



The Role of Livelihood Assets on the Improvement of the Livelihoods of Fisher Households in Zanzibar

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Abstract: Fishery in Zanzibar play a significant role in the economy for income, food security and employment status. Many inhabitants from coastal areas of Zanzibar engaged in fishing activities for income and subsistence need. Majority of the fishers in Zanzibar are poor. They are engaged in fish catch in inshore areas using traditional fishing boats and gears. Fisher's income has been gradually reduced due to declining fish catch which is attributed to poor fishing technology, use of non-motorized small fishing vessels and overfishing. The aim of this study is to investigate how capital assets contribute to the household income and wellbeing of small-scale fishers in Zanzibar. Data used in this study obtained through face to face interview with 226 respondents. The regression results indicated that financial capital, human capital, social capital and natural capital have significantly contributed to the income of fisher households in Zanzibar. The access of assets play a very significant role in the poverty reduction in coastal areas in Zanzibar. The government may prioritised to invest in fish market facilities and improve some services including social network, education, credit facilities for increasing income and reducing poverty to the fishers in the islands of Zanzibar.

Keywords: Small Scale Fishers, Livelihood Assets, Household Income, Zanzibar Island

1. Introduction

Fisheries sector play an imperative role in the economy as they provide a source of income, employment and protein rich food in Zanzibar [1]. Zanzibar as a part of the United Republic of Tanzania, consists of two islands, Unguja and Pemba, with other 50 small islets forming the Zanzibar Archipelago [2]. The mangrove forests of Zanzibar cover about 20,000ha along coastal line, equivalent to 8.6% of total land [3]. The territorial waters which are major fishing area is about 4,450 km² and 12 nautical miles from the shore [4]. However, fishing activities mostly takes place within 5 miles from the shore while fishing craft used by the fishers are small [5]. The islands in Zanzibar are well-known for the rich coral reef ecosystems. The dominant fish species include large and small pelagic, coral reef fish (snapper, parrotfish, grouper and emperors), octopus, and squid and lobsters [6]. The high value seaweed, sea cucumber and seashells are also available in Zanzibar marine fishery. Zanzibar exports seaweed and sea cucumber that are

the source of income for the economy. In terms of value contributes to national economy, seaweed is the third highest source of income after tourism and clove production. Zanzibar also exports marine fisheries product which include prawn, shells, lobster, crabs, squids, octopus, sardines and aquarium fish [7].

Fishers in Zanzibar are poor and use traditional fishing boats and gears such as sailing boats with few planked outboard engine and canoes with outriggers [8]. The small-scale artisanal fishers catch more than 90 percent of the total catch, through foot-fishing and gleaning in the intertidal zone using dugout canoes, and dhow-type planked boats [9]. Many inhabitants in coastal areas have been engaged in fishing activities as their primary occupation for generating income and food [10]. It is clearly documented that small-scale fishers have lack of alternative employment and source of income for their livelihoods due to the low level of education [11]. Fisheries resources have declined in Zanzibar due to overexploitation of marine fisheries over the past decades [12]. The annual catch has been declining by 4% each

year since 2010 [13]. Several studies show that the main factors for declining fisheries and deteriorating conditions of coral reefs are overexploitation of fisheries, destructive fishing gear used, growing population, intensive seaweed farming, indiscriminate mangrove cutting for tourism development, lack of enforcement of fisheries regulation and environmental degradation [14-16]. However, studies are not available to ascertain the factors that contribute to the livelihoods of fishers in Zanzibar. Specifically, this paper attempts to examine the access of livelihood assets on contribute to the income of fisher households in coastal areas of Zanzibar.

2. Literature Review

2.1. Fisheries in Zanzibar

Fisheries sectors contribute economic wellbeing of coastal communities through income and food security [17]. Artisanal fishing villagers use fisheries for their subsistence and livelihoods such as foods, shelter and better health condition [18]. Small scale fisheries employ over 90% of captured fisher. The sector is the principal of livelihood in term of employment, income and food security [19]. Fisheries resources provide up to 70% of animal protein, while the sector employ more than 50% of local population in Indian Ocean regions, Zanzibar in particular [20]. Employment from fisheries sector recognized as a dominant source of income to the fisher households hence the occupation is more accessible [21]. Marine fishery sector accounted as a crucial for improving food securities and animal nutrition to fisher households [22]. Fish and other seafood always contain unique nutrients including fatty acids which are very essential for human health [23]. Recent literatures have increased recognition concerning the role of fisheries for income generation and poverty alleviation [24, 25].

2.2. Livelihood of Zanzibar Fishers

Despite significant economic growth in recent years, most fishers in Zanzibar are poor, living on less than one (USD) per day [26]. Most fisher households rely on coastal marine resources for subsistence and income [27]. The small-scale fishers are mostly illiterate, they are unable to take other occupation. About 17% of fisher households has no education while 32% have completed primary education [28]. Fishers possess poor housing condition with poor construction materials of floors, walls and roofs. About 21% of houses build with an earth floor, metal sheet is common roofing material. The paraffin lamps are the source of lighting and firewood is used for cooking [29]. Only 9% of total fishers owned furniture such as television, refrigerator, stove and iron and 5% own motorbike. The land ownership statistics showed that 58% of fishers have access to of land using for agricultural activities and livestock rearing [30]. However, fishers in Zanzibar have good cooperation in their communities, they help each other, especially during economic crises caused by lean season for fishing [31]. They

fully participate in social and communities' issues such as building of schools, mosques and participate in other social activities and development activities [32]. The government of Zanzibar has implemented several programs to improve livelihood of fishers. Marine conservation areas (MCAs) were established to protect critical habitats in mangrove ecosystems in lagoons, conserve seagrass and coral reefs to enhance sustainable artisanal fisheries and Mari-culture practices [33].

2.3. Poverty and Livelihood Assets

Poverty is a complex and multidimensional concept. Poverty varies according to the dynamic conditions of the individual or community [34]. It is understandable that poverty is not about the lack of income, the social and relational component are important for the poverty analysis [35]. In Zanzibar islands, fishers are generally poor, they have limited access and control of the livelihood assets such as land and other physical assets. Most of Zanzibar fishers inherited their occupation as small-scale fishers [36]. Several literatures have highlighted the importance of livelihood assets, namely physical, financial, human, social and natural assets [37-39]. These livelihood assets have great contribution to income and wellbeing attainment to the fishers [40].

The basic items necessary for fishing include landing sites, fishing gears, storage facilities like ice plants, boats, engines and nets. The main physical assets for the fishers include fishing boats, nets, equipment, and other fisheries infrastructure [41]. Other non-fisheries physical assets are roads, dams, houses, schools, markets, hospitals, electricity and sanitation facilities [43]. Several literatures have acknowledged that the utilization of physical capital for fishing have great contribution to the livelihood of fishers. Artisanal fisher livelihoods benefits can be enhanced through better fish market infrastructure, basic services and storage facilities [44-47]. Empirical studies suggest that there is relationship between physical capital and livelihood outcomes for small scale fishers. Fisher's access to physical assets contribute directly to the income of households [48].

