Climate Change Vulnerability Assessments in Selected Coastal Communities in Mozambique

Inception Report

Final

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Contents

1. Introduction

The current assignment includes: (1) description of the intensity of climate changes threats and identification of potential impacts, relative to the capacity of the interacting human and ecological systems to cope with such threats; (2) identification of communities that are most vulnerable to climate change and its impacts and assist in crafting adaptation plans to help lift those communities that will be severely affected to a state of enhanced resilience. The activities will involve (1) gathering and analysing of social and economic data relevant to the Climate Change Vulnerability Assessment (CCVA) of local communities dependent on major coastal ecosystems and developing knowledge management products, (2) identify specific adaptation technology needs, and national plans with a focus on the needs of coastal communities, (3) mapping of risks and possible responses to extreme climatic events, identify potential networks for the sharing of information on successful adaptation, and (4) contribute to management and policy option on climate change necessary for decision making. Further, the assignment will provide for the definition for inclusion of coastal and marine adaptation options in climate change policies at national level depending on country context and contribute to the enhancement of critical habitats, conservation and sustainable marine conservation networks explicitly supporting the social and economic sustainability of coastal communities.

The review of literature and documentation of experiences of implementing CCVA reveals that, due to the broad nature of the subject, its execution requires expertise in different areas including hydrology, water quality, socio-economics, biology and climate change, whom are best equipped to perform assessments of changes in precipitation, water flows, water quality, biota due to climate change and its impact on communities' life, enabling the identification of suitable adaptation and mitigation actions. The scope of activity described above also entail a complete CCVA. For these reasons to optimize in time and achieve a better result a team of experts was assembled to assist the consultant in implementing this assignment. This implementation structure does not impact the nature of the contract with the client as the consultant remains the sole responsible for the delivery and implementation of the tasks of the contract.

1.1 Purpose of the inception report

The purpose of this inception report is to present the workplan and methods for conducting the CCVA at two sites, the Maputo Bay, including Inhaca, and Xai-xai including Limpopo Estuarine area. This inception report gives a summary of activities planned in the assignment, main deliverables, description of study area, sites´ proposed methods and approach for data collection. The questionnaires proposed in the MACMON monitoring Guide were updated based on the dimensions, domains and indicators defined in Thiault, et al. (2021) and aligned to the specific characteristics of the communities and ecosystems where data will be collected to evaluate the indicators presented in table given in appendix 2.

2. Methods

2.1 Approach proposed to the assignment

The assignment includes two processes, the first is updating and piloting the CCVA Toolkit and the second is evaluating the socio-ecological climate changes vulnerability using a Global Social-Ecological Systems Monitoring Framework for Coastal Fisheries Management based on the MACMON monitoring Guide. The information for determination of weights of domains and indicators will be collected using a questionnaire administered to an assembled focus group and is given in appendix 5. Additional information for CCVA will be collected during the field visits using two questionnaires, (1) Key Information Survey and (2) Global Households Survey.

Following the methodological approaches developed by Thiault, et al. (2021), a set of relevant indicators were identified. Further the CCVA is developed in in alignment with the SWIOFC project activities, as this will ensure, at the later, stage monitoring of project impacts.

The activities of the assignment are grouped in three phases:

1.1.1 Phase I – Planning and Desk Review (four weeks)

To ensure the timely implementation of project activities the experts will conduct a review of the CCVA toolkit followed by collection of relevant information. Based on the information needs of the CCVA toolkit and the overall CCVA, the experts will support the main consultant to prepare the detailed workplan. The workplan will include (1) number of site visits, logistical needs, information that will be collected and/or delivered, including questionnaires; (2) proposal of content to the manuscript; (3) and the list of main deliverables. During this period the main consultant will work with other recruited teams in Kenya, Tanzania and Madagascar to harmonize the data collection tools and methods. This will enable the comparability of results facilitate the regional analysis of the key vulnerability issues facing the coastal communities of the Wester Indian Ocean.

1.1.2 Phase II – Field visits and Pilot the CCVA Toolkit (four weeks)

This phase will include collecting the information for the overall CCVA, as well as developing detailed analysis of risks and opportunities, including technologies, in the studied sites. The Overall CCVA information will be collected using the questionnaire refereed above, (1) Key Information Survey and (2) Global Households Survey. Additionally in order to obtain commensurable results and enable the comparison of the vulnerability level across different communities surveyed a focus group discussion followed by administration of questionnaire to knowledgeable people. This questionnaire will be part of the application of the Analytical Hierarchy Process (AHP), a well know multicriteria decision-making technique developed by Saaty (1980), this technique is based in the organization of the decision-making problem in a hierarchical structure, resulting in ranked relative importance of its elements by using a pair-wise comparison system.

1.1.3   Phase III – Reporting (four weeks)

At this phase the final project report will be prepared and submitted, including the scientific journal manuscript. A short summary report in Portuguese will also be prepared to inform the policy makers on the results of the assignment. The summary report in Portuguese will make the results of the assignment available for decision makers at national level.
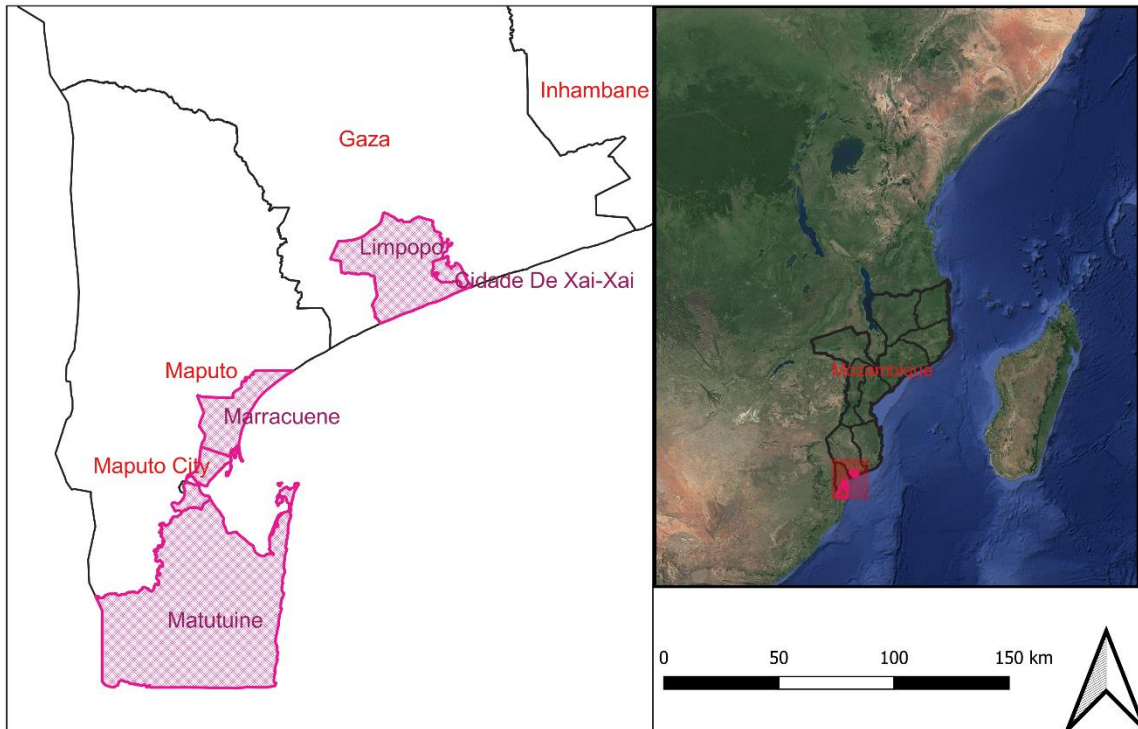
1.2 Study area

Mozambique is located in the southern coast of East Africa with 2470 km of coastline and diverse and productive continental area of about 102.300 km^2. Its coastline is characterized by wide diversified habitats including sandy and rocky beaches; sand dunes, coral reefs, estuaries, bays, seagrass beds and mangrove forest, which support the ecosystem with high biological productivity (Pereira, et al., 2014). The coastline can broadly be classified as 1) coral coast, 2) swamps and 3) parabolic coastal dunes (Pereira, et al., 2014).

The longitudinal range of the Mozambican coastline, as well as the diversity of habitats and ecosystems, support high biodiversity. Several ecological areas of regional and global importance have been identified along the coast. Almost 900 species of reef-associated fishes have been recorded, 122 species of sharks and rays, 400 species of molluscs, 27 species of marine of mammals, including viable population of dugongs, five species of marine turtles, 270 species of hard and soft corals, 14 species of seagrasses and ten species of mangroves (Pereira, et al., 2014). Seagrass meadows in Mozambique cover an area of 439 km2, and generally occur in the intertidal zone. The most important sites for the conservation of this ecosystem and associated species are the Quirimbas Archipelago, Bay Fernão-Veloso, the Bazaruto Archipelago, and the island of Inhaca, one of the study areas of this assignment, and Ponta do Ouro.

The major treats to the coastal and marine ecosystem of Mozambique include overfishing, industrial and coastal development, natural resources exploration, unregulated and damaging tourism practices, population pressure and weather extreme events, such as storms and cyclones (Pereira, et al., 2014).

There are three main types of fisheries in the Mozambican coastline: Industrial, semi-industrial and artisanal. The fisheries sector plays an important role in the economy, contributing with 3% of Gross Domestic Product (GDP) and 4% of global national exports (Pereira, et al., 2014). Commercial fisheries, industrial and semi-industrial, exploit the most important and valuable resources such as shallow and deep water shrimp and pelagic fish species, such as tuna, billfishes and sharks. Artisanal fishery occurs along the entire coast and captures shallow water demersal and pelagic species using traditional gears being the important source of food and employment of the coastal communities, which represents more than two-thirds of the population of Mozambique (Pereira, et al., 2014). Artisanal fisheries, involves 18% of woman that are depending directly or indirectly on fishing related activities (Pereira, et al., 2014).

The study areas for this assignment are Maputo Bay, including Inhaca and Xai-xai, including Limpopo Delta, Figure 1. The study sites will be selected aligned with the sites of the ***National Demonstration Activities of the SWIOFC-Nairobi Convention Partnership Project in Mozambique***.

Figure 1 Study Area - Maputo bay Inhaca and Xai-xai Including Limpopo

1.2.1 Maputo Bay

Maputo Bay is located in southern Mozambique, it includes the coastal part of Maputo and Matola cities, together comprising the largest metropolitan area of the country, the area also has the largest commercial port of the country. It also includes the Districts of Marracuene and Matutuíne, where the Maputo Special Reserve (REM) and the Ponta do Ouro Partial Marine Reserve (RPMPO) are located, forming part of the Libombo Transboundary Conservation area, which links to the Isimangaliso Park (Wetland) in South Africa, named a heritage site for humanity.

The Coastal and marine ecosystems in the Bay are made up of extensive mangrove systems; extensive banks of seaweed, coral reefs and dune forests (Paula, Macamo, & Bandeira, 2014; Fernando, Bandeira, & Guissamulo, 2014; Schleyer & Pereira, 2014). The main fishing resources include shallow water shrimp and other crustaceans, small pelagic and large pelagic fish and demersal rock fish, operated by small scale fishers including commercial vessels (Silva & Masquine, 2014; Inácio A. , Leong, Samucidine, Masquine, & Paula, 2014). These ecosystems are strongly influenced by urban and industrial activities.

According to the work plan for *national demonstration activities of the SWIOFC-Nairobi Convention Partnership Project in Mozambique*, the proximity with Maputo and Matola cities allows the coastal communities to have diversified sources of income, however, there are remote communities located in Machangulo (Matutuíne), Inhaca and Marracuene that rely mostly on fisheries, agriculture and tourism for their livelihoods. The selected SWIOFC´ project pilot sites, include 3.650 households and a total population of 18.252.

1.2.2 Xai-Xai city including Limpopo Estuarine Area

The Limpopo River Estuarine Area is located in Gaza Province, including the communities of the districts of Limpopo, Zongoene Administrative Post, and Xai-Xai, Chilaulene Administrative Post. This area is the only one in Gaza province where mangrove forests strieves in the banks of the Limpopo River together with dune vegetation along the coastal line (Bandeira & Balidy, 2016; AWARD, 2018). Aquatic vegetation in addition to the mangrove ecosystem, includes macroalgae systems on rocky reefs.

The mangrove forest of the Limpopo was, in the 1980's, known to cover only 387 ha, even though the Limpopo is the second largest river in Mozambique, after Zambezi. However, new recent research revealed a historical mangrove cover of 928 ha, of which 382 ha (41.2%) are quite pristine and 546 ha (58.8%) are degraded (Bandeira & Balidy, 2016). The mangrove in the Limpopo estuary is made up of trees (individuals) over 100 year old mangrove. In year 2000, a major flooding developped from upstream caused significant changes in the system increasing the width of the river from around 200 meters to several kilometers, drowning the mangrove forests for about 45 days, and causing sediment transformation and mangrove forest degradation, uprooting and dieback. The mean annual discharge of Limpopo River is usually 170 m^3 /s. However, during the floods of 2000, the river exhibited a peak upstream flash of 16 515 m^3 /s. Property and livelihoods were affected in the basin. This prompted actions for mangrove rehabilitation in 2010 using species *Avicennia marina, Bruguiera gymnorhiza, Ceriops tagal, Rhizophora mucronata* and *Xylocarpus granatum*, with 26.3 ha replanted from 94 453 seedlings out of 168 367 produced in the nursery with 74% survival rate (Bandeira & Balidy, 2016).

In the workplan for the **SWIOFC** Project in Mozambique, it is stated that the amount of sediment brought by the river has dropped significantly, due to the increased modification of flow regime associated with the operation of the dams upstream (Massingir Dam). This hinders the fixation and natural survival of young plants in the substrata. It is also stated that, the impact of salinization is affecting agriculture and diversity of fish species. In the Limpopo River Mouth area, there are fishing resources such as crustaceans, with emphasis on shrimp and mangrove crab, small and large pelagic fish, as well as demersal fish.

In this project area of the **SWIOFC** Project in Mozambique, it covers a population of around 5.770 households of a population of about 28.852 inhabitants that depend mostly on agriculture and fisheries. Livestock is also a relatively important livelihood.

2.2 Sample size

The study sites were selected from the relevant coastal villages in the study areas Maputo Bay, including Inhaca and Xai-Xai, including Limpopo-Estuarine. The villages relevant for this study are distributed in five districts and composed of villages whose households are predominately engaged in fishing, fish trade, gleaning, mangrove cutting and trade. The relevant villages are distributed in two districts in Xai-xai, including Limpopo estuarine (Limpopo and Xai-xai city) and three in Maputo Bay, including Inhaca (Marracuene, Matuituine, Catembe and Inhaca), Table 1.

However, due to limitation of the resources and time, five to six communities will be selected for this study. For estimating the number of households for the survey we assumed that one household contains in average five people. The exact number of communities will be selected from table 1 after close consultation with Key Informants, to ensure that the strata's listed below are included.

The sample size is calculated using the following standard formula for infinite population (Naing et al. 2006):

$$n = z^2 p(1 - p)/e^2$$

Where n is the sample size, z is the statistical certainty chosen at 95% confidence level (z = 1.96) for an error risk of 5%, p is estimated level/coverage to be investigated, chosen at p = 0.5, e is precision desired, expressed as a fraction of 1, usually e = 0.05 is chosen for the confidence interval. The output is corrected for finite population using the formula (Naing et.al. 2006):

$$n_1 = n/(1+n/N)$$

Where n_1 is the sample size for finite population, N is the target population of fishing, fish trade, gleaning, and mangrove cutting, and trade and n is the calculated sample size from infinite population. A sampling interval (SI) of two is calculated by dividing the total population by the sample size.

