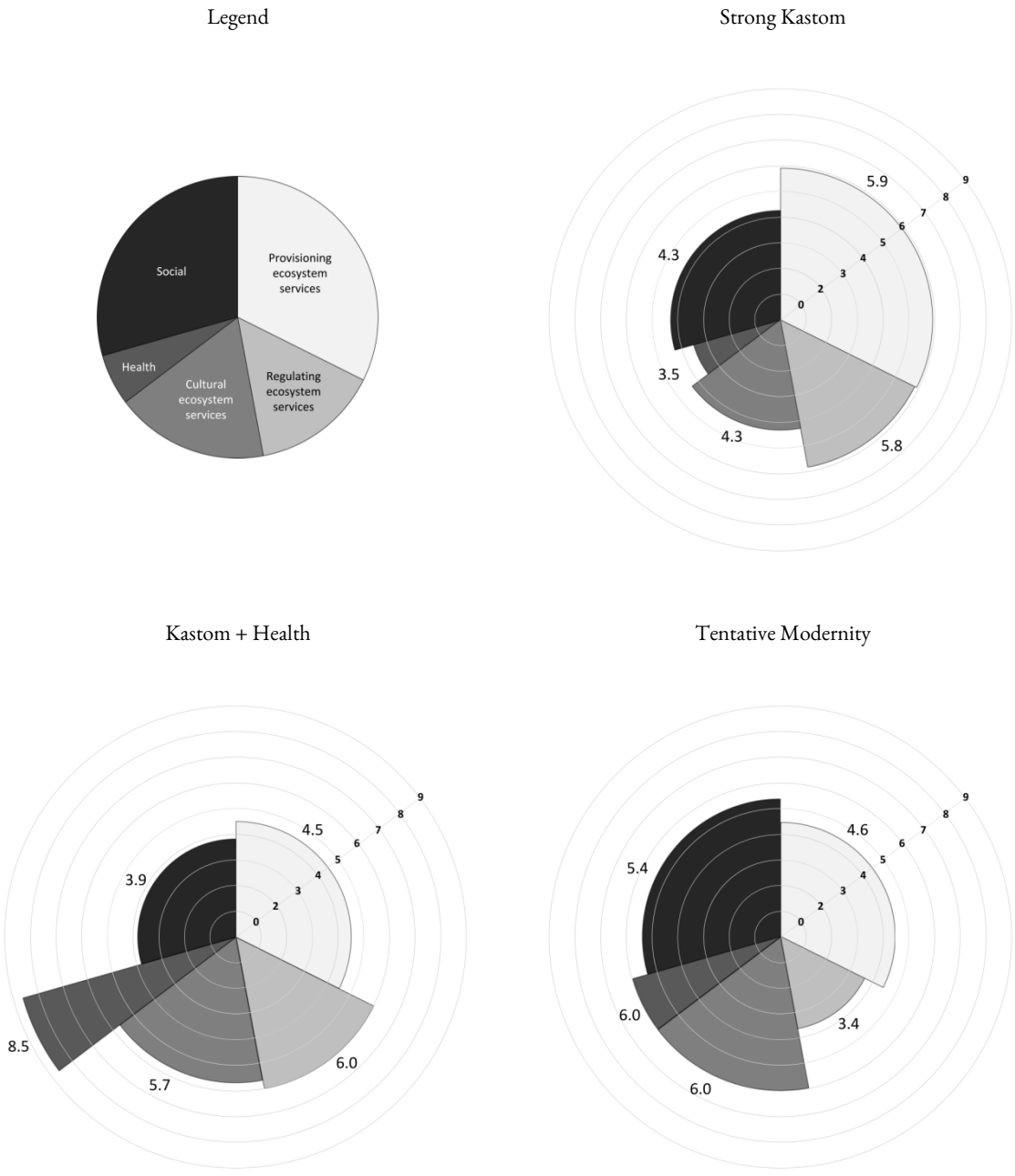

Figure 7: Factors represented as spie charts, indicating the representation of each statement in our initial categorisation of (i) provisioning ecosystem services; (ii) regulating ecosystem services; (iii) cultural ecosystem services; (iv) health; and (v) social issues. The relative share of the pie is a representative of the number of statements in each category. The concentric scale is representative of the score given to that statement in each of the factors. So that all values are positive, the scores have been re-assigned as: -4 = 1; -3 = 2; … +3 = 8; +4 = 9.