Livelihood of small-scale fishers may enhance through credit facilities and other sources of funds such as grants, savings and wealth [51]. The literatures suggest that poor fishers have lack of access to the financial capital [52, 53]. Fishers have limited access to financial credit from formal sources due to their income level and lack of collateral Fisher households rely on moneylenders for credit. However, poor fishers are exploited by the informal moneylenders who charge high rates of their loans. Most financial institutions are not ready to lend money to the small-scale fishers because of low rate of repayment [54-56].

Human assets have great contribution to the livelihood of fishers [57]. Human capital is a combination of capabilities, skills, knowledge, good health and materials. This asset was measured by education levels, fishing skills and physical ability to work [58, 59]. Low level of knowledge, skills and capacity of fishers associated with poor livelihoods outcomes. High attainment of livelihood depends on high level of knowledge and skill with good health status. Skills and ability

of fishers can improve the chance of employment. However, fishers are less likely to access healthcare due to poor poverty [60]. Fishing knowledge help fishers to cover the negative consequence of natural assets due to climate change. The fishers in Zanzibar fully rely on fishing. Fishers have lack of skills in other occupations. Therefore, they are not able to switch over other occupations for their livelihoods.

Social assets are expected to produce benefits collectively [60]. Social capital build through network connection, trust, cooperation and kinship on the particular fishing communities [61]. Social capital can contribute to the livelihoods of fishing households [62]. Previous literatures show that the success of fisheries depends on the degree of network and the level of collaboration between fishing communities and other entities. Networks outside the village could increase the privilege of fishers by establishing cooperation with outside partners [63, 64]. Relationship with local community and neighbours generate incentives to cooperate for fishing and fishers also able to create responsive and flexible fishing practices that match market and environmental functions [65]. Researcher recognizes the role of social capital and the rationale of relationship among small scale fishers [66]. It helps on managing resources and sharing during economic crises or lower season [67]. Trust among the fishers has been identified as a key component of relationship [68]. Trust improve collaboration and reducing conflict in the network governance of natural resources system [69]. However, [70] argue that trust as a necessary for effective cooperation and participation among the fishers are currently lacking. The main reasons behind this lack of trust include lack of soundness, creditability, responsiveness, flexibility and poor communication.

Natural assets are certain stocks of the elements of nature which have value from individual, communities and societies [71]. Natural assets are both living and non-living ecosystem which include fisheries, biodiversity and land [72]. Natural capital is an asset that can support a range of social and economic outcomes [73]. Fish for food is a tangible output that can be attained from natural capital to meet human needs [74]. The assets have special importance for those who derive their livelihoods from natural resources-based activities including fisheries. [75]. A part from fish for food, fresh air and water quality represent a basis for good health and other aspect of livelihood of fisher households. These stocks of natural capital provide humans with flows of goods and benefits that positively impact the livelihoods [76].

2.4. Fisheries Management

The fundamental problem that impeding the capability of fishers on marine resources include proper management approach [77]. Lack of enforcement of fisheries laws and regulations cause a failure to coordinate fishing and effective resource utilization [78, 79]. The poor implementation of fisheries policies is the main reason for declining benefits of ecosystem services to artisanal fishers [80]. Ecosystem should manage with protection of marine biodiversity, guiding sustainable resources uses, and supporting enforcement of

rules and regulations [81]. The effective conservation depends largely on people compliance with rules and regulations [82]. The integrated management about the uses of coastal services is necessary to sustain artisanal fisheries [83]. These become important not only in economic terms such as source of high qualified seafood and employment, but in social component of coastal communities like good relationship between fishers and fishing authority staff [84]. Marine resources management is a politically and culturally driven process shaped by human livelihoods and perceptions where philosophies of both space and place shape the policies and decision making. There are wide range of approaches that currently applied on managing marine resources. Centralized approach such as marine protected areas and enforcing fish catch limits enhance the ability to use and manage ocean resources sustainably and ensure health, productivity and resilience of ocean ecosystems. Number of literatures suggest that social, economic and institutional aspects are the main determinants of the degree of acceptance from communities and that these have significant impact on success of fishers. Community-based approach integrates concerns about the current state of degradation and ensures ecological services which are managed sustainable way by community driven efforts with aspect of food security, local employment and income to local fishers [85].

2.5. Sustainable Livelihood Approach

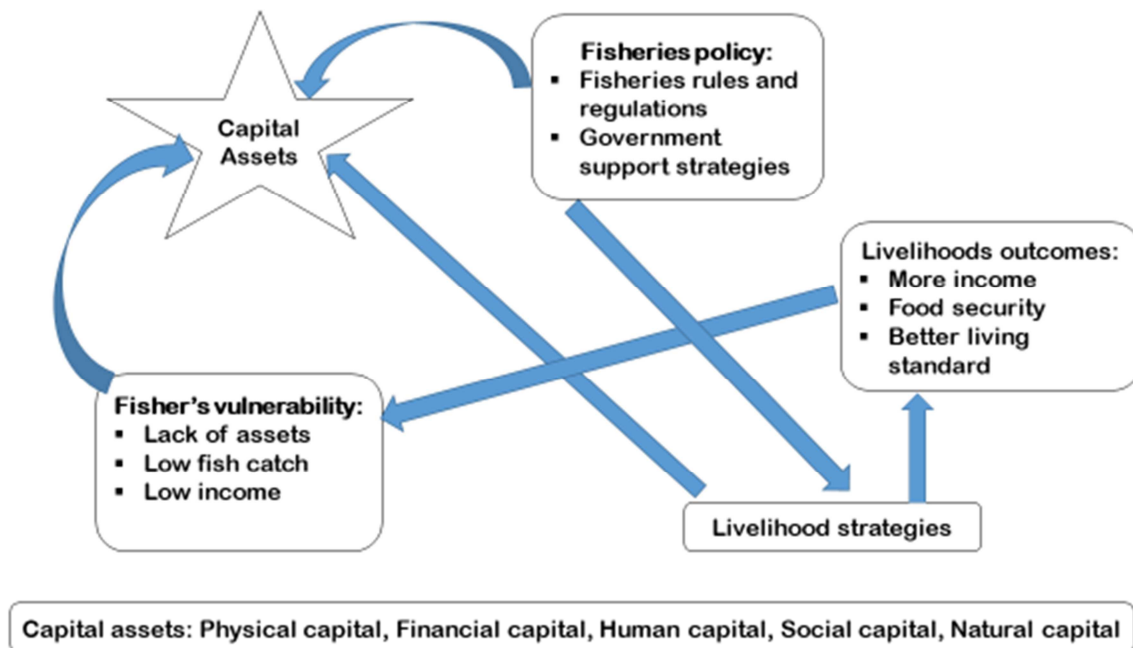
Sustainable livelihood approach is integration factor that allows policies to address development, sustainable resources management and poverty reduction simultaneously. The approach is based on the notion that people require a combined set of assets to achieve positive livelihood outcomes [86]. These assets include physical, financial, human, social and natural asset. This study adopted sustainable livelihood framework, developed by Department for International Development of United Kingdom (DFID, 2000).