The target population will first be divided into strata based on main household occupations that are linked to marine resources namely households that depend on fishing, fish trade, and mangrove wood trade. Systematic random sampling will be used to select the number of households that represent the target population from the identified strata. The respondents will be systematically picked from the sample using the sampling interval to ensure that there are equal chances for each household in the target population to be included in the study (Kothari 2008). This sampling technique will generate a representative sample that allows generalization to a larger population and the usage of inferential statistics.

Table 1 Communities, population and sample size required for each relevant community in the study areas

| Study Area	District	Administractive Post	Village	Population	Number of households	Sample size households	Sampling Interval	Selected villages
Maputo Bay including Inhaca	Marracuene	Macaneta	Macaneta	3602	720	251	3	No
			Mbuva	780	156	111	1	No
			Macaneta II	1188	238	147	2	No
			Hobjana	800	160	113	1	No
			Matsinane	1025	205	134	2	No
			Ilha Xefina	**169**	**34**	**31**	**1**	**Yes**
			Ilha Mbemgueleni	137	27	26	1	No
		Total		**7701**	1540	307	5	
	Inhaca	Inhanca	**Inhaca**	**6505**	**1301**	**297**	**4**	**Yes**
		Total		**6505**	**1301**	**297**	4	
	Catembe		Katembe/ Costa do Sol/ Matola (20%)	36315	7263	365	20	No
		Total		**36315**	**7263**	**365**	20	
	Matutine	? Bela Vista	Santa Maria (PA Machangulo)	647	129	97	1	No
			Maphanga	687	137	101	1	No
			Mhala	176	35	32	1	No
			Ngomene	338	68	57	1	No
			Ndelane	**117**	**23**	**22**	**1**	**Yes**
			Mabulucu	449	90	73	1	No
			Ticalala	100	20	19	1	No
			Mucombo	366	73	61	1	No
			Chivambo	179	36	33	1	No
			Tsolombane	70	14	14	1	No
			Muvucuza	91	18	17	1	No
			MiliBangalala	68	14	13	1	No
		Total		**3288**	**658**	**242**	3	
Xai-xai including Limpopo Estuarine	Limpopo	? (Maybe Chicumbane)	Avoz da frelimo B1 (WIOSAP)	1745	349	183	2	No
			Avoz da frelimo B2 (WIOSAP)	1417	283	163	2	No
			Avoz da Frelimo B4 (WIOSAP)	1601	320	175	2	No
			Avoz da frelimo B3 (WIOSAP)	1402	280	162	2	No
			Avoz da frelimo B5 (WIOSAP)	**643**	**129**	**96**	**1**	**Maybe**
		Total		**6808**	**1362**	**300**	5	
		Zonguene	**Zongoene B2 (WIOSAP)**	**1948**	**390**	**193**	**2**	**Maybe**
			Zongoene B3 (WIOSAP)	2727	545	225	2	No
			Zongoene B4 (WIOSAP)	3117	623	238	3	No
			Zongoene B5 (WIOSAP)	1050	210	136	2	No
		Total		**8842**	**1768**	**316**		
	Xai-xai	Xai-xai City - Chilaulene (?)	**Nhancumene (WIOSAP)**	**809**	**162**	**114**	**1**	**Maybe**
			Zimilene (WIOSAP)	**2503**	**501**	**217**	**2**	**Maybe**
			Salvador Allende (WIOSAP)	7036	1407	302	5	No
			Mahielene (WIOSAP)	1243	249	151	2	No
			Cumbane (WIOSAP)	232	46	41	1	Yes
		Total		**11823**	**2365**	**330**		

2.3 Indicators

Vulnerability can be assessed through three broad dimensions: exposure, sensitivity, and adaptive capacity (Thiault, et al., 2021). All three dimensions' influence vulnerability but, especially in social-ecological vulnerability assessments, the division between these dimensions is not always clear. Because dimensions provide the higher level, first tier, underpinnings for implementing vulnerability-based management, i.e., reducing exposure, decreasing sensitivity, and/ or building adaptive capacity, it is crucial that the meaning of each dimension within a specific context of the analysis is clearly stated (Thiault, et al., 2021).

Climate stressors used to describe indicators may include precipitation change (press) and extreme marine heat events. In addition to climate stressors, exposure domains may derive from environmental, economic, or other external pressures (Thiault, et al., 2021). Social sensitivity to environmental change can be disaggregated into four domains (economic dependency, demographic dependency, psychological dependency, and cultural dependency), and social adaptive capacity relied on five domains (assets, flexibility, social organization, learning, and agency) (Thiault, et al., 2021), table in appendix 1.

For the particular case of selected sites in Maputo bay and Xai-Xai including Limpopo Estuarine Area in which the (1) ecosystem is characterized by extensive mangrove that encompass the coral reefs, extensive banks with seagrass; (2) people dependent on coastal ecosystem services, particularly fisheries, water for agriculture and livestock, all indicators proposed in table of Appendix 1 are relevant and will be used for the CCVA, however the exposure dimension indicators will not be considered for this study.

Additionally, MACMON Monitoring Guide presents a detailed methodology on socio-ecological monitoring guide for conducting the CCVA in coastal areas. These tools were combined to develop the CCVA methodology for this assignment.

The explanation of domains in the context of this assignment is provided in the table in Appendix 1. The Appendix 2 presents the list of indicators, explanations and methods for data collection and scoring. The data collection for determination of the scores for the indicators will be done based on the household survey, appendix 2.
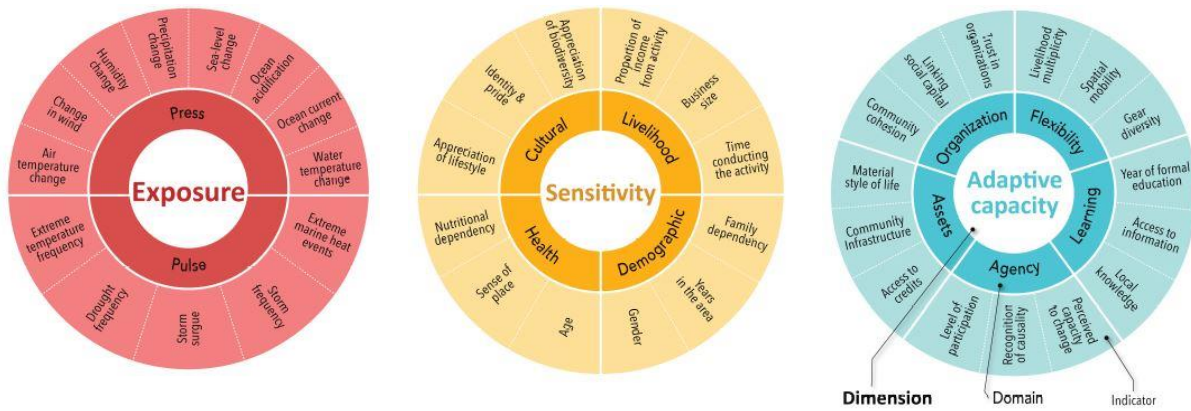
Figure 2: Conceptual diagram illustrating the three proposed nested layers for theoretically and contextually grounded vulnerability assessment

2.4 Questionnaire and procedures

Three questionnaires will be implemented during the survey: (1) the Key Informants Questionnaires to get a qualitative information; (2) Household survey Questionnaire, to get both qualitative and quantitative information that will allow the determination of scores of the indicators; and the (3) Focus group questionnaire, aiming to determine the weights of domains and indicators using the AHP method.

These questionnaires have been designed taking into account the objectives of the research (Kothari and Garg 2014). The questionnaire consists of two parts with part 1 having both closed and open-ended questions on demographic factors, and part 2 having both Likert scale type of questions and open-ended questions on the main variables in the study. Each of the Likert scale questions in part 2 was assessed on a 5-point scale from 1 to 5 (Warmbrod 2014). Vulnerability of coastal communities to climate change will be measured on ordinal scale making use of the Likert scale items in a questionnaire that covers social adaptive capacity and sensitivity dimensions.

Guided questionnaire administration will be adopted in this study to capture a representative sample of the target population, avoid potential non-response bias and control for non-verbal behaviour (Nachmias and Nachmias 2004). The questionnaire will be administered in the respondent's households or acceptable venues over a period of two months between November and December 2021. The researchers will follow up the target respondents, whose households are pre-selected through the sampling interval and appointments will be booked with them in advance where necessary. To ensure accuracy in reporting, each respondent will be informed that their personal details would remain anonymous and confidential. The overall purpose and objectives of the study will be clearly explained to the respondents and informed consent obtained with a clarification that the questionnaire is being filled on voluntary grounds.

2.5 Data analysis

The data analysis will include end-opened questions and closed questions. The closed questions will be converted in scores based on the methods presented in the table in appendix 2. These scores will further be standardized to be assigned values of between zero and one. The scores of indicators will be combined using the weights obtained from the focus group questionnaire to obtain the combined score (indicator) for different domains of both sensitivity and adaptive

capacity. Further, the combined scores for different domains will be aggregated using the weights for domains, also determined using the questionnaire implemented for the focus group to obtain the two indexes per community, e(1) the sensitivity Index and (2) the adaptive capacity index. The final score of social climate change vulnerability index will be determined subtracting the adaptive capacity index by the sensitivity index, figure 3. Finally, the Social climate change vulnerability of studied communities will be compared using the calculated indexes.
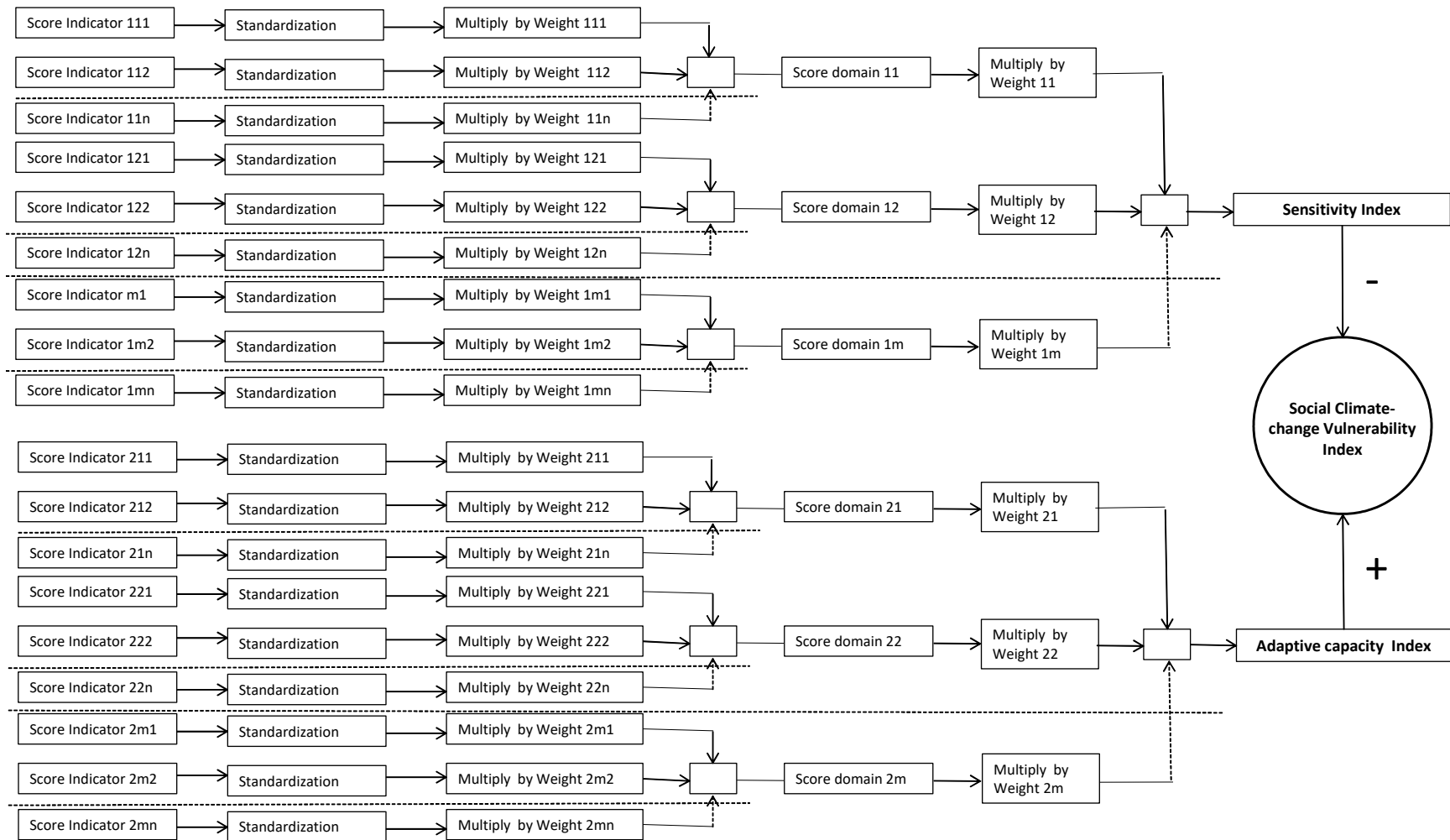
Figure 3 Determination of Social Vulnerability Index

3. Bibliography

AWARD. (2018). *Mangrove Restoration & Livelihood Support in Mozambique.* Limpopo: The Association for Water and Rural Development.

Bandeira, S., & Balidy, H. (2016). Limpopo Estuary Mangrove Transformation, Rehabilitation and Management. *Estuaries of the World*, 227-237.

Fernando, S., Bandeira, S., & Guissamulo, A. (2014). Seagrass grazing by dugongs: Can habitat conservation help to protect the dugong? In S. Bandeira, & J. Paula, *The Maputo Ecosystem* (pp. 223-227). Zanzibar Town: WIOMSA.

Inácio, A., Leong, E., & Samucidine, K. ,. (n.d.). Artisanal Fisheries in Maputo Bay.

Inácio, A., Leong, E., Samucidine, K., Masquine, Z., & Paula, J. (2014). Artisanal Fisheries in Maputo Bay . In S. Bandeira, & J. Paula, *The Maputo Bay Ecosystem* (pp. 297-302). Zanzibar City: WIOMSA.

Paula, J., Macamo, C., & Bandeira, S. (2014). Mangroves of Maputo Bay. In S. Bandeira, & J. Paula, *The Maputo Bay Ecossystem* (pp. 109-126). Zanzibar town: WIOMSA.

Pereira, M., Massingue, A., Atanassov, B., Litulo, C., Carreira, F., Da Silva, I., . . . Tibibiçá, Y. (2014). *Mozambique Marine Ecosystem Review.* Maputo: Biodinâmica/CTV.

Saaty, T. L. 1980. The Analytic Hierarchy Process. New York: McGraw Hill.

Schleyer, M., & Pereira, M. (2014). Coral Reefs of of Maputo Bay . In S. Bandeira, & J. Paula, *The Maputo Bay Ecosystem* (pp. 187-205). Zanzibar Town: WIOMSA.

Silva, R. P., & Masquine, Z. (2014). Shallow-Water Shrimp Fisheries in Maputo Bay. In S. Bandeira, & J. Paula, *The Maputo Bay Ecosystem* (pp. 277-284). Zanzibar city: WIOMSA.