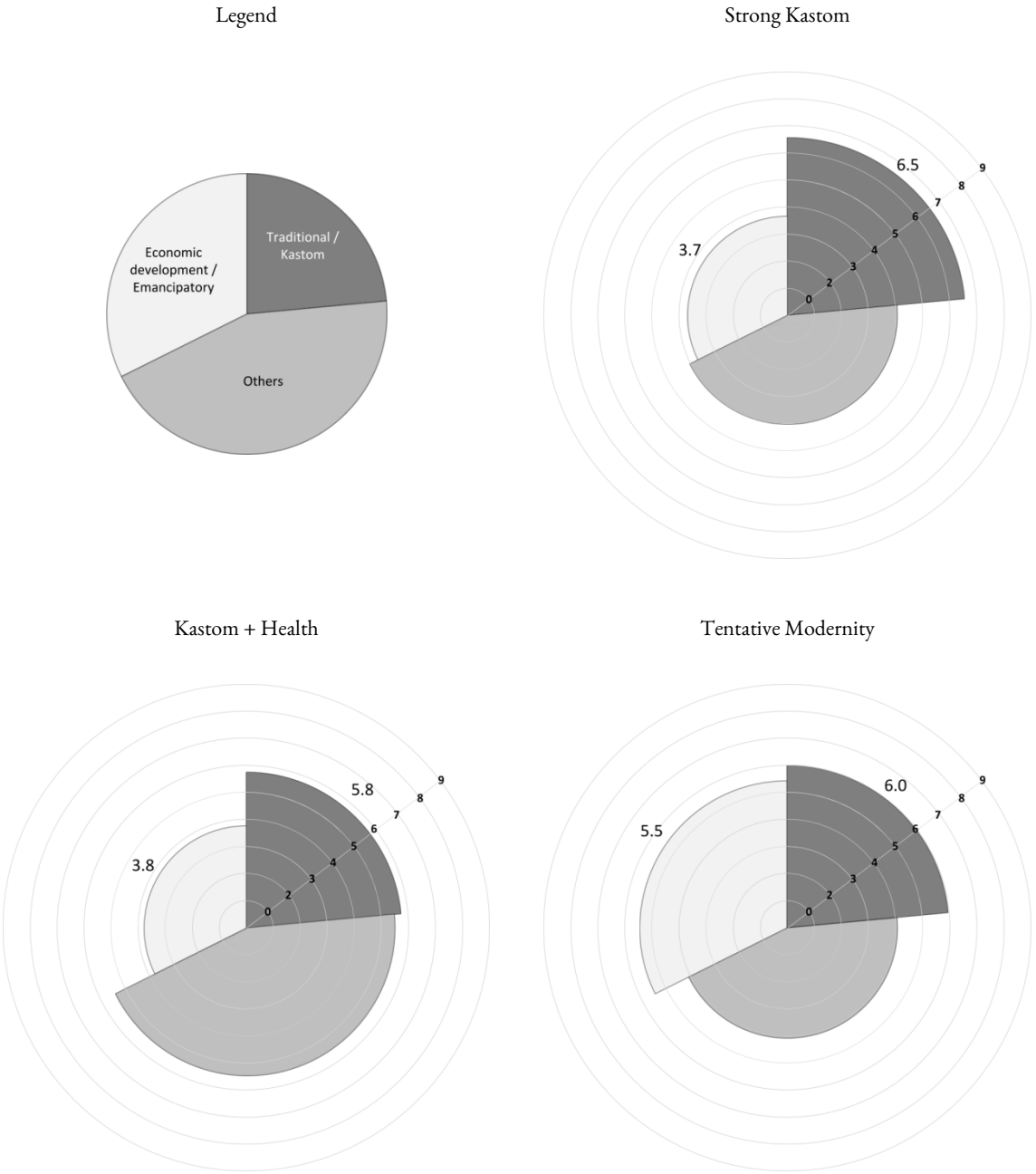

Figure 8: Factors represented as spie charts, indicating the propensity for traditional and economic development / emancipatory statements to be associated with each extracted factor. Traditional / Kastom statements are: 6, 12, 13, 15, 16, 17, 18 and 23. Economic development / Emancipatory statements are: 14, 20, 21, 22, 24, 25, 26, 28, 31, 33, and 34. The relative share of the pie is representative of the number of statements in each category. The concentric scale is representative of the score given to that statement in each of the factors. So that all values are positive, the scores have been re-assigned as: -4 = 1; -3 = 2; ... +3 = 8; +4 = 9. The factor score is provided adjacent to the two relevant segments.