The basic components of this approach are livelihood assets and capabilities [87]. Assets include physical, financial, human, social and natural asset. Capability is access of people on deploying livelihood assets. The assets are like inputs which are allocated in different strategies to reduce poverty. Poverty to the fishers can be expressed in term of income and non-income components. Non-income component is made by people's capability and vulnerability [88]. The vulnerability defined as a degree to which the community react adversely during the occurrence of natural disasters. Vulnerability measures the risk associated with physical, natural, socio or economic aspects. Capability focus on ways of attaining livelihood outcomes by poor people [89]. Traditionally, capability focus on human welfare in term of life expectancy and good health [90]. Poverty reduction, more income earnings, food security are most requisites as livelihood outcomes to the small-scale fishers [91].

Assets in this study defined as physical, natural, human, social and financial capital. Physical capital comprises of basic infrastructure and fishing equipment. Transport, communication, electric power, fishing boat and gears are some physical assets that are potential for achieving livelihood

to the small-scale fishers. Natural capital represents the flow of natural resources stocks such as cultivated land, fishing areas, biodiversity and ecosystem services. These natural resources are the basis for fishing activities and are most requisite on derived livelihood outcome by small scale fishers. Human capital includes skills, knowledge, experience and good health. Human capital is important to enhance the ability of fishers to pursue different livelihood outcomes. Social capital includes socio network, trust, relationship, engagement in membership and leadership of small-scale fishers. These

social norms are basis for co-operation to any fishing community. Co-operation is a root of strength on attaining livelihood outcomes by household fishers. Financial capital represents financial resources available include savings, credits, remittance, pensions and inherited wealth [92]. Financial resources provide fishers with different livelihood options by equipped the purchasing power. Access to various capital assets is important in determining the livelihood of fishers. However, a single category of assets cannot support livelihood outcome that fishers pursue.



Source; DFID, 2000

Figure 1. Sustainable livelihood framework developed by DFID (2000).

3. Material and Methods

3.1. Measurement of Livelihood Assets

The measurement of livelihood assets followed the recommendation made by Pearson, 1901, using principal component analysis to aggregate several items into a single dimension. Principal component analysis is relatively easy to compute and provides more accurate weight than simple summation. The intuition underlying these methods, there is a latent variable from each type of livelihood asset that manifest itself through ownership of the different assets. The study used principal component analysis for two reasons; first, technically equivalent to rotation of the dimensions, such that the variance from the observation is minimized. Second, the coefficient on any variable is related to how much information it provides about other variables. Higher or lower coefficient means that ownership of asset conveys more or less information about other assets. PCA also can be used to reduce large number of related variables to a more manageable number prior to using them in other analysis. The central idea of PCA is to reduce the dimensionality of data set consisting

large numbers of interrelated variables, while retaining as much as possible the variation presented in the data set [93]. Principal Components Analysis select the factor with eigenvalues greater than one.

Indices can be constructed using this formula, $1 = \sum_{i=1}^n W_i X_i$: where by 1- stand as a sum of weighted index, W- stand as percentage of contribution of each selected variable and X- stand as the value given by the respondents for each variable. Livelihood assets in this study include the physical, financial, human, social and natural assets which are measured by a set of variables as defined in Table 1. Physical capital is generally defined as comprising the stock of equipment, infrastructure and productive resources. In this study physical capital include fishing equipment such as fishing gears, boats and engine. Other assets are consumer durables like housing, furniture, television, computer and refrigerator. Physical capital index measured by three dimensions and each dimension was measured by five indicators. Financial capital index comprises the monetary resources available to households. For this study, financial capital includes household savings, loans, remittances and pension fund. Financial capital index constructed by three dimensions and each dimension was measured by five indicators. Human capital index refers to education and good

health which affect people's ability to use their labour. In this study human capital was measured by three dimensions and each dimension measured by five indicators. Social capital index is the intangible asset. The study identified social relations, trust and network among household fishers, membership and leadership of fishers in the society as the main variable used for the study. The index comprises three dimensions and each dimension measured by five indicators. Natural capital index are natural resources that have direct

impact to the livelihood of people. For fisher households, natural capital includes land, fishing ground, livestock and water resources. The natural capital index was constructed using three dimensions and each dimension was measured by five indicators. Household income was derived through various livelihood assets. For this study household income was used as dependent variable. The study used three dimensions for measuring household income, each dimension was measured by five indicators.

Table 1. Definition of variables for various livelihood asset index.

Variable	Description
Dependent variable:	
household income	The variable assessed by income of fishers from fishing activities. Other source of income from non-fishing activities such as small business, handworks or carpentry. Last source of income to Zanzibar's fishers is selling of used assets.
Independent variable:	
Physical capital index	Ownership of fishing assets include fishing gears, storage facilities, fishing boats and boat engines with non-fishing assets include house, furniture and motorbike.
Financial capital index	Source of fund available to the fishers from different sources including cash, savings, loans, pension and other grants.
Human capital index	Physical ability of fishers associated with skills, knowledge, experience and good health of fishers and their households.
Social capital index	Good cooperation associated with trust, network, relationship and engagement of fisher is association as a member or leader.
Natural capital index	The access of natural environment including cultivated land, fishing areas, ecosystem services and biological diversity.

3.2. Regression Model

Multiple regression analysis was carried out to examine the relationships between livelihood assets and household income of small-scale fishers in Zanzibar. As shown in the equation, the outcome variable is household income determined by explanatory variables that are various household assets including physical, financial, human, social and natural capital.

$$Y_d = \alpha + \beta_1 PC + \beta_2 FC + \beta_3 HC + \beta_4 SC + \beta_5 NC + \mu_i$$

where Y_d is the household income, PC =physical capital, FC =financial capital, HC =human capital, SC =social capital, NC =natural capital and μ_i =unobserved variables. α , β_1 , β_2 , β_3 , β_4 and β_5 are parameters to be estimated.

3.3. Study Area and Data Source

This study conducted at coastal areas of Zanzibar Island.



Figure 2. Location of Zanzibar Island.