Thiault, L., Thiault, L., Jupiter, S. D., Johnson, J. E., Cinner, J. E., Jarvis, R. M., . . . Claudet, J. (2021). Harnessing the potential of vulnerability assessments for managing social-ecological systems. *Ecology and Society*, 1-26.

Appendix 1. Explanation of Domains in the context of the study

Dimension	Domain	Explanation
Sensitivity	Livelihood	Livelihoods encompass elements that are relevant to sustain life of people in the community. For this case, includes employment, fisheries and other marine resources and the time spent by the head of household doing the activity that sustains the family.
	Demographic	Demographic, that encompass gender, percentage of children in the household, years that the family lives in the village and family dependency (explained by percentage of employed people in the household)
	Cultural	This domain includes cultural habits that might influence the sensitivity of the community, encompassing, the (1) appreciation of biodiversity explained by the intention of people to protect the ecological systems; the (2) Identity and pride, that is explained by the feeling of ownership of the land and resources; and (3) Appreciation of lifestyle, that is explained by the feeling of willing to live in the village doing the same activities.
	Health	This domain includes (1) Age of the household leader, (2) Nutritional dependency, measured by access to food and the (3) Sense of place, that determines the sense of being home.
Adaptation capacity	Learning	Learning is explained by the Level of formal education, Knowledge of rules that aim to regulate the exploitation or marine resources in the context of climate change and the Access to information on climate change, early warning system, etc. This knowledge enhances de adaptive capacity of the community.
	Assets	This domain is related to the assets that the village people own, that encompass, the Material style of life (accessories owned by the households); Community Infrastructures, that include hospitals, schools and coastal protection infrastructures, and the Access to credits that determine the ability of the community to adapt to climate changes.
	Flexibility	Flexibility is related to the ability of communities to adapt to changes caused by climate changes. In this case, it includes, the Livelihood multiplicity, ability to adapt to live without fishing, usage of different Gears and Spatial mobility.
	Agency	Agency includes in this case the (1) Perceived capacity to change, explained by the feeling about leaving the village, (2) Recognition of causality, management affecting availability and quality of marine resources and (3) Level of participation, measured by the involvement of the community in different aspects of marine resources management.
	Organization	The organization is related to (1) Trust in organization, measured by the community trust on the organizations; (2) Community cohesion, measured by the availability to help each other; and (3) Linking Social capital measured by the Information on the taxes paid ensure that the community argue for the intended support.

Appendix 2 - Indicators including explanation, data collection methods and scoring – Mozambique

Dimension	Domain	Indicator	Method	Explanation	Scoring method
Sensitivity	Livelihood	Employment Status	Q9	This is the employment of the family leader, If the employment is sensitive to climate change, this indicator should be considered zero	Unemployed =1 Employed in a climate sensitive job = 1 Employed = 0
		Percentage of catch from fishing sold	Q26	This indicator measures the ability of local communities of getting money from fisheries and how much are they dependent on the marine resources?	Percentage of fish sold.
		Percentage of income from the main activity	Q14a	If the income of people comes from the same source it becomes more sensitive	Percentage of income from activity scored as (1), main activity.
		Time conducting the activity	Q15a	The family becomes more sensitive if they depend on marine vulnerable resources and they develop only the	Less than one year = 1, less sensitive 1-5 years =2 5-10 years =3

Dimension	Domain	Indicator	Method	Explanation	Scoring method
				same activity for a long time	10-20 years =4 20-30 years =5 More than 30 years = 6, highly sensitive
	Demographic	Gender	Q3	The gender of family leader. The female leaded families are considered sensitive	Female =1 Male = 0
		Years Living In the village	Q7	The time spent in the village might limits the willingness to move to another place, if necessary, thus making them more sensitive to climate change.	Less than one year = 1, less sensitive 1-5 years =2 5-10 years =3 10-20 years =4 20-30 years =5 More than 30 years = 6, highly sensitive
		Percentage of children in the family members	Q8	If the percentage of children is higher the family becomes more sensible. Children,	Fraction of children in the family

Dimension	Domain	Indicator	Method	Explanation	Scoring method
				considering age below 18 years	
		Family dependency	Q12a and Q8	This indicator evaluates the ability to sustain the family if one family member becomes unavailable	Percentage of household members employed
	Cultural	Appreciation of biodiversity	Q77 and Q78a	Understanding and appreciation of biodiversity, including associated cultural habits might reduce the sensitivity of the ecosystem and community by increasing the willingness to participate in the protection of the ecosystems.	Standardized average of Q78 and Q79aI don't understand the question = 5, highly sensitive. My actions have significant effect on biodiversity = 1, low sensitivity Yes = 0, low sensitivity. No = 1, highly sensitive;
		Identity and pride	Q78b	Feeling pride of the land and resources increase the willingness to participate in the protection of	Yes = 0, low sensitivity. No = 1, highly sensitive;

Dimension	Domain	Indicator	Method	Explanation	Scoring method
				ecosystem and climate change adaptation actions	
		Appreciation of lifestyle	Q79	When the villagers appreciate their lifestyle, they are most likely to participate in actions to protect the environment and adaptation actions	Very bad = 5, highly sensitive Vary good = 0, low sensitivity
	Health	Age	Q1	The age to be considered here, is the age of family leader. If the respondent is the family leader representative, the age of family leader should be the one to be registered.	Below 20 and above 65 = 1 highly sensitive. Between 20 and 65 = 0, less sensitive
		Nutritional dependency	Q40, Q41, Q42 and Q43	Nutritional dependency is evaluated based on access to food	For questions Q40, Q41 and =Q42. Yes =1, highly sensitive and No = 0, not sensitive. For Q43, once = 5, highly sensitive

Dimension	Domain	Indicator	Method	Explanation	Scoring method
					and Over 3 times = 4 not sensitive. The results of the questions are combined using the sum of standardized values, varying from 0-1
		Sense of place	Q7	The time spent in the village gives the person a sense of home, and this makes difficult to move to another place, when required. This effect is comparable with special mobility	Less than one year = 1, less sensitive

1-5 years =2

5-10 years =3

10-20 years =4

20-30 years =5

More than 30 years = 6, highly sensitive |
| Adaptation capacity | Learning | Level of education | Q3 | The education to be considered is the family leader's. Highly educated family leader have high adaptive capacity. | [1] Class 8 or less   [2] Secondary school - level certificate [3] A-level certificate[4] Tertiary [5] |

Dimension	Domain	Indicator	Method	Explanation	Scoring method
					University and above
		Knowledge of rules	Q32	This indicator evaluates if there rules regarding and if this rules are known (1) Places where people are not supposed to fish, (2) Certain fishing gears that people are not supposed to use, (3) Certain times that people are not supposed to fish, (4) Certain species or types of fish that people are not supposed to catch. If the rules are either not established or know, this will result on low adaptive capacity	The score is calculated as average of the scores to items listed in the explanation. For each item, if the No one = 5, knowledge and implementation of rule, high adaptive capacity; and Don't know = 1, not knowing the rules, even if there are available, low adaptive capacity.
		Access to information	Q68 Q70 and Q73a	Access to information on climate change, adaptation measures and early warning increases the adaptive	As standardized average of scores of questions Q68 Q70 and Q73a. For Q68

Dimension	Domain	Indicator	Method	Explanation	Scoring method
				capacity of the community	Yes = 1, high adaptive capacity No = 1 Low adaptive capacity For Q70 and 73a (Not worried and Very limited) = 1, low adaptive capacity (Very and Very good) = 5, high adaptive capacity
	Assets	Material style of life	Q45	Having the assets means high adaptive capacity and not having means low adaptive capacity	Yes = 1, high adaptive capacity No = 0, low adaptive capacity
		Community Infrastructures	D46c	The community infrastructures such as hospitals, schools and coastal protection infrastructures determine high adaptive capacity	Very good = 5, high adaptive capacity Very bad = 1, low adaptive capacity

Dimension	Domain	Indicator	Method	Explanation	Scoring method
		Access to credits	**Q51**	Access to credits reveals high adaptive capacity	No =0, low adaptive capacity Yes = 1, high adaptive capacity
	Flexibility	Livelihood multiplicity	Q17	The respondent selects the livelihood options within the list in the Household questionnaire. High number of options indicates high adaptive capacity	Number of livelihood options selected by total number of livelihood options
		Adapt to live without fishing	Q19	This indicator evaluates the ability to leave if fishing in the area becomes unsustainable activity. This indicator is relevant for Mozambique as coastal country where there are people depending greatly on fishing.	Average score from 1 to 5, given by respondents divided by 5. Where extremely sensitive is Strongly disagree = 1 and Strongly agree =5 to the statement "I could easily stop fishing,

Dimension	Domain	Indicator	Method	Explanation	Scoring method
					and make my living on land"
		Gear	Q22	This evaluates the possibility of catching marine resources, thus making the respondents able to adapt in case of changing in the fishing methods caused by reduction of resources availability.	Gear options used by total number of gear options
		Spatial mobility	49	By responding the question "Supposing that for some reason you were moving away from your current village, how would you feel about leaving?" reveal the willingness to move if required to leave in other area.	Very bad = 1, low adaptive capacity Very happy = 5, high adaptive capacity
	Agency	Perceived capacity to change	Q49	By responding the question "Supposing that for some reason you	Very bad = 1, low adaptive capacity

Dimension	Domain	Indicator	Method	Explanation	Scoring method
				were moving away from your current village, how would you feel about leaving?" reveal the willingness to move if required to leave in other area.	Very happy = 5, high adaptive capacity
		Recognition of causality	Q60 to Q63	Recognition of management affecting availability and quality of marine resources represents high adaptive capacity because enables the community on willing to participate in the management.	Average of scores given to each question (Much worse, A lot less, Much harder or A lot less reliable) = 1, low adaptive capacity (Much better, A lot more, Much easier, A lot more reliable) = 5, high adaptive capacity
		Level of participation	Q64a), Q64b), Q65, Q66	This indicator measures the involvement of the community in different aspects of	For Q64a, 64b and 65 (Not at all and Not involved,) =1, low

Dimension	Domain	Indicator	Method	Explanation	Scoring method
			and Q67	marine resources management.	adaptive capacity (Very often and Highly involved (in leadership)) = 4, high adaptive capacity For Q65 (Strongly disagree) = 1, low adaptive capacity Strongly agree = 5, high adaptive capacity For Q66 and 67 (Very unfair, Daily and Don't know) = 1, low adaptive capacity (Very fair, No conflict) = 5 high adaptive capacity

Dimension	Domain	Indicator	Method	Explanation	Scoring method
	Organization	Trust in organization	Q31	This indicator measures how much the community trust on the organizations, that include, other people in the village, village leaders, marine resources management, NGOs and government	This is calculated as the average trust in the items listed in the explanation of the indicator. For each item, Not at all = 1, showing non trust on the organizations, low adaptive capacity; and Trust all = 5, showing trust on the organizations, high adaptive capacity
		Community cohesion	Q33	The availability to help each other in every circumstance demonstrated social cohesion and higher adaptive capacity	Yes = 1, demonstrates high community cohesion and high adaptive capacity and No = 0, demonstrating low social cohesion. low

Dimension	Domain	Indicator	Method	Explanation	Scoring method
					adaptive capacity
		Linking Social capital	Q74, 75 and 76	Information on the taxes paid ensure that the community argue for the intended support from the government. Well structured, taxes can be used to build adaptive capacity	Yes = 1, high adaptive capacity

No = 0, low adaptive capacity |

Appendix 3 Key Informants Questionnaire

Targeted Key Informants: Fisheries officials, Beach management unit leaders, Head of villages, Community development officials, Community based organization, Planners, NGOs

1. Location

1.1   Name of the Interviewee:

1.2   Occupation:

1.3   Name of Region:

1.4   Name of District:

1.5   Name of Ward:

1.6   Age: Contact:

1.7   What types of marine ecosystems are present in the sites: Mangroves, Coral reefs, Seagrass beds? If the interviewee has a Land use or seascape map with villages on it, discuss about the locations of the ecosystems. If not, prepare and bring a map and point out the ecosystems locations.

2. Exposure

2.1   Have communities in the site experienced changes in climate? And how the current climate is different from that of 20-30 years ago?

2.2   Explain on how the following parameters affected your livelihood activities; - Precipitation change, sea level change, water temperature change, change in wind, air temperature change, humidity change, ocean acidification, ocean current change, extreme temperature frequency, drought frequency, storm surge and extreme marine heat events

2.3   What are the main climate parameters that have the most impact on fish communities?

3. Sensitivity

3.1   Livelihood

3.1.1   What are the impacts of climate change on coastal and marine resources? How have they been affected?

3.1.2   What are the impacts of climate change on the community livelihoods?

3.1.3   Where do you or coastal community in your area depend on for survival between land or coastal and marine based livelihood? Why?

3.1.4   To what extent do you or coastal community in the site rely on coastal and marine resources for survival?

3.2   Cultural

3.2.1   Are there any important cultural, traditional or spiritual practices associated with the sea

3.2.2   What are the cultural benefits from coastal and marine resources that local communities enjoy? Have these cultural benefits affected by climate change? How?

3.3   Health

3.3.1   What are the impacts of climate change on local community's health? Food and waterborned Diarrheal Disease, Air Pollution, Food security (Length of the lean season), mental health and stress-related disorders.

4. Adaptive capacity

4.1   Flexibility

4.1.1   Business size /Frequency of fishing in the community (Difference from a reference time) [Livelihood multiplicity]

4.1.2   Time spent in the sea (Difference from a reference time) [Spatial mobility]

4.1.3   Fishing distance from the shore (Difference from a reference time) [Spatial mobility]

4.1.4   Gear diversity

4.1.5   What are the main sources of income? (1) Fishing (2) Commerce (3) Agriculture (4)Workers (For another households) (5) Other

4.2   Organization

4.2.1   Are there migrant fishers in the site? Have they settled permanently or temporarily? What period of the year do they fish and where?

4.2.2   How many different ethnic groups are there in the site?

4.2.3   Are there conflicts/problems about marine resources here? If conflict happens, (b) who is involved? (c) What is the conflict about? (d) What is the intensity? (e) What is the frequency? (f) How is the conflict resolved? [Community cohesion]

4.3   Assets

4.3.1   When were there interventions by government, NGOs, projects or individuals from outside the village (e.g. nurseries, environmental awareness, infrastructure, school, running water, hospital)? [Community infrastructures]

4.3.2   Do the sites have access to credit? What is the percentage of households that have access to credit? [Access to credits]

4.4   Learning

4.4.1   How do communities have access to information: Radio, Mobile… [Access to information]

4.5   Governance (will be added to Organization)

4.5.1   How is the site managed? Community based? Government based? NGOs?

4.5.2   What types of activities have you [the interviewee] been involved in?

4.5.3   What tools have you used? How effective were these tools in reaching and motivating Fishers?

4.5.4   Who have your efforts been focused on?

4.5.5   Who have you collaborated with?

4.5.6   What are the sources of weather and climate information in the site?

4.5.7   Do people break rules?
- Places where people are not supposed to fish

- Certain fishing gears that people are not supposed to use
- Certain times that people are not supposed to fish
- Certain species or types of fish
- that people are not supposed to catch

5. Fieldwork: Village selection

Based on these data, to which villages would you think we should conduct household surveys to get representative data of the site?