Table 5: Weighted factor membership for selected demographic characteristics. The scores are weighted such as to indicate how many respondents would load into each factor if the number of respondents in each category of each of the characteristics was equal, i.e. if there were 27.5 members from each of the pairings.

	Male / Female		Subsistence status		Community status	
	Male	Female	At least some wage	Purely subsistence	Non-community	Community
Strong Kastom	12.4	5.5	9.6	7.2	3.9	8.6
Kastom + Health	9.7	7.9	13.0	6.5	15.7	7.4
Tentative Modernity	1.4	6.3	3.2	5.0	0	5.1

Figure 9: Sentiment towards climate change adaptation statements and climate change impact statements for our three factors. Adaptation statements were S1, S8, S9, S10, and S11. Impact statements were S3, S4, and S19.

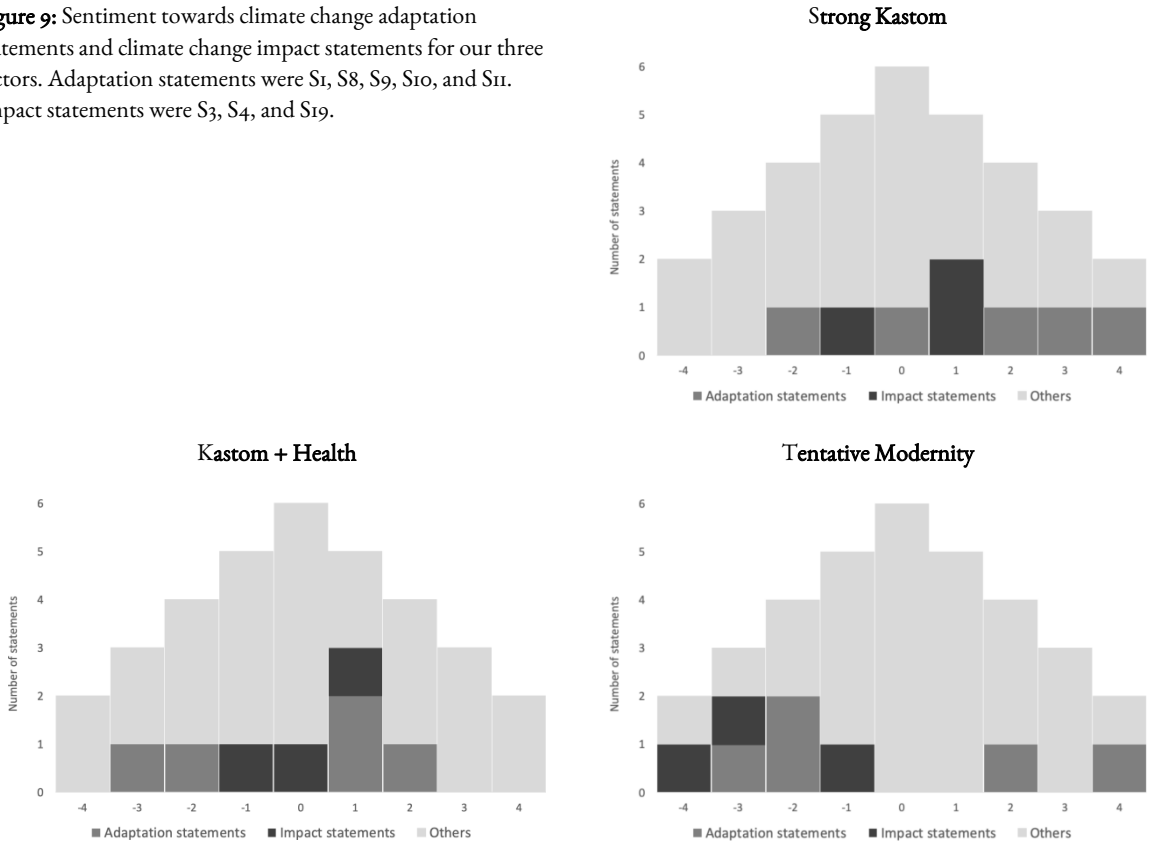
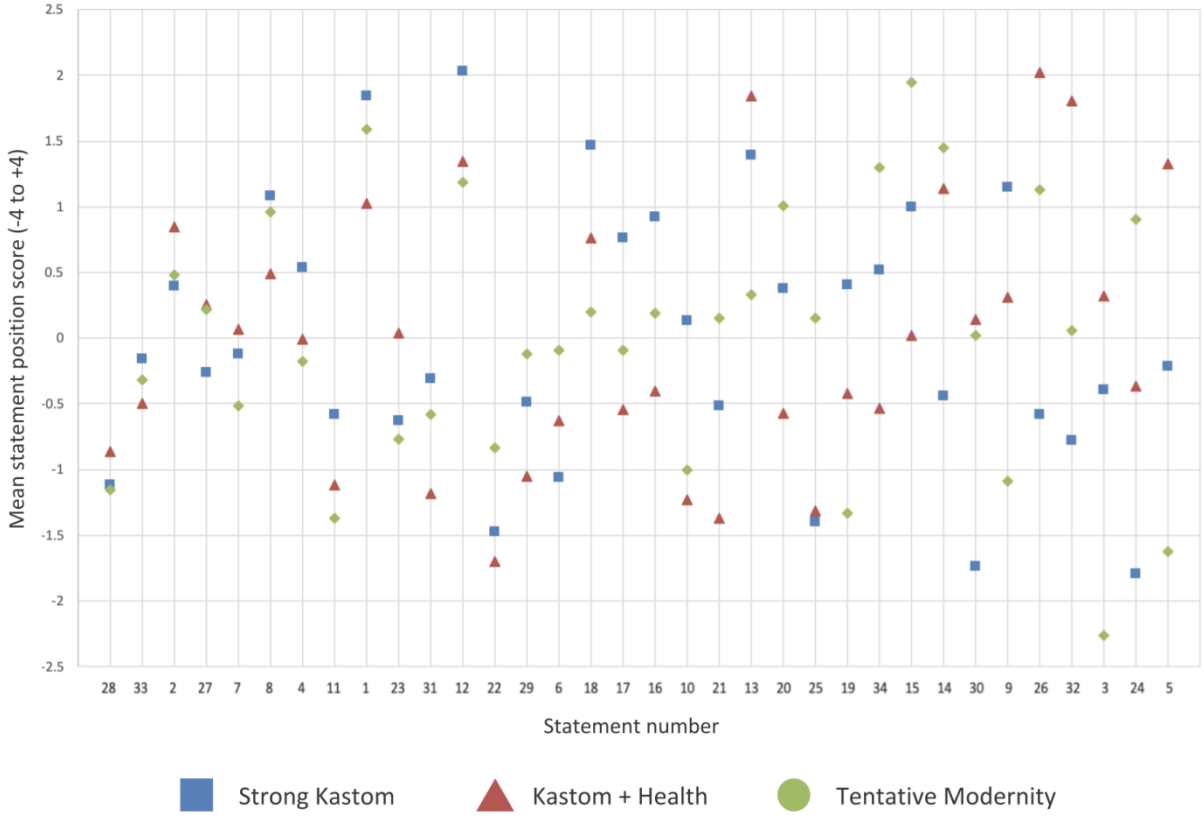
Figure 10: Factor score congruence for statements. Statements (x axis) are ranked in order of standard deviation (lowest on the left to highest on the right) of the mean scores from each factor. The y axis reports the mean score for each factor for that statement. Statements to the left of the chart have high congruence, statements to the right have low congruence between the factors. Therefore, statement 28 has the highest level of congruence between the factors, but has a generally negative salience. Factor 2 has a third ranked congruence *and* has a generally positive salience.