Before the survey, the researcher obtained the research permit from Office of Second Vice President of Zanzibar who has the statutory power to supervise and regulate all research activities undertaken in Zanzibar to ensure the ethical requirements for the survey. Data used in this study were obtained from survey carried out from eight landing sites from November 2020 to January 2021. Three marine conservation areas have been selected for this study, which are Mnemba Island, Chwaka Bay and Pemba Channel. A total 226 respondents were selected from several villages and interviewed face to face. The questionnaire used in this study covered various aspects of household economy including demographic information, fisher's income and involvement of income generating activities. Other information gathered concerning the indicators of various livelihood assets. The experienced local enumerators were appointed from the government statistics office in Zanzibar to carry out the survey. The respondents were informed about the schedule of the survey by fisheries officer from District Commissioner's Office prior the actual interview. Statistical packages for social sciences (SPSS version 25) were used for required data screening exercise, factor analysis and multiple linear regression analysis. In this study, responses were measured through using a five-point Likert scale from strongly disagree to strongly agree for all constructs of the study. Pilot studies were conducted to update the questionnaire. The result of the pilot survey found that the data was reliable and it was within the acceptable range of Cronbach alpha of 0.7 or above as proposed by several authors [94, 95].

4. Results and Discussion

4.1. Results of Factor Analysis

Factor analysis was conducted to construct a measurement index and factors were extracted from the correlation matrix through principal component analysis (PCA). Factor loading represents that the factor extracts sufficient variance from that variable. Only variables that have factor loadings of 0.5 and above are included in each selected factor. Bartlett's test of sphericity was used to ensure that the data have sufficient correlation to perform factor analysis and to assess which items need to be dropped. Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) is used to measure sampling adequacy to test whether the data obtained are suitable for this kind of analysis.

4.1.1. Household Income Index

Household income is an outcome variable which has three dimensions; income from fishing activities, income from selling of disposal assets and income from non-fishing activities. The results of factor loading value of these dimensions exceeded the recommended value of threshold of 0.5. KMO value of dimensions were 0.855, 0.833 and 0.818 respectively which indicates that the present data are suitable for principal component analysis. Similarly, Bartlett's test of sphericity was found significant ($p < 0.05$), indicating a sufficient correlation between dimension in order to continue with further analysis which are regression analysis.

Table 2. Household income index.

No.	Statement	Factor loading
1	Income of fisher's households generated from fishing activities	0.855
2	Income of fisher's households generated from selling disposable assets	0.833
3	Income of fishers generated from non-fishing activities operated	0.818

4.1.2. Physical Capital Index

Table 3 indicate that all of the factor loading value for three dimensions exceeded the recommended value of threshold of 0.5. This means that, no item should be dropped. KMO indicating that the present data are suitable for principal

component analysis. Similarly, Bartlett's test of sphericity was found significant ($p < 0.05$), indicating a sufficient correlation between the dimension in order to continue with regression analysis.

Table 3. Physical capital index.

No	Statement	Factor loading
1	The fishers own fishing boat and gears for fish catch	0.528
2	The fishers own living house with some properties	0.509
3	Fishers have an access of using storage facilities	0.597

4.1.3. Financial Capital Index

Financial capital as a variable constructed by three dimensions, credits, savings and cash. The results from factor loading value of particular dimension exceeded the recommended value of threshold of 0.5 as shown on the table 4. This result suggests the relevance of dimensions that no one

may be dropped from analysis. KMO value of particular dimensions were 0.708, 0.590 and 0.500 respectively. This result for KMO indicating that the present data are suitable for principal component analysis. Similarly, Bartlett's test of sphericity was found significant ($p < 0.05$), indicating a sufficient correlation between the dimension in order to continue with the analysis.

Table 4. Financial capital index.

No	Statement	Factor loading
1	Access of credits and loans to the household fishers	0.708
2	The ownership of saving account by fishers	0.590
3	The ownership of cash for daily consumption available for daily consumption for household	0.500

4.1.4. Human Capital Index

Human capital is a variable which have three dimensions; fishing knowledge, experience in fish catch and fisher's health condition. The results of factor loading value showed that all three dimensions exceeded the recommended value of threshold of 0.5. The results of KMO value were 0.656, 0.500

and 0.574 respectively. This result indicating that the present data are suitable for principal component analysis. Bartlett's test of sphericity was found significant ($p < 0.05$), indicating a sufficient correlation between dimension which allow to continue with further analysis.

Table 5. Human capital index.

No	Statement	Factor loading
1	Fishing knowledge help fishers for significant fish catch	0.656
2	Fishing experiences have greater contribution on fish catch	0.500
3	Fishing activities need good health condition to the fishers	0.574

4.1.5. Social Capital Index

Social capital is a variable which have three dimensions: network, trust and relationship. The results of factor loading value for all dimensions exceeded the recommended value of threshold of 0.5. The results of KMO were 0.777, 0.623 and

0.607 respectively. This result indicate that the present data are suitable for principal component analysis. Bartlett's test of sphericity was found significant ($p < 0.05$), indicating a sufficient correlation between the dimension in order to continue with the analysis.

Table 6. Social capital index.

No	Statement	Factor loading
1	Fishing activities need enough network with other stakeholders	0.777
2	Trust to the fishers are component that bring good relationship in fishing community.	0.623
3	Most fishers have good reputation and encourage in the leadership	0.607

4.1.6. Natural Capital Index

Natural capital is a variable which have three dimensions: land, ecosystem and livestock. The results of the factor loading value of all dimensions exceeded the recommended value of threshold of 0.5. KMO value were 0.766, 0.644 and

0.832 respectively. This result indicates that the present data are suitable for principal component analysis. Bartlett's test of sphericity was found significant ($p < 0.05$), indicating a sufficient correlation between the dimension in order to continue with the analysis.

Table 7. Natural capital index.

No	Statement	Factor loading
1	Ownership of land is important aspect to livelihood of fishers	0.766
2	Ecosystem is important for fisher household for significant fish catch	0.644
3	Ownership of livestock help fishers economically during economic crises.	0.832

4.2. Results of Regression Analysis

In the regression analysis, the households' annual income was hypothesised to be a function of household livelihood assets directly and indirectly. The F-statistics are significant at

the 1% level, indicating that all the models provide overall goodness of fit. Similarly, the R^2 values for the estimated equations is 53% (Table 8).

Table 8. Relationships between households' income and fisher's livelihood assets.

Variable	B	Std. Error	t-value	p-value
(Constant)	-7.105	8.164	-0.870	0.385
Physical Capital	0.065	0.108	0.602	0.548
Financial Capital	0.189	0.064	2.949	0.004**

Variable	B	Std. Error	t-value	p-value
Human Capital	0.257	0.092	2.778	0.006**
Social Capital	0.180	0.067	2.705	0.007**
Natural Capital	0.191	0.073	2.620	0.009**
R-square	0.536			
Adj-R Square	0.526			
F-ratio	50.860			
F-probability	0.000			

Dependent variable: Annual household income; significance levels are denoted by two asterisks (**) at the 5% level.