Do you have any contacts or key informants that we should talk to in the site/selected villages

Appendix 4 Household Survey
CLIMATE CHANGE VULNERABILITY ASSESSMENTS IN SELECTED COASTAL COMMUNITIES IN MOZAMBIQUE

QUESTIONNAIRE

Study site: _____ County/District: _____

Village: _____ Date: _____

Survey no.: _____ Name of interviewer: _____

Latitude/longitude: _____

PART 1: SENSITY DIMENSION

Demographic Characteristics *(Please tick one)*

1) Age (in years): ………………………………

2) Sex:

    [1] Female   [2] Male   [3] Other

3) Formal education:

    [1] Class 8 or less   [2]   Secondary school - level certificate [3] A-level certificate

    [4] Tertiary   [5] University and above

4) What is your religion?

    [1]   Muslim   [2] Christian   [3] Hindu

    [4] Traditional   [5] Other (specify) …………………………………

5) Marital status: [1]   Single   [2] Married [3] Married before [4] Other

6) Where are you originally from? (*Tick only one option below*)
    [1]   This village   [2] Another village in this county   [3] Coastal area other than

    this location   [4] This country (not coastal area)   [5] Another country

7) How many years have you lived in this village? ....

8) How many people are currently in your household, including yourself? *(Please write down the number of people below each category)*

Adult male	Adult female	Male children	Female children

9) What is your employment status? [1]   Unemployed   [2] Employed

10) If employed, what form of employment are you engaged in?

11) If unemployed, is anyone from your household engaged in formal employment?

   [1]   No   [2]   Yes

12) Please give details of employment for any members of your household who are employed
    (specify type of occupation) _____

    _____

12a How many family members are employed? _____

13) If unemployed, how do you earn income or obtain food and other necessities?

    _____

14) How much income do you earn per week/month/year? Mts. _____

14a List the main sources of income to the family and score than in order of priority and

include de average amount per activity.

Activity	Priority	Average income
Total		

15) If fisher, what marine resources do you depend on? Mts. _____

15a How long you have been developing the activity that is the main source of income?

_____

PART 2: SOCIAL ADAPTIVE CAPACITY DIMENSION

FLEXIBILITY

Livelihood multiplicity

16) Traditional uses of marine resources

    i.   What goods did you obtain from the marine resources in the past?

    ii.   Have these goods changed over time? [1] No   [2] Yes

    iii.   If yes, how?

    iv.   How else did you benefit from the marine resources in the past? *(probe for ecological services)*

    v.   Has the benefits changed over time? [1] No   [2] Yes

    vi.   If yes, how?

        a)   How do you use marine resources now?

            i.   What goods do you obtain from the marine resources now?

            ii.   How else do you benefit from the marine resources now? *(probe for ecological services)*

17) What economic activities do you engage in to obtain food or income to your house? What do other people in your house do that brings in food or money to your house?

Livelihood activity	Tick livelihoods of the respondent	Number of people in the household involved in activity		Rank the economic activities in order of importance
		Women	Men	
Fishing				
Gleaning				
Medium scale fish trade/fish dealer				
Fish mongers (*mama karanga*)				
Mangrove cutting or trade				
Agent (middleman)				
Aquaculture/Mariculture				

Hunting				
Farming (cash crops)				
Farming (peasant/subsistence, livestock)				
Salaried employment (e.g. teacher, nurse)				
Tourism and handicrafts				
Small business(not marine related)				
Other:				
Other:				

18) Is fishing your primary livelihood? [1]   No   [2]   Yes

19) If yes, how much do you agree with this statement? *(Please circle **one** option):*

"I could easily stop fishing, and make my living on land"

Strongly disagree	Somewhat disagree	Neither	Somewhat agree	Strongly agree

20) Cultural/heritage impacts

   a) What areas of the marine environment/resources are of special interest to communities for cultural or religious purposes?

   b) Has this changed over time? [1]   No   [2]   Yes

   c) If yes, how? _____

Fishing and Marine Resources Management/Gear diversity

21) Do you own a boat? (Tick as appropriate)

   [1] No boat
   [2] Boat without a motor (e.g., canoe)
   [3] Boat with a motorized engine (engine has__hp)
   [4] Other(specify)__

22) Which fishing gears does your household use? *(Tick appropriately)*

Gear	Tick gear used	Gear	Tick gear used
Hand line (inshore/reef)		Purse seine net	

Hand line (offshore/blue water)		Hand spear	
Multiple hooks (more than 20)		Spear-gun	
Trolling line		Fish trap	
Mesh gillnet, above5cm(2inches)		Explosives/Poison	
Mesh gillnet, below5cm(2inches)		Gleaning	
Mosquito nets		Other(specify):	
Small/beach seine net (nets dragged along substrate)		Other(specify):	

23) Which fishing gear is the most important to your household?_____

_____

24) Where is your fishing ground? _____

25) Catch, fishing effort and catch value:

Parameter	Details
Quantity of fish & other seafood landed (Kgs/ Bundles/pieces)	
Number of fishing crew	
Number of hours (fishing and travelling)	
Total value of catch (local currency)	

26) Typically, what percentage of your catch from fishing or gleaning do you sell, retain for own consumption or give away?

Retain for own consumption ____% sell ____%   give away____% don't know ____%

27) If you were to get 50% less catch all year what would you do? (*Tick **multiple boxes** if necessary*)

Keep fishing at same	Fish more often	Change fishing grounds	Change fishing gears	Fish less & switch to other	Stop fishing entirely

amount				livelihood	
Other(specify):					

28) In general, how often do you and your household eat locally caught fish or other sea food that was caught by you or someone in your community? (*Please circle **one** option*)

More than once per day	Once per day	More than once per week	Once per week	More than once per month

29) Over the past 5 years, has the number of fish caught around your area changed? If so, how has it changed? *(Tick **one** option)*

[1] Significant decrease   [2] Decrease   [3] No change

[4] Increase   [5] Significant increase

30) What can be done to increase availability of fish in the sea around here?_____

_____

ORGANIZATION

31) In general, how much do you trust the following people? (*Tick **one** option for each group).*

	Not at all	Distrust more people than trust	About half-half	Trust more people than distrust	Trust all
People in your village					
Village leaders					
Marine resource management group					
NGOs					
Government					

32) I am interested in learning about some of the rules and traditions about fishing here.

(A) Are there places where people are not supposed to fish, nor use certain gears, etc.?

(B) Who created the rules? **(C)** Do people still fish there? If so, how many people? *(Interviewer: please **fill out first row** before moving to next row, i.e. ask A-C for places where people are not supposed to fish followed by A-C for fishing gears that people are not supposed to use).*

Rule	Description of rules, e.g. what gears are not used etc.	Who created the rules? *(tick multiple boxes if necessary)*	Do people still fish there? If so, how many? *(tick one box)*
Places where people are not supposed to fish		□ Fishers/local users □ NGO □ Government □ Other:_____ □ Don't know	□ No one □ A few □ About half □ Most □ Everyone □ Don't know
Certain **fishing gears** that people are not supposed to use		□ Fishers/local users □ NGO □ Government □ Other:_____ □ Don't know	□ No one □ A few □ About half □ Most □ Everyone □ Don't know
Certain **times** that people are not supposed to fish		□ Fishers/local users □ NGO □ Government □ Other:_____ □ Don't know	□ No one □ A few □ About half □ Most □ Everyone □ Don't know
Certain **species or types of fish** that people are not supposed to catch		□ Fishers/local users □ NGO □ Government □ Other:_____ □ Don't know	□ No one □ A few □ About half □ Most □ Everyone □ Don't know

Other, please describe:		☐ Fishers/local users ☐ NGO ☐ Government ☐ Other:_____ ☐ Don't know	☐ No one ☐ A few ☐ About half ☐ Most ☐ Everyone ☐ Don't know

Social Capital

33) Social networks

    a) Are there times when you go to someone else for help? [1] No   [2] Yes

    b) If the answer to question a) is yes, who do you run to for help in times of need? __

        _____

    c) Why do you run to this person(s) and not any other person(s)? _____

    d) Who are the key decision makers in the community? _____

    e) How are decisions made in the community? _____

Learning

34) Local perception of marine resources management and management success

    a. In your opinion, are the marine resources managed well? _____

    b. What aspects of management do you consider successful in your area? _____

        _____

    f) Is there effective enforcement of rules and regulations governing marine

        resources? [1] No   [2] Yes

        If yes, explain: _____

    c. Are the local communities involved in marine resources management?

        [1] No   [2] Yes

        If yes, how? _____

    d. What is your opinion regarding marine resources conservation? _____

35) Level of understanding of human impacts on marine resources

    a. Are there any activities that damage marine resources in the area? _____

    b. Are you concerned about sustainability of the marine resources? _____

36) Distance from village to the sea; importance of markets; slope _____

37) Distance from village to nearest market _____

38) How is cultural knowledge passed down by the community from one generation to another? _____

39) Is there any cultural memory, traditions, and assets that relate to coastal and marine resources that have been handed over to you? _____

_____

Food Security and Wellbeing

40) Were there any moments in the last month when your home did not have enough to eat?

[1] No   [2] Yes   [3] I don't know

41) Was this unusual?
[1] No   [2] Yes   [3] I don't know

42) In the past year, have there been times when you feared that your food would not last until you were able to get more?
[1] No   [2] Yes   [3] I don't know

43) In general, how many times do you eat in the day?
[1] Once   [2] 2 times   [3] 3 times   [4] Over 3 times

44) Since yesterday, can you tell me about the meals you have prepared for your family?

ASSETS AND ACCESS TO CREDIT

Material Style of Life

45) Material style of life and owned assets. *Please **tick all the household items or facilities p**resent in the household. Also **record the number of each asset** owned by the household.*

Cooking pots	Radios/cassette/CD	DVD/VCD players
[1] No [2] Yes How many:	[1] No [2] Yes How many:	[1] No [2] Yes How many:
Mattresses	Mobile phone (not smart phone)	Smart phone sortables
[1] No [2] Yes How many:	[1] No [2] Yes How many:	[1] No [2] Yes How many:

Flushing toilet [1] No [2] Yes How many:		Indoor piped water (tap) [1] No [2] Yes How many:	
Washing machine [1] No [2] Yes How many:	Computers [1] No [2] Yes How many:	Electric refrigerators or freezers [1] No [2] Yes How many:	
Cattle/Goats/Pigs /Sheep(livestock) [1] No [2] Yes How many:	Televisions [1] No [2] Yes How many:	Satellite dishes [1] No [2] Yes How many:	
Private toilet [1] No [2] Yes How many:	Other1 [1] No [2] Yes How many:	Other2 [1] No [2] Yes How many:	

Roof Material	Wall Material	Floor Material	Electricity
☐ Bamboo/Thatch ☐ Wood ☐ Metal ☐ Tile ☐ Other:_____	☐ Bamboo/Thatch ☐ Wood ☐ Metal ☐ Cement ☐ Other:_	☐ Dirt/Soil ☐ Wood ☐ Concrete ☐ Tile ☐ Other:_____	☐ Solar ☐ Generat or ☐ Grid ☐ None ☐ Other:

46) Community infrastructure

    a) How are the communities governed?

    b) How do the communities relate with higher levels of government?

    c) How do you classify the quality of community infrastructures, hospitals, schools, coastal protection infrastructures, etc ?

Very bad	bad	Neither good nor bad	Good	Very good

47) It would be great to know more about how you feel about your life here. All things considered, has your satisfaction with your life as a whole changed over the last three years? [1] No   [2] Yes.

If so, how has it changed? *(Please tick **one** option)*

Much worse	Worse	No change	Better	Much better

48) *If there was a change,* what are the three main causes of this change?

1._____

2._____

3._____

49) Supposing that for some reason you were moving away from your current village, how would you feel about leaving?

Very sad	Sad	Neither happy nor sad	Happy	Very happy

50) Do you have access to savings to respond to extreme climatic events? [1] No [2] Yes

51) Do you have access to credit facilities? [1] No   [2] Yes; Explain _____

52) For people dependent on marine resources, do you have access to markets?

[1] No   [2] Yes

53) Do both men and women have equal access to resources? [1] No [2] Yes

54) Are there any barriers restricting access to the coastal and marine resources? Explain

55) Is government investing in longer term adaptation options? [1] No   [2] Yes,

If yes, how? _____

AGENCY

Recognition of causality

56) Does fisheries and mangrove management affect this community? [1] No   [2] Yes

57) Does fisheries and mangrove management affect you? [1] No   [2] Yes

58) If yes, what are the positive impacts of fisheries and mangrove management for you?

_____

59) What are the negative impacts of fisheries management on you? _____

_____

60) In general, do you think management has affected fish stocks? If yes, how has the fish stock been affected? *(Please tick **one** option)*

Much worse	Worse	No change	Better	Much better

61) In general, do you think management has affected the quality (e.g., size) of fish and other sea food landed?
*(Please tick **one** option)*

A lot less	Somewhat less	No change	Somewhat more	A lot more

62) In general, do you think management has made it easier or harder to catch fish and other sea food (in terms of time, effort, or travel distance)? (*Please tick **one** option*)

Much harder	Hard	Neither	Easier	Much easier

63) In general, do you think management has affected the reliability of what you can catch?

If yes, how has it changed the reliability? (*Please tick **one** option*)

A lot less reliable	Less reliable	No change	More reliable	A lot more reliable

Level of participation

64) Currently, are you involved in the following aspects of marine resources management?

   a) decisions about marine resource use (attending meetings about marine resources)

Not at all	Seldom	Never	Often	Very often

   b) management of marine resources

Not involved	Involved a little	Never	Involved	Highly involved (in leadership)

65) How much do you agree or disagree with this statement: *(Please tick **one** option)*

   "People like me have influence on the management of marine resources."

Strongly disagree	Disagree	Neither	Agree	Strongly agree

66) In general, do you think the way that decisions are made about marine resource use and management are fair? *(Please circle **one** option)*

Very unfair	Unfair	Neither	Fair	Very fair	Don't know

Why? _____

67) Is there any conflict over marine resources here? If yes, how often does this conflict occur? *(Please circle **one** option)*

No conflict	Less than once per year	More than once per year	Monthly	Weekly	Daily	Don't know

CLIMATE CHANGE

68) Have you heard of climate change or global warming?

[1] No   [2] Yes

69) Can you tell me what it is? *Please check all the answers the respondent provides. Do not prompt the respondent*

☐ Drought – not enough rain   ☐ More storms & extreme weather
☐ Floods – too enough rain   ☐ Increased disease
☐ Sea level rise   ☐ Impact on fish catch
☐ Warmer conditions
☐ Other

70) Are you worried about this affecting your family?

[1] Not worried   [2] A little worried [3] Not sure   [4] Worried [5] Very worried

71) What traditional knowledge or practices relevant to addressing climate are available in the communities? _____

72) What adaptation options are available to you and the local communities? _____

_____

73) Do you and other members of the community have access to relevant information, such

as forecasts or early warming? _____

a) How do you classify it?

[1] Very limited   [2] limited [3] Not bad   [4] Good   [5] Very good

ADITIONAL QUESTIONS

Linking Social capital

74) Do you pay taxes?

[1] No   [2] Yes
75) Are you informed about the taxes paid?
[1] No   [2] Yes

76) Do you have support from the government to sustain the development of your activities

based on the taxes paid?

[1] No   [2] Yes
a) Describe, what kind of support do you receive?

Appreciation of biodiversity

77) Do you think that it is important that people participate in biodiversity preservation? Do

you think that the daily activities of local people might impact on biodiversity.

I don't understand the question	My actions do not have effect on the biodiversity	My actions do have limited effect on the biodiversity	My actions have effect on biodiversity	My actions have significant effect on biodiversity

78) Do you have traditions that regulate the fishing and exploitation of costal resources?

[1] No   [2] Yes
a) Describe, these traditions?_____
_____.
b) How do you feel about your village, environment and marine resources? Are you
willing to protect them as your home land and culture?
[1] No   [2] Yes

79) How much you like you lifestyle in the village?

Very bad	Bad	Not bad but not good	Good	Very good

SUPLLEMENTARY QUESTIONS - Adaptation to Covid-19

80) How has COVID-19 impacted how you and your family obtain food and income compared to how you normally would at this time of year?

81) Have you and your family made any changes to cope with these impacts? [1] No [2] Yes

82) If the answer to question 74 is yes, please explain _____

_____

83) Has COVID-19 changed the quantity of fish or other sea food that much you have been catching compared to how you would normally catch at this time of year?
[1] No [2] Yes
If yes, how?

Much worse	Worse	No change	Better	Much better

84) Has COVID-19 impacted the fish market? [1] No [2] Yes

Please explain _____

85) Are people in the community able to access markets? [1] No [2] Yes

Please explain _____

86) Have you and your family made any changes to cope with these impacts? Please tell me about them.

87) Has COVID-19 changed the price of fish now compared to this time of year normally? How?

Has COVID-19 affected the types and variety of food you and your family are eating now, compared to normally at this time of year? [1] No [2] Yes
If yes, how? _____

88) Are there foods you normally eat at this time of year that you are not able to eat at the moment?   [1] No [2] Yes

If yes, why?

89) Have you and your family made any changes to cope with these impacts? Please tell me about them.

90) What impacts has COVID-19 had on livelihoods in the community?

_____

_____

_____.

91) Has the number of people who are engaged in fishing changed? [1] No [2] Yes

If yes, how? _____

92) Has the intensity of fishing changed? [1] No [2] Yes

If yes, how? _____

93) How has the community responded to COVID-19? _____

Appendix 5 Questionnaire for determination of relative weights of domains and indicators using the AHP method

We are carrying out research, in the context of development of CCVA for the coastal areas of Mozambique. Through this survey, it is intended to determine the relative weights to be attributed to the different domains and to each of the indicators that make up the groups. The methodological explanation is given in an accompanying document, you can also interact with the researchers involved for any clarification on the filling procedures. The survey is completely anonymous.

I.   Sensitivity

a) Domains

1 There are different aspects that determine the sensitivity of coastal area communities. In your opinion what is more important in determining the sensitivity to climate change for the communities in the southern part of Mozambique, the livelihood or demographic aspects? To what degree you think your choice is important.
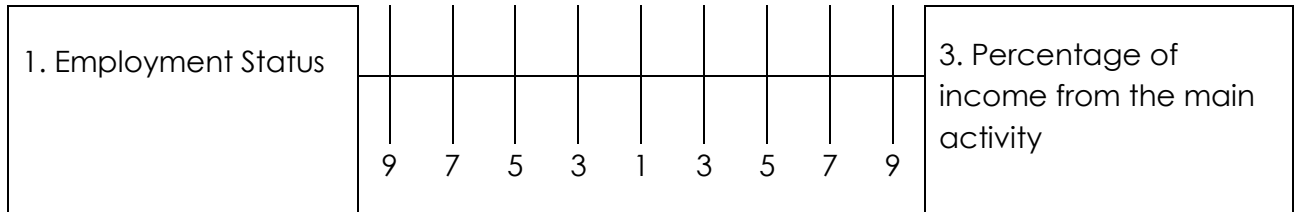
1.Livelihood		2.Demographic
	9 7 5 3 1 3 5 7 9	

2 There are different aspects that determine the sensitivity of coastal area communities. In your opinion what is more important in determining the sensitivity to climate change for the communities in the southern part of Mozambique, the livelihood and economic dependence on the resource or the Cultural aspects? To what degree you think your choice is important.

1.Livelihood		3.Cultural

	9 7 5 3 1 3 5 7 9	

3 There are different aspects that determine the sensitivity of coastal area communities. In your opinion what is more important in determining the sensitivity to climate change for the communities in the southern part of Mozambique, the Livelihood or the Health issues? To what degree you think your choice is important.
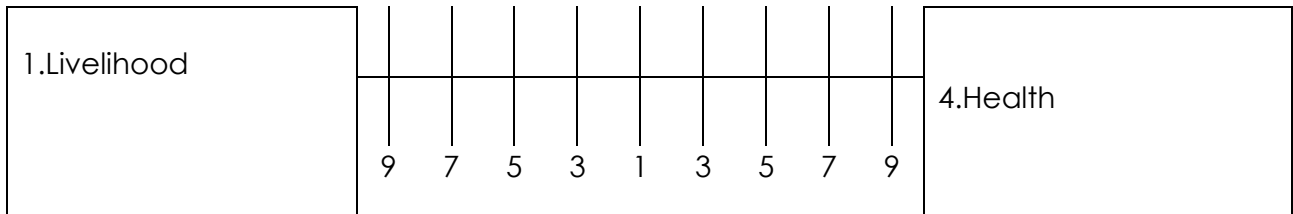
1.Livelihood	9 7 5 3 1 3 5 7 9	4.Health

4 There are different aspects that determine the sensitivity of coastal area communities. In your opinion what is more important in determining the sensitivity to climate change for the communities in the southern part of Mozambique, the Demographic aspects or the Cultural aspects? To what degree you think your choice is important.
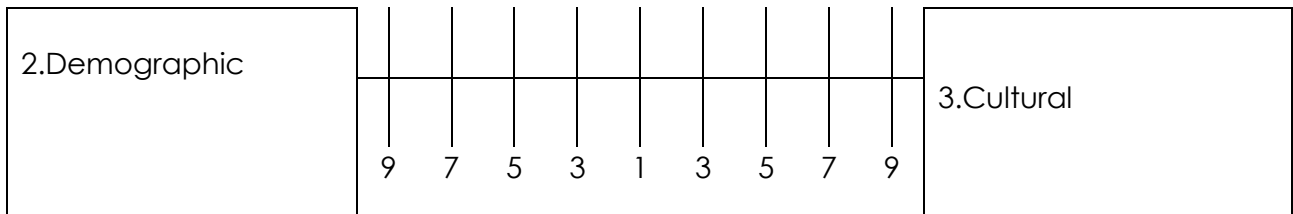
2.Demographic	9 7 5 3 1 3 5 7 9	3.Cultural

5 There are different aspects that determine the sensitivity of coastal area communities. In your opinion what is more important in determining the sensitivity to climate change for the communities in the southern part of Mozambique, the Demographic aspects or the health? To what degree you think your choice is important.
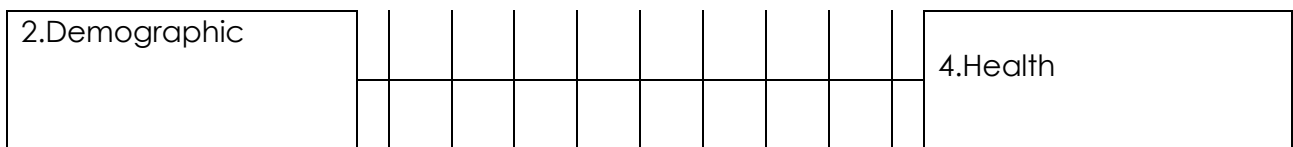
2.Demographic		4.Health

	9 7 5 3 1 3 5 7 9	

6 There are different aspects that determine the sensitivity of coastal area communities. In your opinion what is more important in determining the sensitivity to climate change for the communities in the southern part of Mozambique, the Cultural aspects or the Health aspects? To what degree you think your choice is important.

3.Cultural	9 7 5 3 1 3 5 7 9	4.Health
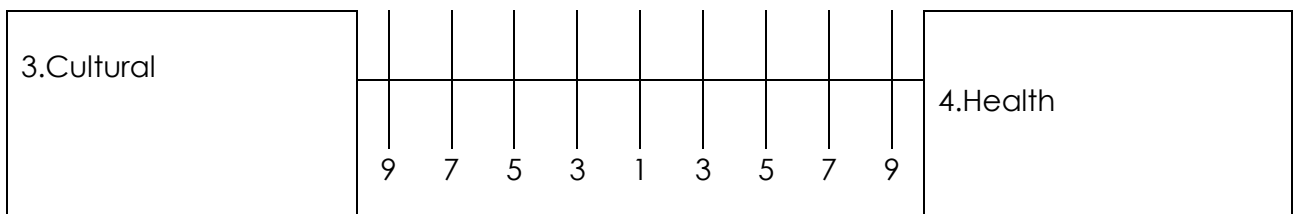
b) Livelihood/Economic dependence

7 Within the different domains there are different indicators that will contribute to the overall sensitive. For example, within the livelihood of coastal communities of Southern part of Mozambique: In your opinion what is more important the Employment Status or the Percentage of catch from fishing sold? To what degree you think your choice is important.
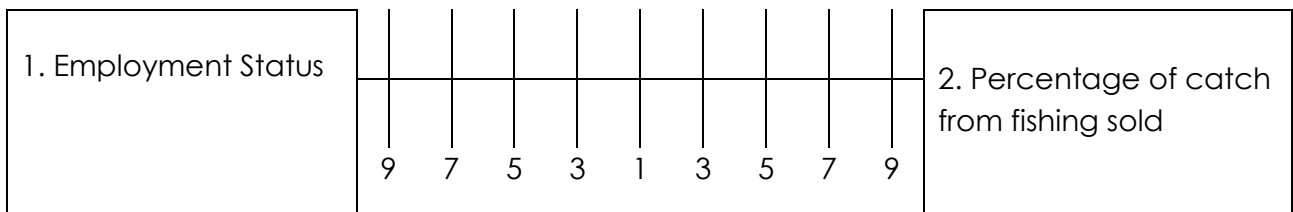
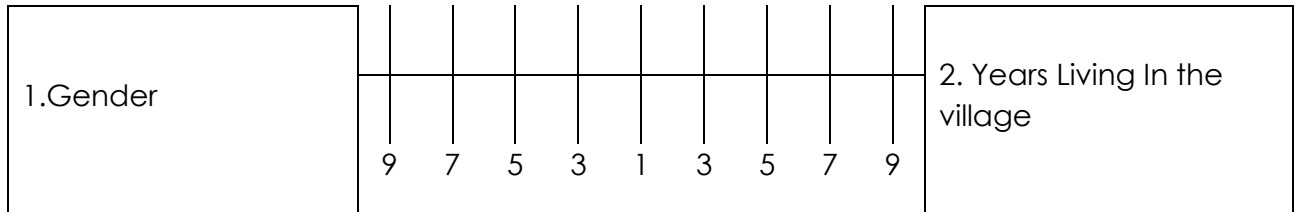| 1. Employment Status	9 7 5 3 1 3 5 7 9	2. Percentage of catch from fishing sold

8 Within the different domains there are different indicators that will contribute to the overall sensitive. For example, within the livelihood of coastal communities of Southern part of Mozambique: In your opinion what is more important the Employment Status or

the Percentage of income from the main activity? To what degree you think your choice is important.

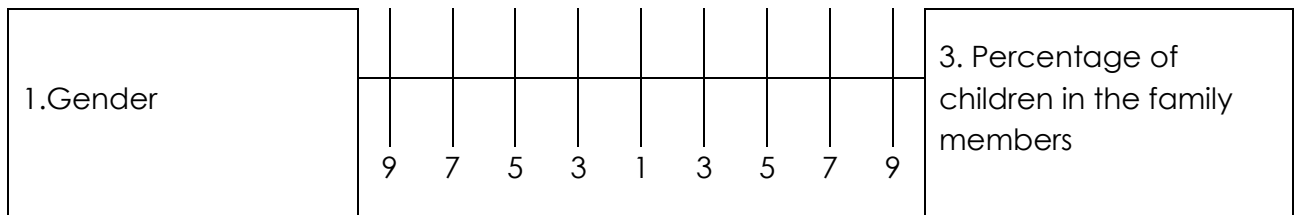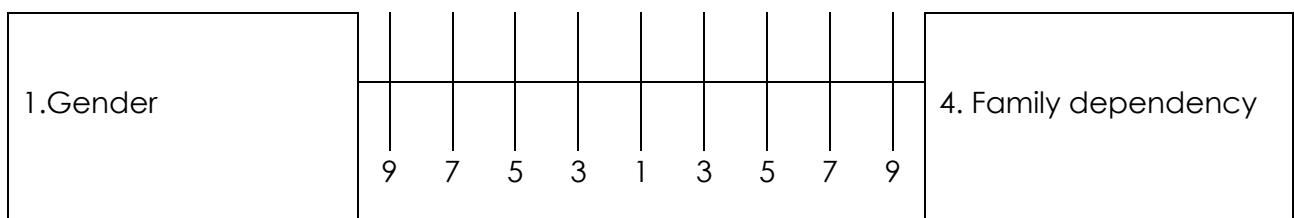| 1. Employment Status | 9 7 5 3 1 3 5 7 9 | 3. Percentage of income from the main activity |

9 Within the different domains there are different indicators that will contribute to the overall sensitive. For example, within the livelihood of coastal communities of Southern part of Mozambique: In your opinion what is more important the Employment Status or the Time conducting the activity? To what degree you think your choice is important.

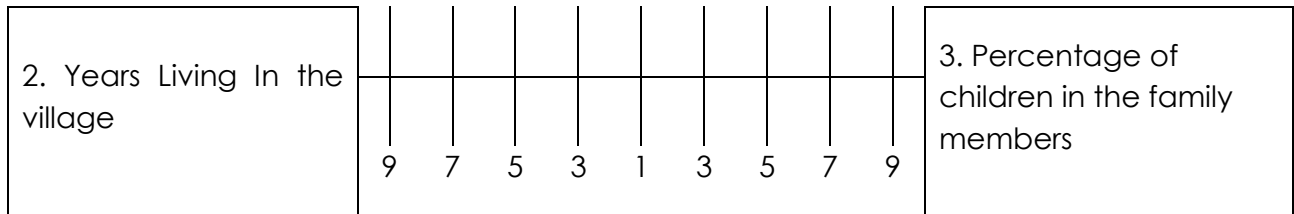| 1. Employment Status | 9 7 5 3 1 3 5 7 9 | 4. Time conducting the activity |
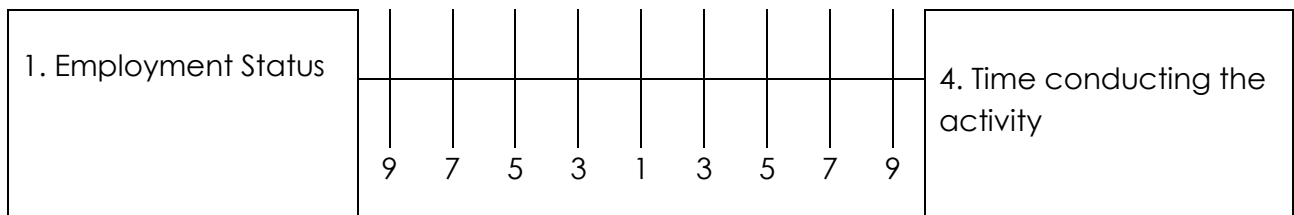
10 Within the different domains there are different indicators that will contribute to the overall sensitive. For example, within the livelihood of coastal communities of Southern part of Mozambique: In your opinion what is more important the Percentage of catch from fishing sold or the Percentage of income from the main activity? To what degree you think your choice is important.