The results show that the coefficients of financial capital, Human capital, Social capital and Natural capital are positive and statistically significant for household income of fishers. The significant direct relationship between income and livelihood assets indicates that increasing access to livelihood assets contributed to income of coastal fishers in Zanzibar. This regression results indicate that the small-scale fishers have significantly improved access to financial assets (borrowing credit from different sources, savings). The access to financial assets contributed to their household income. The results indicate that fisher households have significantly improved access to human capital (training, awareness, health). The access to human capital contributed significantly to the income of fisher households. The results indicate that households have significantly improved access to natural capital (fishing ground, ecosystem services). The access to natural capital has contributed to fisher household's income. The results also indicate that fishers have improved access to the social capital (network, trust, relationship, cooperation) significantly. The access to social capital has significant impact on household income for the fishers in Zanzibar (Table 8). The coefficient for physical capital is positive but statistically insignificant. The results indicated that the levels of physical capital (fishing gears, fishing boats, fish market facilities) possess by the poor fishers are still low to have any significant impact on their household incomes.

5. Discussion

The results of the financial capital suggest that access to various financial assets positively significant relationship with contributes to household income for the fishers. Therefore, the proposed hypothesis of positive relationship between fisher's income and access of financial capital was accepted. This result is similar to the findings of the previous study who found that livelihood of fishermen was improved through access of credits by the fishers. Credit system in the fishing sector support and encourage fishing activities. However, the results are not supported with other studies [96, 97], the findings of the study show that credit failed to enable poor fishers to move out of poverty. Rather than achieving long-term livelihood improvements, access to credits only means short term consumption smoothing with a risk of being trapped into a cycle of indebtedness. The results of the study indicated that human capital access has contributed significantly to the income of fisher's households. Therefore, the proposed hypothesis of positive relationship between fisher's income and access of human capital was accepted.

The results are consistent with other studies [98, 99] who found that lack of formal education does not mean the lack of fishing knowledge rather than fishing experience. The majority of fishers have been involved in fishing activities over many years and therefore possess extensive ecological knowledge. However, the results are not supported by other study and opposed by the results of [100] who found that small scale fishers earned less income from fishing and are not in position to shift into alternative jobs due to the lack of education. The results of this study revealed that there is positive and significant relationship between social capital and household income of fishers. Therefore, the proposed hypothesis of positive relationship between fisher's income and access of social capital was accepted. These results are supported by the results of [101, 102] who observed that fishing communities have a tendency of helping each other during economic crises. The result is not similar with the results of other study [103] who found that most of time fishers are embroiled in a dispute over the fishing grounds as well as the fish market. The study revealed the positive and significant relationship between natural capital and income of fisher households. The proposed hypothesis of positive relationship between fisher's income and access of natural capital was accepted. The results are similar with other studies [104] who found that fishing ground are abundant with stock of fish, modern fishing facilities is required for significant fish catch. However, this result was contrary with the results of who found that fishing ground are degraded by human behaviour causes the declining of fish catch. This study also analysed the mediating effect of fishing rules and regulations on the income of fisher households in Zanzibar. The results revealed that it has partial mediation for physical capital, human capital, social capital and natural capital. However, the financial capital was full mediated by rules and regulations in relations with financial capital and income of fishers.

According to the Zanzibar development Vision 2050, blue economy taken as a priority area for the next 30 years, serving as an effective and sustainable means of improving livelihoods and economy. The study recommends to the government on blue economy policy development considering the contribution of fisheries sector. Small scale fishers of Zanzibar should be protected against immigrant fishers by allocating fishing zones between them and medium scale fishers. Fish market need improvement on building with facilities such as clean water, storage facilities and fish processing services. The government should empower the fishers by supporting them financially and technically. Local investors may focus in fisheries because it is an investment

that still idle while the returns is almost promise. Fish processing industry is needed to add value in term of income to the fishers and economy of Zanzibar.

6. Conclusion

The study analyses the socio-economic matters of the fisher household in Zanzibar Island. Data were collected from sample of fisher households on various aspects such as household sources of income and household assets ownership. Primary data were collected using structured questionnaires and secondary data regarding socioeconomic status were collected from published reports provided by government entities. The important livelihood assets that contribute to household benefits are identified and analysed. The linkages between household assets and the predictors of household income are explained by multiple regression analysis. The study discovered that fishers are the poorest class in Zanzibar. Their livelihood depends primarily on fishing and selling labour at low wages. The results of the study suggest that the access of fishing equipment such as fishing gears and vessels by the fishers is much important. If fishers have fully ownership of fishing properties may ensure the entire income from fish sold rather than existing condition of sharing the income between fisher and owner of fishing equipment. The access of financial assets such as loan, subsidies or grants are crucial for modern fishing. Training concerning new technology in fisheries and the best ways of protecting coral reefs and mangroves is very important and can add value to the fishers in terms of skill and knowledge about fishing. Social relations between the fishing community and other communities in the society is very significant for the livelihood of fisher households. This study recommends to the fishers about effective involving in alternative economic activities such as agriculture, livestock, and small businesses activities. The government should consider the need of reviewing the fisheries laws and regulations in order to work with current economic situation.

Conflicts of Interest

The authors declare no conflict of interest.

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References

- [1] Ochiewo, J. (2016). Social and Economic Impacts of Capture Fisheries and Mariculture. 297–308.

- [2] Said, H., & Tanova, C. (2021). Management Workplace bullying in the hospitality industry: A hindrance to the employee mindfulness state and a source of emotional exhaustion. *International Journal of Hospitality Management*, 96 (May), 102961.
- [3] Colbert-sangree, N. (2012). The State of Artisanal Fisheries in Southern Unguja: Governance, Conservation and Community.
- [4] Myers, G., Walz, J., & Jumbe, A. (2020). Trends in urban planning, climate adaptation and resilience in Zanzibar, Tanzania. 2020 (77), 57–70.
- [5] Horsley, J., Prout, S., Tonts, M., & Ali, S. H. (2015). The Extractive Industries and Society Sustainable livelihoods and indicators for regional development in mining economies. *Biochemical Pharmacology*, 2 (2), 368–380.
- [6] Sekadende, B., Scott, L., Anderson, J., Aswani, S., Francis, J., Jacobs, Z., Popova, E. (2020). The small pelagic fishery of the Pemba Channel, Tanzania: What we know and what we need to know for management under climate change. 197 (August).
- [7] Kiszka, J. J., Berggren, P., Braulik, G., Collins, T., & Minton, G. (2017). Cetacean bycatch in the western Indian Ocean: A review of available information on coastal gillnet, tuna purse seine and pelagic longline fisheries.
- [8] Morales, E. M. Q., & Horton, M. (2014). Fishing and Fish Consumption in the Swahili Communities of East Africa, 700 - 1400 CE.
- [9] AFDP. (2020). Agriculture and Fisheries Development Programme (AFDP) United Republic of Tanzania. Project Design Report Main report and annexes. (31).
- [10] Department of Fisheries Development, Ministry of Agriculture, Livestock, Natural Resources and Fisheries (2017). Zanzibar Fisheries Frame Survey.
- [11] FAO. (2010). Best practices to support and improve the livelihoods of small-scale fisheries and aquaculture households.
- [12] Roccliffe, S., & Harris, A. (2016). Blue Ventures Report: The status of octopus fisheries in the Western Indian Ocean. 44.
- [13] Hampus Eriksson, B., De la Torre-Castro, M., Eklöf, J., & Jiddawi, N. (2010). Resource degradation of the sea cucumber fishery in Zanzibar, Tanzania: A need for management reform. *Aquatic Living Resources*, 23 (4), 387-398. DOI: 10.1051/2011002.
- [14] Sailale, I., & Chande, M. (2016). The use of earth observation satellite for identification of potential fishing zones in Tanzania: *Submitted to deep sea fishing authority*. (July).
- [15] Benansio, J. S., Development, R., & Jiddawi, N. S. (2016). Investigating changes in fish biodiversity in coastal villages of Zanzibar Island, Tanzania. (November, 2016).
- [16] Benansio, J. S., Wolff, M., Breckwoldt, A., & Jiddawi, N. (2016). Have the fishing communities of Zanzibar Island benefited from increasing tourism development? 8 (5), 95–107.
- [17] Mutayoba, V., Mwalimu, T., & Memorial, N. (2018). Is Booming Tourism in Zanzibar Pro- poor? A Micro-economic Impact Analysis. (August 2018).
- [18] Nilsson, J. A., Fulton, E. A., Johnson, C. R., & Haward, M. (2019). How to sustain fisheries: Expert knowledge from 34 nations. *Water (Switzerland)*, 11 (2).

- [19] Morales, R. (2018). The importance of small-scale fisheries: Global, regional and national initiatives; the event will be webcast: FAO News Flickr Collection: (July).
- [20] Rehren, J., Samoilys, M., Reuter, H., & Jiddawi, N. (2020). Reviews in Fisheries Science & Aquaculture Integrating Resource Perception, Ecological Surveys, and Fisheries Statistics: 1–18.
- [21] Manlosa, A. O. (2021). Aquaculture-capture fisheries nexus under COVID-19: Impacts, diversity, and social-ecological resilience. 75–85.
- [22] Roy, A. (2019). Blue Economy in the Indian Ocean: Governance Perspectives for Sustainable Development in the Region. Observer Research Foundation.
- [23] Khamis, Z. A., & Kalliola, R. (2017). Ocean & Coastal Management Geographical characterization of the Zanzibar coastal zone and its management perspectives. 149, 116–134.
- [24] Office of the Chief Government Statistician, Ministry of Finance and Planning, Zanzibar (2020), Household Budget Survey 2019-2020.
- [25] Salim, S. S., Narayanakumar, R., Sathiadas, R., Manjusha, U., & Antony, B. (2017). Appraisal of the socio-economic status of fishers among the different sectors in Kerala, south-west coast of India. *Indian Journal of Fisheries*, 64 (1), 66–71.
- [26] Onyango, P. O. (2011). Poverty Alleviation in Small-Scale Fisheries. Governance Challenges in Lake Victoria Fishing Communities, Tanzania.
- [27] Khalili Tilami, S., & Sampels, S. (2018). Nutritional Value of Fish: Lipids, Proteins, Vitamins, and Minerals. *Reviews in Fisheries Science and Aquaculture*, 26 (2), 243–253.
- [28] Eggertsen, M., Eriksson, H., Slater, M. J., Raymond, C., & Torre-castro, M. De. (2020). Economic value of small-scale sea cucumber fisheries under two contrasting. 25 (2).
- [29] Helena. (2015). Fish Consumption: Choices in the Intersection of Public Concern, Fish Welfare, Food Security, Human Health and Climate Change. *Journal of Agricultural and Environmental Ethics* volume 28, pages 533–551 (2015).
- [30] The World Bank Group (2017). Zanzibar Poverty Assessment, The World Bank, 1818 H Street NW, Washington, DC 20433, USA, fax 202-522-2422, e-mail pubrights@worldbank.org.
- [31] Herklots, T., Yussuf, S. S., Mbarouk, K. S., Meara, M. O., Carson, E., Plug, S. B., Jacod, B. (2020). “I lost my happiness, I felt half dead and half alive” - A qualitative study of the long-term aftermath of obstetric near-miss in the urban district of Zanzibar, Tanzania. 8, 1–10.
- [32] Tranche, R. F. (2016.). Social Capital and Community Based Organizations’ Functionality in Innovation Processes: Perspectives from three Case Studies in Tanzania. (January 2016).
- [33] Staehr, P. A., Sheikh, M., Ussi, A., Suleiman, M., Kloiber, U., Dahl, K., Muhando, C. (2018). Managing human pressures to restore ecosystem health of Zanzibar coastal waters. 7 (2), 59–70.
- [34] Myers, G. A. (2010). Social construction of Peri-urban places and alternative planning. 3 (0549319), 575–595.
- [35] The Revolutionary government of Zanzibar (2015). Zanzibar Fisheries Policy, 2015.
- [36] Jayaweera, I. (2010). Livelihood and diversification in Rural Coastal Communities: Dependence on Ecosystems Services and possibilities for Dependence on Ecosystems Services and possibilities for Sustainable Enterprising in Zanzibar, Tanzania.
- [37] Kim, B. T., Brown, C. L., & Kim, D. H. (2019). Assessment on the vulnerability of Korean aquaculture to climate change. *Marine Policy*, 99 (April 2018), 111–122.
- [38] Eriksson, H., Sulu, R., Blythe, J. L., Ploeg, J. Van Der, & Andrew, N. (2020). Intangible links between household livelihoods and food security in Solomon Islands: implications for rural development. 25 (4).
- [39] Hossain, M. A., Sathi, S. S., Hossain, S., Akter, M. F., & Ullah, M. O. (2020). Assessing the livelihood status of fishermen at Sunamganj district in Bangladesh. 9 (1), 16–20.
- [40] Islam, M. M. (2013). Vulnerability and Adaptation of Fishing Communities to the Impacts of Climate Variability and Change: Insights from Coastal Bangladesh: *Submitted in accordance with the requirements for the degree of Doctor of Philosophy the University of Leeds, School of Earth and Environment*.
- [41] Yazdanpanah, M., Moghadam, M. T., Savari, M., Zobeidi, T., Sieber, S., & Löhr, K. (2021). The Impact of Livelihood Assets on the Food Security of Farmers in Southern Iran during the COVID-19 Pandemic.
- [42] Mahler, D. G. (2020). Lives and Livelihoods Estimates of the Global Mortality and Poverty Effects of the COVID-19 Pandemic. (June).
- [43] Abraham, E. (2020). Deconstructing Sustainable Livelihood Framework for Equitable Living in Crisis of Global Pandemic. Munich Personal RePEc Archive (101977). <https://mpra.ub.uni-muenchen.de/101977/> MPRA Paper No. 101977, posted 22 Jul 2020 07: 11 UTC.
- [44] Mahandrakumar, K., & Pauline, A. A. (2020). Extent of Livelihood Assets Influence on Livelihood Changes. 9 (9), 3716–3727.
- [45] Kry, S., Sasaki, N., Datta, A., Abe, I., Ken, S., & Tsusaka, T. W. (2020). Assessment of the changing levels of livelihood assets in the Kampong Phluk community with implications for community-based ecotourism. *Tourism Management Perspectives*, 34 (October 2018).
- [46] Priyadarshi, S., Ojha, S. N., & Sharma, A. (2019). An Assessment of Vulnerability of Fishers’ Livelihood to Climate Change in Coastal Odisha. *Current World Environment*, 14 (1), 60–67.
- [47] Ibrahim, A. Z., Hassan, K., Kamaruddin, R., & Anuar, A. R. (2017). Examining the Livelihood Assets and Sustainable Livelihoods among the Vulnerability Groups in Malaysia. *Indian- Pacific Journal of Accounting and Finance (IPJAF)*, 1 (3), 52–63.
- [48] Kebe, M., Jern, P., Collins, R., Kay, W., & Kekula, E. (2013). A livelihoods analysis of coastal fisheries communities in Liberia. In (FAO) *Fisheries and Aquaculture Circular*. No. 1043.
- [49] Ibrahim, A. Z., Hassan, K., Kamaruddin, R., & Anuar, A. R. (2018). Livelihood assets and food security achievement: An empirical study of the coastal fishermen in northern peninsular Malaysia. *Indian Journal of Public Health Research and Development*, 9 (11), 1383–1390.