| 2. Percentage of catch from fishing sold | 9 7 5 3 1 3 5 7 9 | 3. Percentage of income from the main activity |
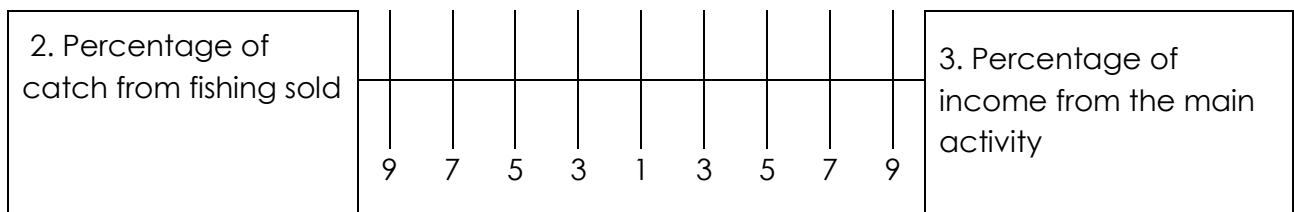
11 Within the different domains there are different indicators that will contribute to the overall sensitive. For example, within the livelihood of coastal communities of Southern part of Mozambique: In your opinion what is more important the Percentage of catch from fishing sold or the Time conducting the activity? To what degree you think your choice is important.
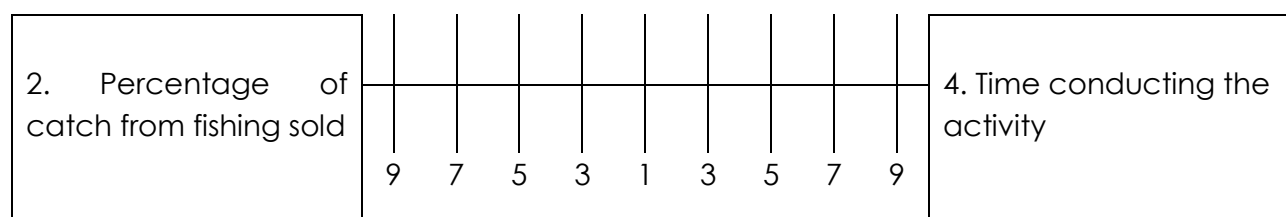
| 2. Percentage of catch from fishing sold | 9 7 5 3 1 3 5 7 9 | 4. Time conducting the activity |

12 Within the different domains there are different indicators that will contribute to the overall sensitive. For example, within the livelihood of coastal communities of Southern part of Mozambique: In your opinion what is more important the Percentage of income from the main activity or the Time conducting the activity? To what degree you think your choice is important.

| 3. Percentage of income from the main activity | 9 7 5 3 1 3 5 7 9 | 4. Time conducting the activity |
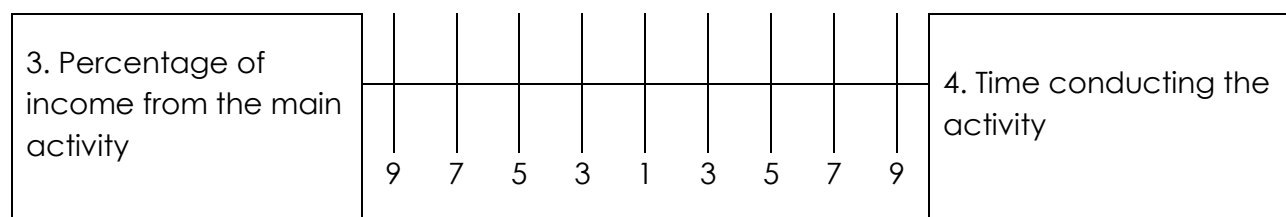
c) Demographic

13 Within the different domains there are different indicators that will contribute to the overall sensitive. For example, within the demographics of coastal communities of Southern part of Mozambique. In your opinion what is more important the Gender or the Years Living In the village? To what degree you think your choice is important.

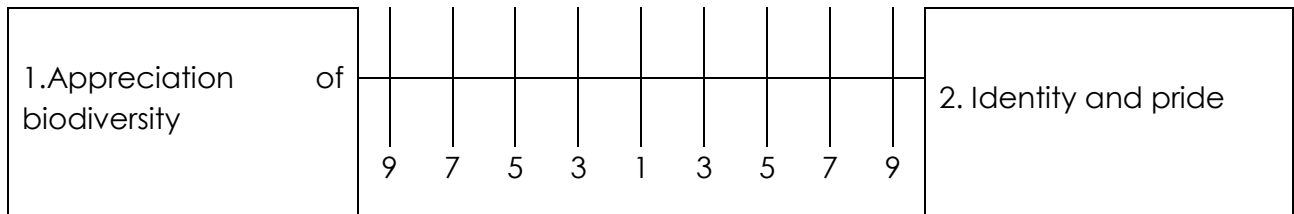| 1.Gender	9 7 5 3 1 3 5 7 9	2. Years Living In the village

14 Within the different domains there are different indicators that will contribute to the overall sensitive. For example, within the demographics of coastal communities of Southern part of Mozambique. In your opinion what is more important the Gender or the Percentage of children in the family members? To what degree you think your choice is important.

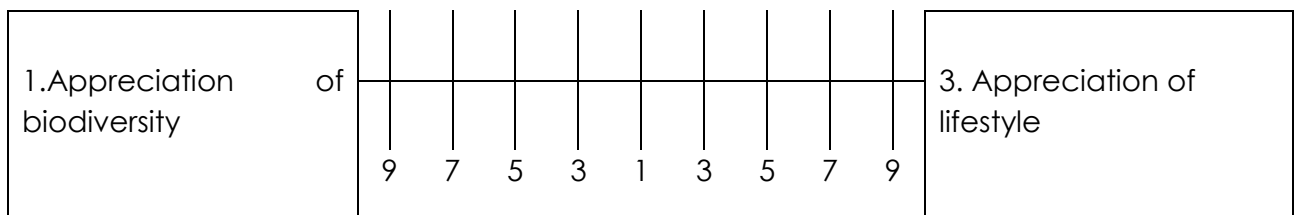| 1.Gender	9 7 5 3 1 3 5 7 9	3. Percentage of children in the family members

15 Within the different domains there are different indicators that will contribute to the overall sensitive. For example, within the demographics of coastal communities of Southern part of Mozambique. In your opinion what is more important the Gender or the Family dependency? To what degree you think your choice is important?

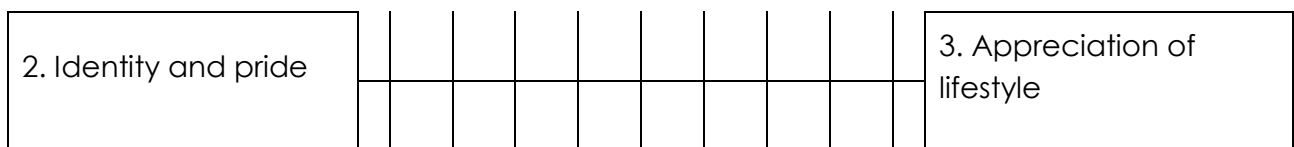| 1.Gender	9 7 5 3 1 3 5 7 9	4. Family dependency

16 Within the different domains there are different indicators that will contribute to the overall sensitive. For example, within the demographics of coastal communities of Southern part of Mozambique. In your opinion what is more important the Years Living In the village or the Percentage of children in the family members? To what degree you think your choice is important.

2. Years Living In the village	9 7 5 3 1 3 5 7 9	3. Percentage of children in the family members

17 Within the different domains there are different indicators that will contribute to the overall sensitive. For example, within the demographics of coastal communities of Southern part of Mozambique. In your opinion what is more important the Years Living In the village or the Family dependency? To what degree you think your choice is important?
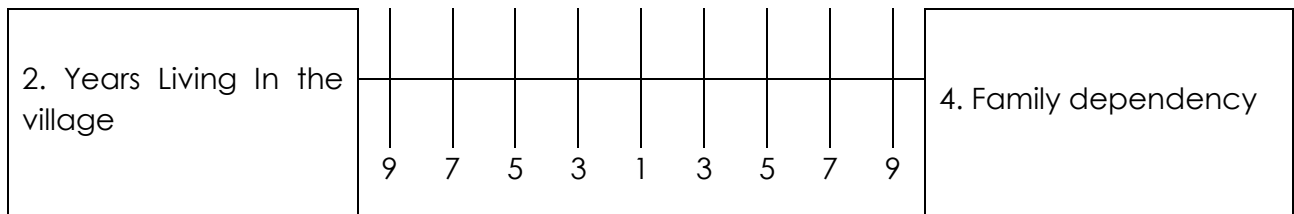
2. Years Living In the village	9 7 5 3 1 3 5 7 9	4. Family dependency

18 Within the different domains there are different indicators that will contribute to the overall sensitive. For example, within the demographics of coastal communities of Southern part of Mozambique. In your opinion what is more important the Percentage of children in the family members or the Family dependency? To what degree you think your choice is important?

3. Percentage of children in the family members	9 7 5 3 1 3 5 7 9	4. Family dependency
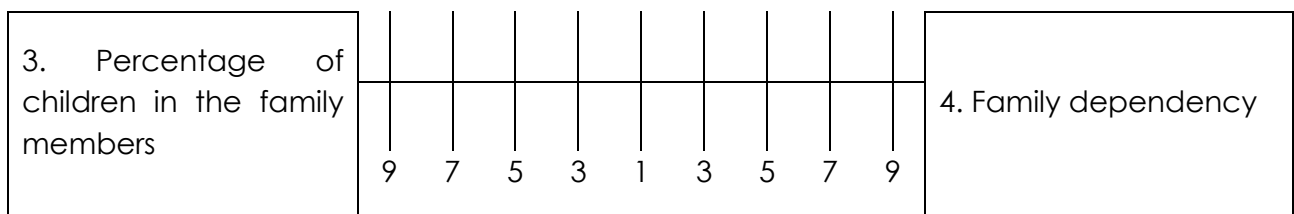
d) Cultural

19 Within the different domains there are different indicators that will contribute to the overall sensitive. For example within the cultural domain of coastal communities of Southern part of Mozambique. In your opinion what is more important the Appreciation of biodiversity or the Identity and pride? To what degree you think your choice is important?

1.Appreciation of biodiversity	9 7 5 3 1 3 5 7 9	2. Identity and pride

20 Within the different domains there are different indicators that will contribute to the overall sensitive. For example within the cultural domain of coastal communities of Southern part of Mozambique. In your opinion what is more important the Appreciation of biodiversity or the Appreciation of lifestyle? To what degree you think your choice is important?

1.Appreciation of biodiversity	9 7 5 3 1 3 5 7 9	3. Appreciation of lifestyle

21 Within the different domains there are different indicators that will contribute to the overall sensitive. For example, within the cultural domain of coastal communities of Southern part of Mozambique. In your opinion what is more important the Identity and pride or the Appreciation of lifestyle? To what degree you think your choice is important?

2. Identity and pride		3. Appreciation of lifestyle

| | 9 | 7 | 5 | 3 | 1 | 3 | 5 | 7 | 9 | |

d) Health

22 Within the different domains there are different indicators that will contribute to the overall sensitive. For example, within the health of coastal communities of Southern part of Mozambique. In your opinion what is more important the Age or the Nutritional dependency? To what degree you think your choice is important?

| 1. Age | 9 | 7 | 5 | 3 | 1 | 3 | 5 | 7 | 9 | 2. Nutritional dependency |

23 Within the different domains there are different indicators that will contribute to the overall sensitive. For example, within the health of coastal communities of Southern part of Mozambique. In your opinion what is more important the Age or the Sense of place? To what degree you think your choice is important?

| 1. Age | 9 | 7 | 5 | 3 | 1 | 3 | 5 | 7 | 9 | 3. Sense of place |

24 Within the different domains there are different indicators that will contribute to the overall sensitive. For example, within the health of coastal communities of Southern part of Mozambique. In your opinion what is more important the Nutritional dependency or the Sense of place? To what degree you think your choice is important?

| | | | | | | | | | | 3. Sense of place |

57

2.Nutritional dependency	9 7 5 3 1 3 5 7 9	
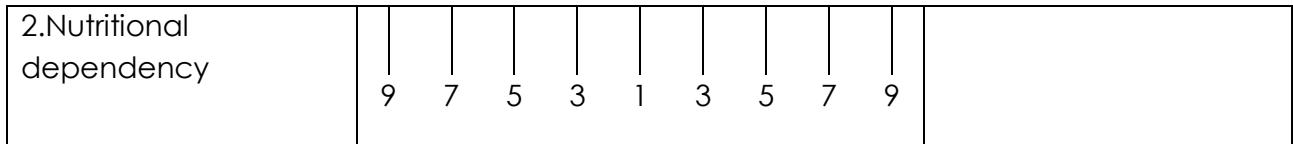
II.   Adaptation Capacity

a) Domains

1 There are different aspects that impact the Adaptive capacity of coastal communities. In your opinion what is more important in determining the Adaptive capacity to climate change for the communities in the southern part of Mozambique, the Learning or Assets? To what degree you think your choice is important.
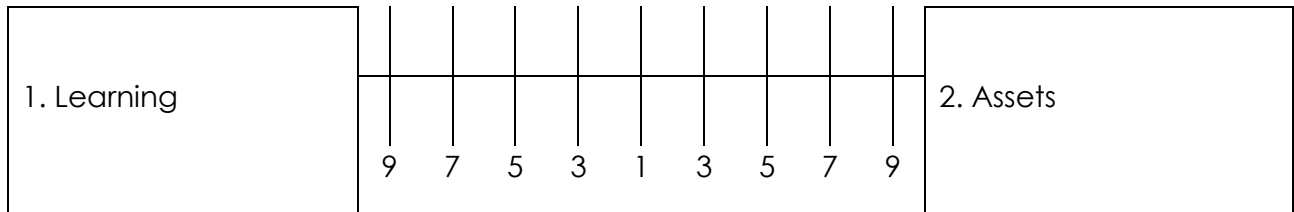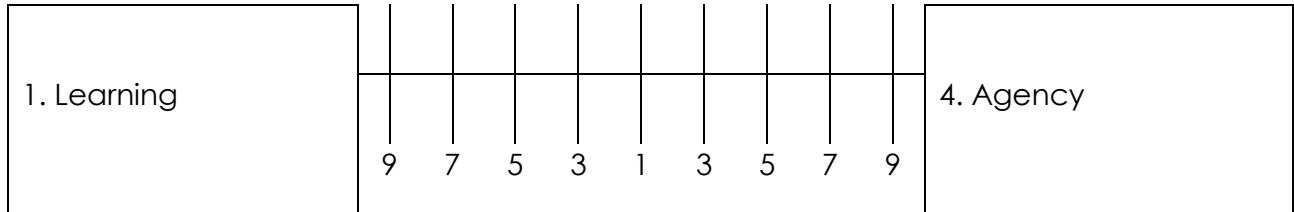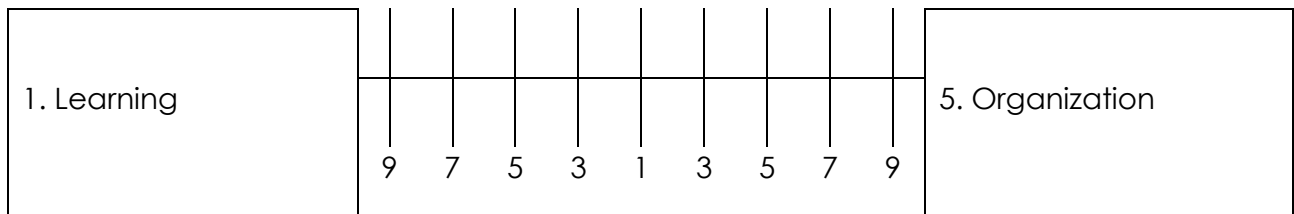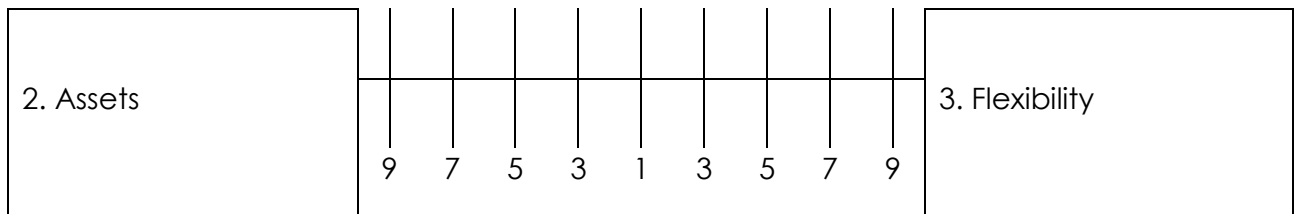
1. Learning	9 7 5 3 1 3 5 7 9	2. Assets