- [50] Udoh, E. J., Akpan, S. B., & Uko, E. F. (2017). Assessment of Sustainable Livelihood Assets of Farming Households in Akwa Ibom State, Nigeria. *Journal of Sustainable Development*, 10 (4), 83.
- [51] F. Kamiludin, H. S. and W. S. (2020). Livelihoods sustainability pattern in Sangrawayang Village, Simpenan District, Sukabumi Regency.
- [52] Sunny, A. R., Prodhon, S. H., & Sazzad, S. A. (2020). Understanding Livelihood Characteristics and Vulnerabilities of Small-scale Fishers in Coastal Bangladesh. (July).
- [53] Amevenku, F. K. Y., Asravor, R. K., & Kuwornu, J. K. M. (2019). Determinants of livelihood strategies of fishing households in the Volta Basin, Ghana. *Cogent Economics & Finance*, 7 (1), 1–15. <https://doi.org/10.1080/23322039.2019>.
- [54] Kleih, U., Linton, J., Marr, A., MacTaggart, M., Naziri, D., & Orchard, J. E. (2013). Financial services for small and medium-scale aquaculture and fisheries producers. *Marine Policy*, 37 (1), 106–114.
- [55] Bajwa, S. K. (2015). A Study of Status of Livelihood Assets at Household Level: Evidence from Saidpur Village. *Pakistan Institute of Development Economics* (December 2015), 1–29.
- [56] Emdad Haque, C., Julián Idrobo, C., Berkes, F., & Giesbrecht, D. (2015). Small-scale fishers' adaptations to change: The role of formal and informal credit in Parat, Brazil. *Marine Policy*, 51, 401–407.
- [57] Ibrahim, A. Z., Hassan, K. H., & Kamaruddin, R. (2018). The Level of Livelihood Assets Ownership among Vulnerability Group in East Coast of Malaysia. 157–161.
- [58] Md Nazirul Islam Sarker, Min Wu, M. A. H. & G. M. A. (2019). A vulnerability and livelihood resilience in the face of natural disaster: A critical conceptual review. (October).
- [59] Turner, R. A., Szaboova, L., & Williams, G. (2018). Social Science & Medicine Constraints to healthcare access among commercial fishers. *Social Science & Medicine*, 216 (September), 10–19.
- [60] Seferiadis, A. A., Cummings, S., Zweekhorst, M. B. M., & Bunders, J. F. G. (2015). Producing social capital as a development strategy: Implications at the micro-level. *Progress in Development Studies*, 15 (2), 170–185.
- [61] Fischer, H. W., & Chhatre, A. (2016). Assets, livelihoods, and the 'profile approach' for analysis of differentiated social vulnerability in the context of climate change. (February).
- [62] Tobisson, E. (2014). Consequences and Challenges of Tourism and Seaweed Farming: A Narrative on a Coastal Community in Zanzibar. 12 (2), 169–184.
- [63] Holland, D. S., Kitts, A. W., Pinto Da Silva, P., & Wiersma, J. (2013). Social Capital and the Success of Harvest Cooperatives in the New England Groundfish Fishery. *Marine Resource Economics*, 28 (2), 133–153.
- [64] Bodin, Ö., Kininmonth, S., Crona, B., Chapman, L. J., Vaccaro, I., & Chapman, C. A. (2017). Microeconomic Relationships Between and Among Fishers and Traders Influence the Ability to Respond to Social-Ecological Changes in a Small-Scale Fishery. *Ecology and Society*, 22 (2).
- [65] Katikiro, R. E., & Mahenge, J. J. (2016). Fishers' Perceptions of the Recurrence of Dynamite- Fishing Practices on the Coast of Tanzania. 3 (November), 1–14.
- [66] Turgo, N. (2016). The kinship of everyday need Relatedness and survival in a Philippine fishing Community. *South East Asia Research*, 24 (1), 61–76.
- [67] Stern, M. J., & Coleman, K. J. (2015). The Multidimensionality of Trust: Applications in Collaborative Natural Resource Management. *Society and Natural Resources*, 28 (2), 117– 132.
- [68] Sandall, J., Temby, O., Hickey, G. M., & Cooksey, R. W. (2012). Understanding the Role of Social Capital in Government Collaboration on Climate Change: Evidence from New York. (July 2014), 1–37.
- [69] Hartley, T. W., & Glass, C. (2010). Science to management pathways in US Atlantic herring management: Using governance network structure and function to track information flow and potential influence. *ICES Journal of Marine Science*, 67 (6), 1154–1163.
- [70] Glenn, H., Tingley, D., Sánchez Maroño, S., Holm, D., Kell, L., Padda, G., Kuikka, S. (2012). Trust in the fishery's scientific community. *Marine Policy*, 36 (1), 54–72.
- [71] Yuvarajan, P., Cbt, R., Damle, D. K., & Chandrasekaran, S. (2019). Sustainable livelihood framework and approaches to the development of fish farming - Popular Article November 2019 Editorial.
- [72] Nawrotzki, R. J., Hunter, L. M., & Dickinson, T. W. (2014). Rural livelihoods and access to natural capital: Differences between migrants and non-migrants in Madagascar: *NIH Public Access*. (Abrego 2009), 1–34.
- [73] Li, W., Shuai, C., Shuai, Y., Cheng, X., Liu, Y., & Huang, F. (2020). How Livelihood Assets Contribute to Sustainable Development of Smallholder Farmers: *Journal of International Development*; January, (2020).
- [74] Stacey, N., Gibson, E., Loneragan, N. R., Warren, C., Wiryawan, B., Adhuri, D. S., Fitriana, R. (2021). Developing sustainable small-scale fisheries livelihoods in Indonesia : Trends, enabling and constraining factors, and future opportunities. *Marine Policy*, 132, 104654.
- [75] Israr, M., & Khan, H. (2010). Availability and Access to Capitals of Rural Household in Northern Pakistan. *Institute of Development Studies, NWFP-Agricultural University, Peshawar-Pakistan* 26 (3), 443–450.
- [76] Saroj. (2015). Livelihood Vulnerability Assessment to the Impacts of Socio-Environmental Stressors in Raksirang VDC of Makwanpur District Nepal.
- [77] Mosepele, K., & Kolawole, O. D. (2017). Fisheries governance, management and marginalisation in developing countries: Insights from Botswana. *Cogent Food & Agriculture*, 3 (1).
- [78] Fouqueray, M., & Papyrakis, E. (2019). An empirical analysis of the cross-national determinants of marine protected areas. *Marine Policy*, 99 (November 2017), 87–93.
- [79] B. Fregene, J. I. and Mb. (2016). Assessment of conflicts activities on livelihood of fishing and fish farming households in Nigeria. *ICAS VII Seventh International Conference on Agricultural Statistics* (October 2016), 310–314.
- [80] Bladon, A. J., Short, K. M., Mohammed, E. Y., & Milner-Gulland, E. J. (2016). Payments for ecosystem services in developing world fisheries. *Fish and Fisheries*, 17 (3), 839–859.

- [81] Golam Mustafa, M. (2015). Coastal and Marine Fisheries Management in SAARC Countries. SAARC Agricultural centre (2015).
- [82] Arias, A., J. E. Cinner, R. E. Jones, and R. L. Pressey. 2015. Levels and drivers of fishers' compliance with marine protected areas. *Ecology and Society* 20 (4): 19. <http://dx.doi.org/10.5751/ES-07999-200419>.
- [83] Johnson, A. E., Cinner, J. E., Hardt, M. J., Jacquet, J., Mcclanahan, T. R., & Sanchirico, J. N. (2013). Trends, current understanding and future research priorities for artisanal coral reef fisheries research. *Fish and Fisheries*, 14 (3), 281–292.
- [84] Maynou, F., Recasens, L., & Lombarte, A. (2011). Fishing tactics dynamics of a Mediterranean small-scale coastal fishery. *Aquatic Living Resources*, 24 (2), 149–159.
- [85] Ahmed, J. U., Mannaf, M., & Akter, S. (2018). Role of Small-scale Fishing on the Livelihood Improvement of Haor Fishermen: An Empirical Evidence from Bangladesh. *American Journal of Economics and Business Administration*. 1–10.
- [86] Apine, E., Turner, L. M., Rodwell, L. D., & Bhatta, R. (2019). The application of the sustainable livelihood approach to small scale- fisheries: The case of mud crab *Scylla Serrata* in South west India. *Ocean and Coastal Management Elsevier*. 170 (December 2018), 17–28.
- [87] Sun, R., Mi, J., Cao, S., & Gong, X. (2019). Classifying Livelihood Strategies Adopting the Activity Choice Approach in Rural China.
- [88] Lienert, J., Burger, P., & Burger, P. (2015). Merging capabilities and livelihoods: Analyzing the use of biological resources to improve well-being. 20 (2).
- [89] Walker, A. A. F. J. (2018). Exploring the Contributions of the Capability Approach to the People First Strategy: The Case of VSO's Livelihoods Programmes. (June).
- [90] Kapembwa, S., Gardiner, A., & Pétursson, J. G. (2020). Small-scale fishing: Income, vulnerability and livelihood strategies at Lake Itzhi-Tezhi, Zambia. *Development Southern Africa*, 0 (0), 1–22.
- [91] Taber, K. S. (2018). The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education Content courtesy of Springer Nature, terms of use apply Rights reserved. 1273–1296.
- [92] Siyoum, A. D., Hilhorst, D., & Pankhurst, A. (2012). The differential impact of microcredit on rural livelihoods: Case study from Ethiopia. 1 (3), 957–975.
- [93] Rahi, S. (2017). Research Design and Methods: A Systematic Review of Research Paradigms, Sampling Issues and Instruments. *Development International Journal of Economics & (January)*.
- [94] Mishra, S., Sarkar, U., Sciences, F., Taraphder, S., Sciences, F., Datta, S., & Sciences, F. (2017). Principal Component Analysis. (January).
- [95] Fekadu, G., Tebarek, A., Megento, L., & Gurmesa, F. (2021). The extent of livelihood diversification on the determinants of livelihood diversification in Assosa Wereda, Western. *GeoJournal*, 5 (1992).
- [96] Rahman, S., & Akter, S. (2014). Determinants of Livelihood Choices: An Empirical Analysis from Rural Bangladesh. *Journal of South Asian Development* (November 2014).
- [97] Njuguna, R. A. (2015). Determinants of Choice of Alternative Livelihood Diversification Strategies in Solio Resettlement Scheme, Kenya. (August).
- [98] Ding, W., Jimoh, S. O., Hou, Y., Hou, X., & Zhang, W. (2018). Influence of Livelihood Capitals on Livelihood Strategies of Herdsmen in Inner Mongolia, China. 1–17.
- [99] Maulidah, S., Koestiono, D., Riana, F. D., I., Rural, A., & In, H. (2020). Improving the sustainability of livelihood assets as a strategy for paddy self-sufficiency: 17 (2), 9486–9494.
- [100] Kassie, G. W., Kim, S., Jr, F. P. F., Worku, G., Kim, S., Jr, F. P. F., Fellizarjr, F. P. (2017). Determinant factors of livelihood diversification: Evidence from Ethiopia. *Cogent Social Sciences*, 26.
- [101] Dehghani, M., Akbar, A., Azadi, H., & Sche, J. (2018). Revealing the role of livelihood assets in livelihood strategies: Towards enhancing conservation and livelihood development in the Hara Biosphere. 94 (January), 336–347.
- [102] Rockenbach, T., & Sakdapolrak, P. (2017). Social networks and the resilience of rural communities in the Global South: 22 (1).
- [103] Bazezew, A., Bewket, W., & Nicolau, M. (2013). Rural household's livelihood assets, strategies and outcomes in drought prone areas of the Amhara Region, Ethiopia: *Case Study in Lay Gaint. District*. 8 (46), 5716–5727.
- [104] Sarah, A. (2012). Determinants of Rural Household Income Diversification in Senegal and Kenya.