2 There are different aspects that impact the Adaptive capacity of coastal communities. In your opinion what is more important in determining the Adaptive capacity to climate change for the community in the southern part of Mozambique, the Learning or Flexibility? To what degree you think your choice is important.
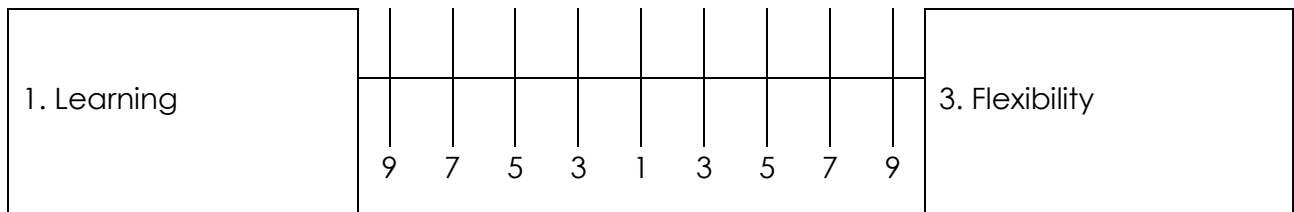
1. Learning	9 7 5 3 1 3 5 7 9	3. Flexibility

3 There are different aspects that impact the Adaptive capacity of coastal communities. In your opinion what is more important in determining the Adaptive capacity to climate

change for the community in the southern part of Mozambique, the Learning or Agency? To what degree you think your choice is important.
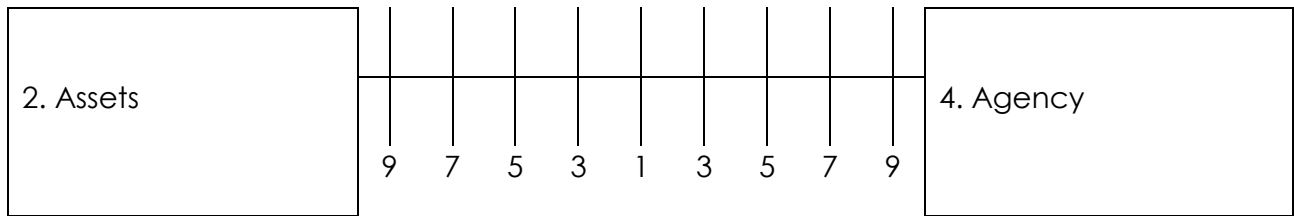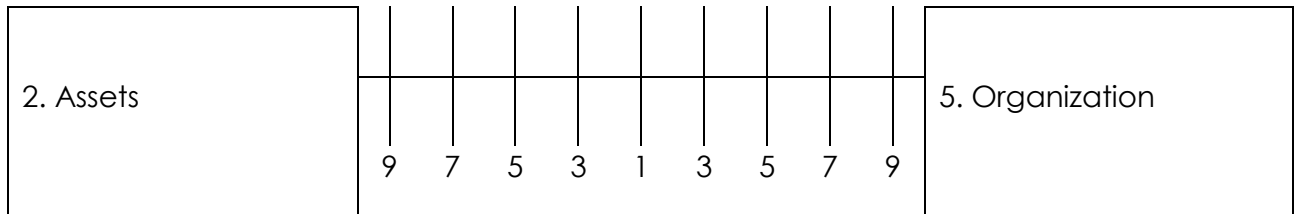
1. Learning										4. Agency
	9	7	5	3	1	3	5	7	9	

4 There are different aspects that impact the Adaptive capacity of coastal communities. In your opinion what is more important in determining the Adaptive capacity to climate change for the community in the southern part of Mozambique, the Learning or Organization? To what degree you think your choice is important.

1. Learning										5. Organization
	9	7	5	3	1	3	5	7	9	

5 There are different aspects that impact the Adaptive capacity of coastal communities. In your opinion what is more important in determining the Adaptive capacity to climate change for the community in the southern part of Mozambique, the Assets or Flexibility? To what degree you think your choice is important.
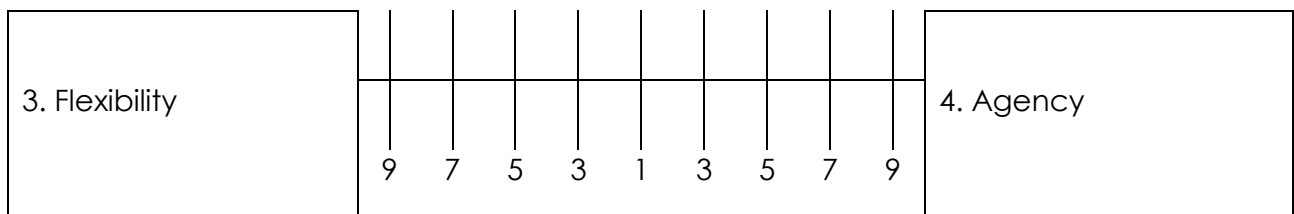
2. Assets										3. Flexibility
	9	7	5	3	1	3	5	7	9	

6 There are different aspects that impact the Adaptive capacity of coastal communities. In your opinion what is more important in determining the Adaptive capacity to climate change for the community in the southern part of Mozambique, the Assets or Agency? To what degree you think your choice is important.
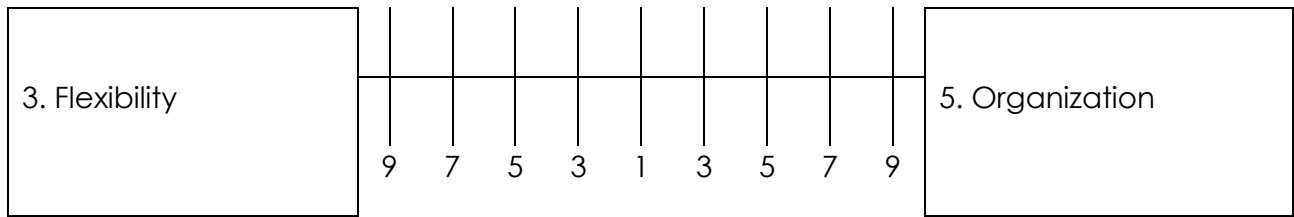
| 2. Assets | 9   7   5   3   1   3   5   7   9 | 4. Agency |

7 There are different aspects that impact the Adaptive capacity of coastal communities. In your opinion what is more important in determining the Adaptive capacity to climate change for the community in the southern part of Mozambique, the Assets or Organization? To what degree you think your choice is important.

| 2. Assets | 9   7   5   3   1   3   5   7   9 | 5. Organization |

8 There are different aspects that impact the Adaptive capacity of coastal communities. In your opinion what is more important in determining the Adaptive capacity to climate change for the community in the southern part of Mozambique, the Flexibility or Agency? To what degree you think your choice is important.

| 3. Flexibility | 9   7   5   3   1   3   5   7   9 | 4. Agency |

9 There are different aspects that impact the Adaptive capacity of coastal communities. In your opinion what is more important in determining the Adaptive capacity to climate change for the community in the southern part of Mozambique, the Flexibility or Organization? To what degree you think your choice is important.

| 3. Flexibility											5. Organization
	9	7	5	3	1	3	5	7	9		

10 There are different aspects that impact the Adaptive capacity of coastal communities. In your opinion what is more important in determining the Adaptive capacity to climate change for the community in the southern part of Mozambique, the Agency or Organization? To what degree you think your choice is important.

4. Agency											5. Organization
	9	7	5	3	1	3	5	7	9		
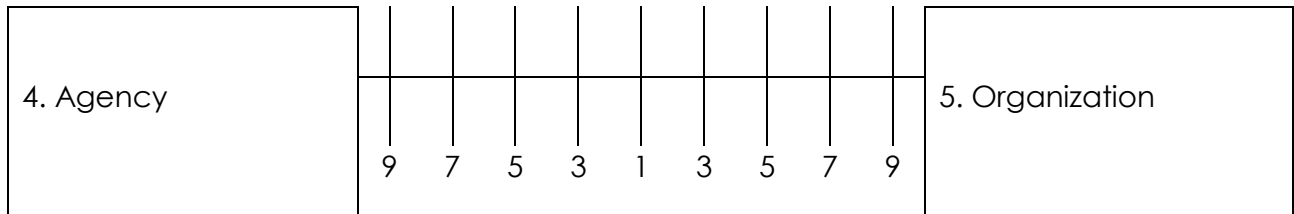
b) Learning

11 Within the different domains there are different indicators that will contribute to the overall Adaptive capacity. For example, within the Learning for the coastal communities of Southern part of Mozambique. In your opinion what is more important the Level of education or the Knowledge of rules? To what degree you think your choice is important?
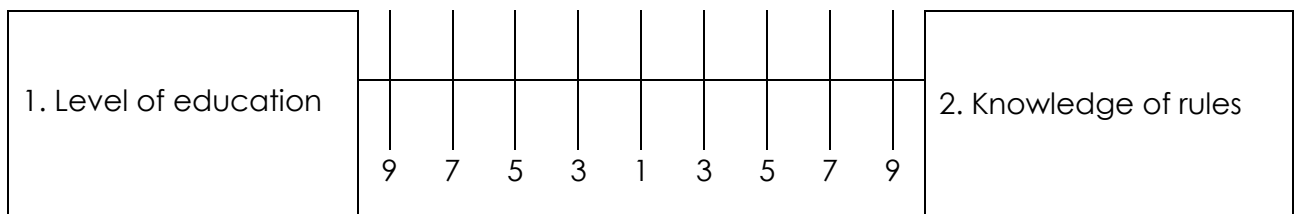
1. Level of education											2. Knowledge of rules
	9	7	5	3	1	3	5	7	9		

12 Within the different domains there are different indicators that will contribute to the overall Adaptive capacity. For example, within the Learning for the coastal communities of Southern part of Mozambique. In your opinion what is more important the Level of education or the Access to information? To what degree you think your choice is important?
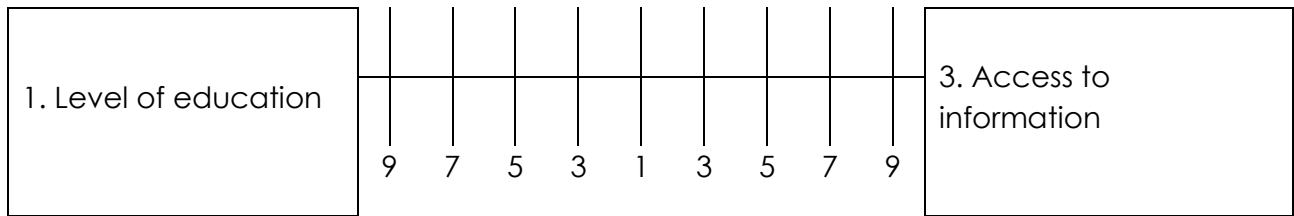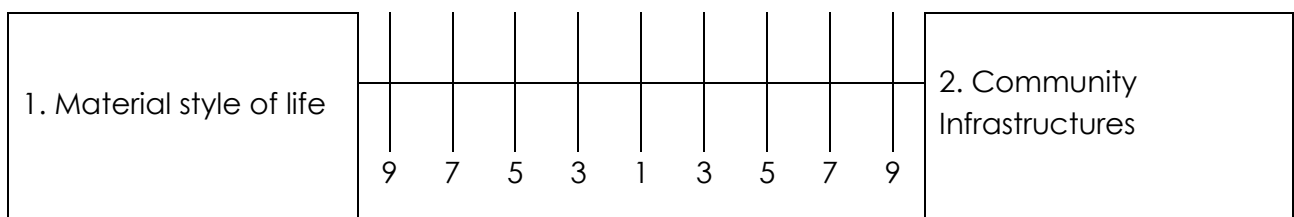
1. Level of education	9　7　5　3　1　3　5　7　9	3. Access to information

13 Within the different domains there are different indicators that will contribute to the overall Adaptive capacity. For example, within the Learning for the coastal communities of Southern part of Mozambique. In your opinion what is more important the Knowledge of rules or the Access to information? To what degree you think your choice is important?
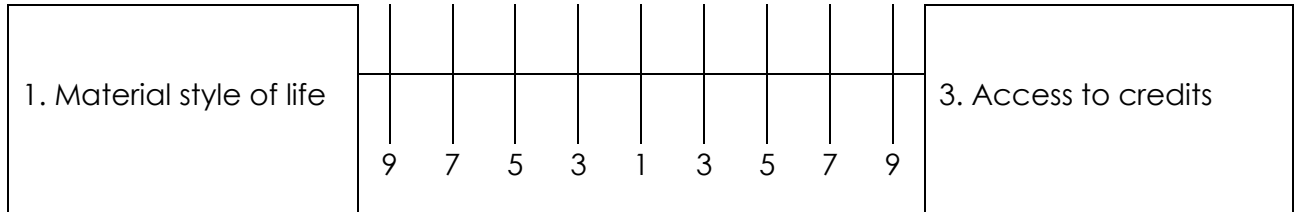
2. Knowledge of rules	9　7　5　3　1　3　5　7　9	3. Access to information
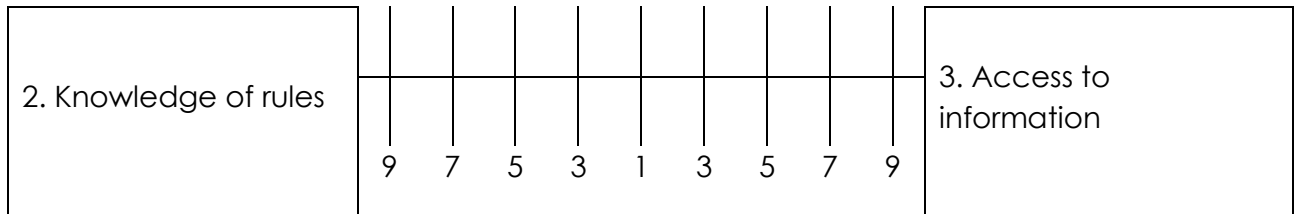
c) Assets

14 Within the different domains there are different indicators that will contribute to the overall Adaptive capacity. For example, within the Assets for the coastal communities of Southern part of Mozambique. In your opinion what is more important the Material style of life or the Community Infrastructures? To what degree you think your choice is important?
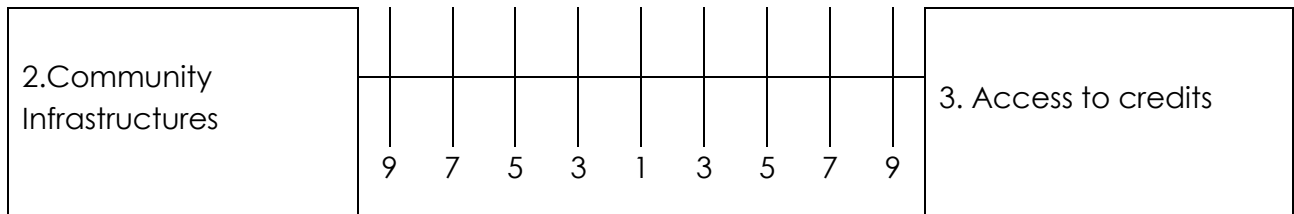
1. Material style of life	9　7　5　3　1　3　5　7　9	2. Community Infrastructures

15 Within the different domains there are different indicators that will contribute to the overall Adaptive capacity. For example, within the Assets for the coastal communities of

Southern part of Mozambique. In your opinion what is more important the Material style of life or the Access to credit? To what degree you think your choice is important?
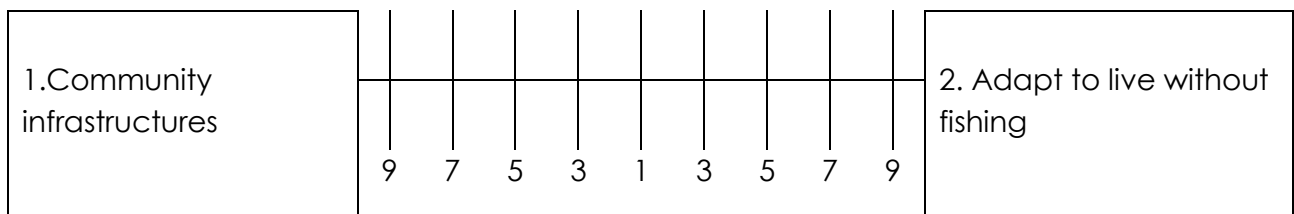
1. Material style of life	9 7 5 3 1 3 5 7 9	3. Access to credits

16 Within the different domains there are different indicators that will contribute to the overall Adaptive capacity. For example, within the Assets for the coastal communities of Southern part of Mozambique. In your opinion what is more important the Community Infrastructures or the Access to credit? To what degree you think your choice is important?
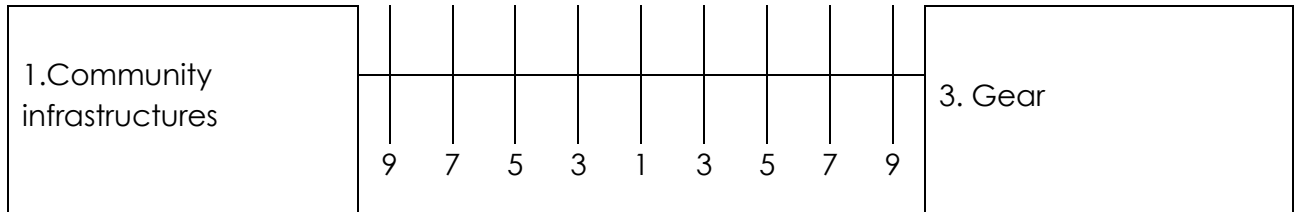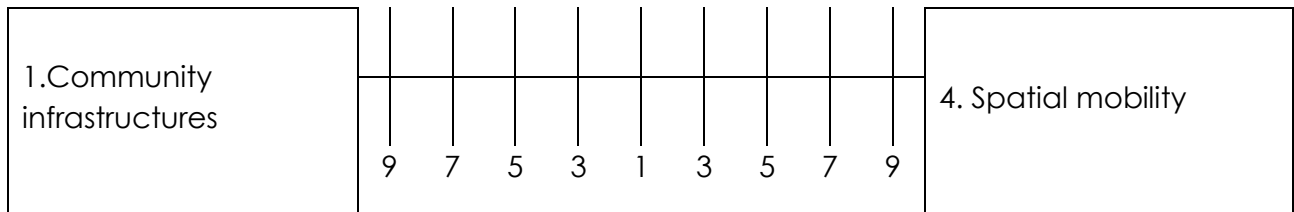
2.Community Infrastructures	9 7 5 3 1 3 5 7 9	3. Access to credits

d) Flexibility

17 Within the different domains there are different indicators that will contribute to the overall Adaptive capacity. For example, within the Flexibility for the coastal communities of Southern part of Mozambique. In your opinion what is more important the Community Infrastructures or Adapt to live without fishing? To what degree you think your choice is important?
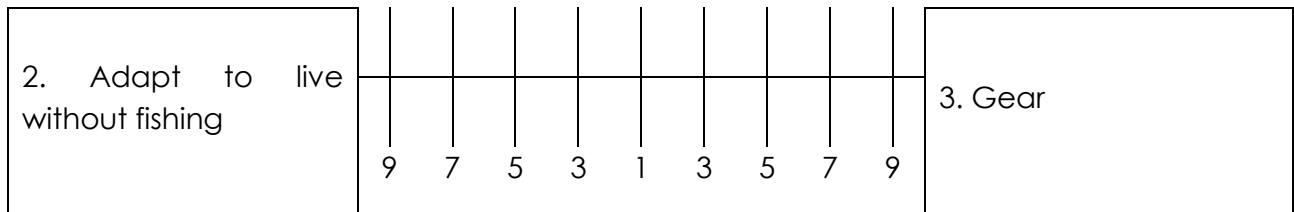
1.Community infrastructures	9 7 5 3 1 3 5 7 9	2. Adapt to live without fishing

18 Within the different domains there are different indicators that will contribute to the overall Adaptive capacity. For example, within the Flexibility for the coastal communities of Southern part of Mozambique. In your opinion what is more important the Community Infrastructures or Gear? To what degree you think your choice is important?

1.Community infrastructures	9 7 5 3 1 3 5 7 9	3. Gear

19 Within the different domains there are different indicators that will contribute to the overall Adaptive capacity. For example, within the Flexibility for the coastal communities of Southern part of Mozambique. In your opinion what is more important the Community Infrastructures or Spatial mobility? To what degree you think your choice is important?
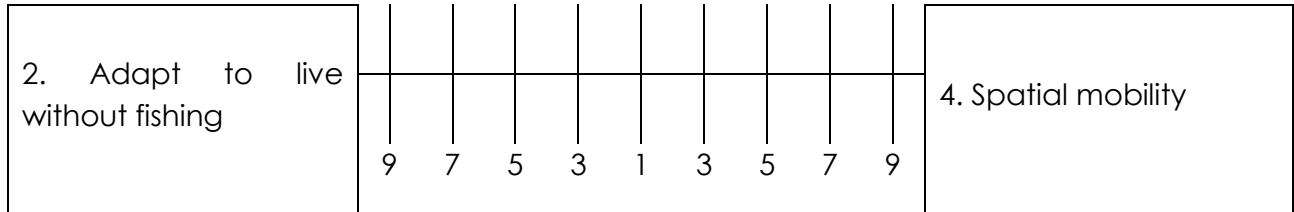
1.Community infrastructures	9 7 5 3 1 3 5 7 9	4. Spatial mobility

20 Within the different domains there are different indicators that will contribute to the overall Adaptive capacity. For example, within Flexibility, for the coastal communities of Southern part of Mozambique. In your opinion what is more important the Adapt to live without fishing or Gear? To what degree you think your choice is important?

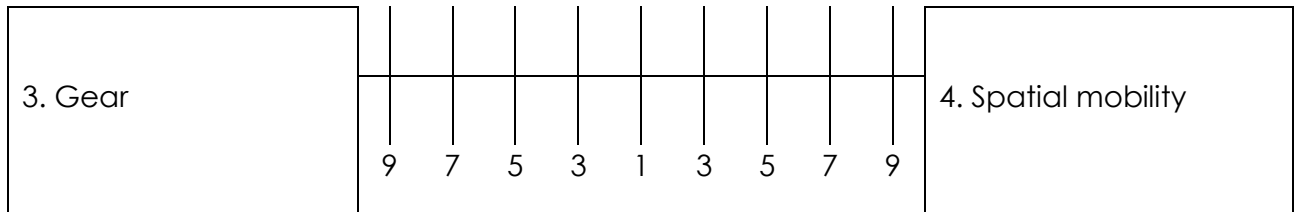| 2. Adapt to live without fishing	9 7 5 3 1 3 5 7 9	3. Gear

21 Within the different domains there are different indicators that will contribute to the overall Adaptive capacity. For example, within the Flexibility for the coastal communities

of Southern part of Mozambique. In your opinion what is more important the Adapt to live without fishing or Spatial mobility? To what degree you think your choice is important?

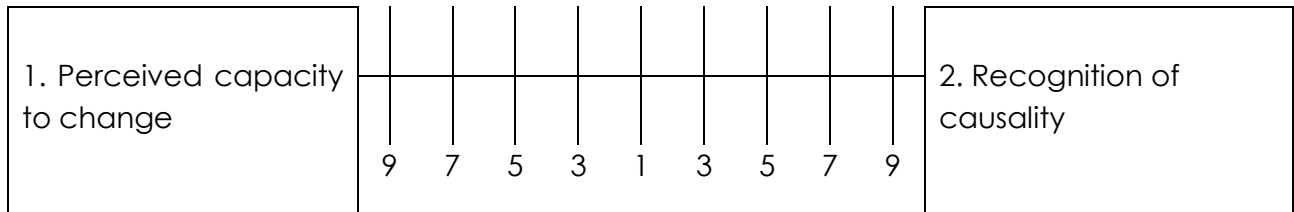| 2. Adapt to live without fishing	9 7 5 3 1 3 5 7 9	4. Spatial mobility

22 Within the different domains there are different indicators that will contribute to the overall Adaptive capacity. For example, within Flexibility for the coastal communities of Southern part of Mozambique. In your opinion what is more important the Gear or Spatial mobility? To what degree you think your choice is important?
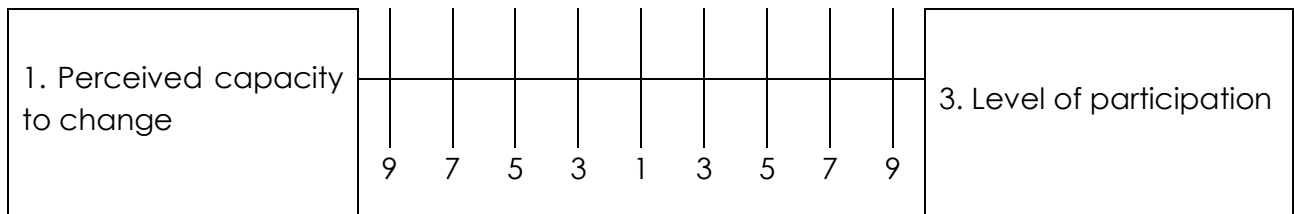
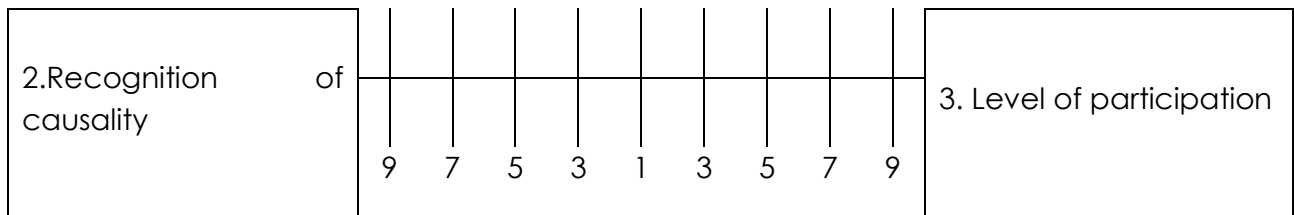| 3. Gear	9 7 5 3 1 3 5 7 9	4. Spatial mobility

c) Agency

23 Within the different domains there are different indicators that will contribute to the overall Adaptive capacity. For example, within the Agency for the coastal communities of Southern part of Mozambique. In your opinion what is more important the Perceived capacity to change or Recognition of causality? To what degree you think your choice is important?

1. Perceived capacity to change	9 7 5 3 1 3 5 7 9	2. Recognition of causality

24 Within the different domains there are different indicators that will contribute to the overall Adaptive capacity. For example, within the Agency for the coastal communities of Southern part of Mozambique. In your opinion what is more important the Perceived capacity to change or Level of participation? To what degree you think your choice is important?

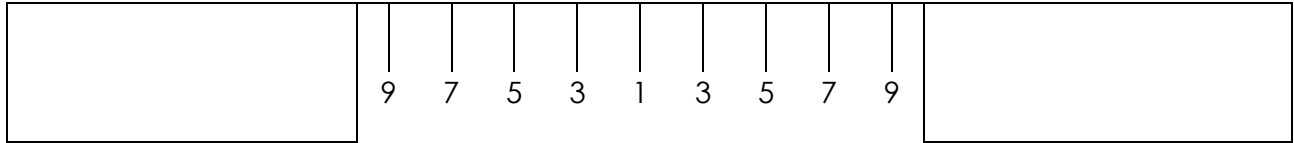| 1. Perceived capacity to change | | 9 7 5 3 1 3 5 7 9 | | 3. Level of participation |

25 Within the different domains there are different indicators that will contribute to the overall Adaptive capacity. For example, within the Agency for the coastal communities of Southern part of Mozambique. In your opinion what is more important the Recognition of causality or Level of participation? To what degree you think your choice is important?

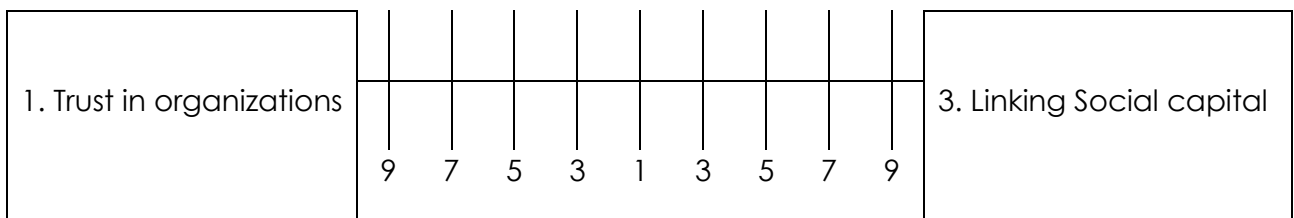| 2.Recognition of causality | | 9 7 5 3 1 3 5 7 9 | | 3. Level of participation |

c) Organization

26 Within the different domains there are different indicators that will contribute to the overall Adaptive capacity. For example, within the Organization for the coastal communities of Southern part of Mozambique. In your opinion what is more important the Trust in organizations or Community cohesion? To what degree you think your choice is important?

| 1. Trust in organizations | | | 2. Community cohesion |

	9 7 5 3 1 3 5 7 9	

27 Within the different domains there are different indicators that will contribute to the overall Adaptive capacity. For example, within the Organization for the coastal communities of Southern part of Mozambique. In your opinion what is more important the Trust in organizations or Linking Social capital? To what degree you think your choice is important?

1. Trust in organizations	9 7 5 3 1 3 5 7 9	3. Linking Social capital

28 Within the different domains there are different indicators that will contribute to the overall Adaptive capacity. For example, within the Organization for the coastal communities of Southern part of Mozambique. In your opinion what is more important the Community cohesion or Linking Social capital? To what degree you think your choice is important?

2.Community cohesion	9 7 5 3 1 3 5 7 9	3. Linking Social capital