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Nexus of Fishing Boat Motorisation, Profitability and Poverty Status of Artisanal Fisherfolks on Epe Lagoon, Lagos State: A Multidimensional Poverty Index (MPI) Approach

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Abstract
The study examined the nexus of fishing boat motorisation, profitability and poverty status of artisanal fisherfolks on Epe Lagoon, Lagos State: A MPI approach. Specifically, the study analysed profitability and determined MPI of respondents. The study area was Epe lagoon, with stratified sampling technique adopted. One hundred and sixty (160) respondents were stratified into 2 strata based on craft propulsion: Manual Propulsion Technology (MPT) and Motorized Technology (MT). The sampling unit was the respondents' households. Information obtained using interview schedules were analysed using descriptive statistics, profitability ratios, and Alkire and Foster MPI. Although the MT respondents had higher Net income, the Benefit-Cost ratio was lower due to the cost of maintenance of the outboard engine. Four MPI dimensions: education, health, living standard and financial standard were examined. MPT respondents were more deprived (MPI 27.8%) than the MT respondents (17.87%). The headcount of multidimensionally poor MPT respondents was 86.43%, while MT respondents were 53.4%. Deprivations were in living standards (no electricity, portable water or toilet and clean cooking energy) and financial standards (unreliability of fishing income; no savings, difficulty in credit access, no cooperative society). These deprivations violated some UN SDGs goals. The study recommends rapid intervention by the State government in the living standard of the fishing communities by the provision of basic amenities like potable water, electricity and an access road. The prohibition of discharge of the heated coolant water from the Egbin power plant into the western end of the lagoon because of its heavy metal deposits. Cooperative education should be extended to the fisherfolks.

Keywords: Multidimensional Poverty Index (MPI), Deprivation, Sustainable Development Goals (SDGs)

Introduction

Poverty is an issue whose tentacles are of global concern; as such, eradicating poverty is of great concern to government and non-governmental organisations worldwide because of not just its economic implications, but for the social implications which exceed the outbreak of diseases and deaths and include violence, restiveness and increased crime rate. Because of the undesirable outcomes of poverty, the United Nations' first Sustainable Development Goal (SDGs) of No Poverty; intends to end poverty in all its forms everywhere. The European Council defined poverty as individuals or families whose resources are so small as to exclude them from the minimum acceptable way of life of the Member State in which they live (EEC, 1981).

Artisanal fishery, a term used as a synonym for small-scale fisheries by some researchers like Béné, (2003), describes a small-scale, labour-intensive fishery with relatively low investment in capital inputs and the use of relatively simple technology (Abasilim and Onyewuchi, 2020). Artisanal fishery has been linked to poverty by many researchers (Béné and Friend, 2011; Wekke and Cahaya, 2015). It has been described as an occupation of last resort and the fisherfolks as the poorest of poor which can be attributed to their low fishing income (Béné, 2003; Polnac, 1991). Schoor (2005) described the fishing communities as small, underdeveloped and often severely impoverished communities whose immediate survival depends on their ability to continue benefiting from a local fishery that in many cases are centuries, while Omitoyin *et al*. (2021) and Williams (2007) described Nigerian fishing communities as far from developed, and many of the fisherfolks as poor and can only afford the many basic needs. Thus, the ability of the fisherfolks to develop their communities will be limited to their income.

In a country like Nigeria, where many as 4 in 10 Nigerians live below the national poverty line and 1 out of every poor people in sub-Saharan Africa living in Nigeria according to the World Bank Group (2022) report, it becomes worrisome if an occupational group is singled out as the poorest. Allison *et al*. (2006) noted that fisherfolks were not necessarily the poorest of the poor in monetary terms, but may, instead, be among the many vulnerable socio-economic groups due to their particularly high exposure to certain natural, health-related or economic shocks and disasters. FAO (2005) also indicated that the artisanal fisherfolks were among the many socially disadvantaged groups in the country, because of the remoteness of their habitations, which is conditioned by the location of the resources. These deprivations faced by the fisherfolks observed by these researchers are clearly in line with deprivations in social indicators as indicated by the United Nations Development Programme (UNDP). If fisherfolks were not income poor as opined by researchers like Allison and Horemans (2006) and Allison *et al*. (2006), then it becomes worrisome if they cannot save from their income to enhance their productivity. Most artisanal fisherfolks do not own or have access to improved technologies like motorized crafts. Motorized craft is an improvement on the manually propelled craft that saves the fisherfolks time, energy and provides easier and deeper navigation within the water bodies (Olaoye *et al*., 2012; Ogundiwin, 2014). The open-access artisanal fishery coupled with climate change exposes the fisherfolks to economic shocks, the rate of renewal of the impacts of the resources on the livelihood of the fisherfolks who solely depend on it (Flatten, 2016).

Based on this background, this study examined the nexus of fishing boat motorisation, profitability and poverty status of artisanal fisherfolks on Epe Lagoon, Lagos State. Specifically, this study described the socioeconomic characteristics of the two strata of respondent fisherfolks: Manual Propulsion Technology (MPT) and Motorized Technology (MT) fisherfolks in the study area; analysed the profitability of each stratum and determined the Multidimensional Poverty Index of each stratum of respondents.

Materials and Methods

Study area

Epe lagoon, Lagos State, is one of the ten lagoons in Lagos State, Southwest Nigeria (Badejo *et al*., 2014). It has 460 km^2 of brackish water areas, with salinity ranging between 0.24±0.19, pH 7.56±0.05 and temperature 30.35±0.17 (Soyinka and Ebigbo, 2012). Although Epe lagoon is not one of the major lagoons in Lagos State, it supports major fishing activities in Lagos State because of its high level of species richness with little or no seasonal variation in specie composition, hence the town of Epe, harbouring the lagoon, is noted for artisanal fishery (Badejo *et al*., 2014). It is a transportation route for people, goods and timber logs to other places in South-Western Nigeria; houses the Egbin thermoelectric power plant, which serves as a major source of electric power generation in Western Nigeria; and is also the major source of water for the inhabitants of Epe and other villages situated along the bank.

Sampling technique

A multistage sampling technique was adopted for this study. Fisherfolks who fished on the Epe lagoon were purposively selected. Eight communities on the shores of Epe lagoon were randomly selected. An equal number of the respondents who were household heads were randomly selected and information elicited from them by enumerators using interview scheduled. The sampling units were the respondents' households. Due to incomplete or improperly filled questionnaire, information from 106 respondents comprising 47 were MPT fisherfolks and 59 MT fisherfolks, were admitted for analysis.

Data collection instrument

The interview schedule was used to elicit data from respondents. The poverty assessment instrument used was an adapted version of the survey modules originally developed by OPHI, and used by some researchers like Ataguba *et al*. (2011) and Israel *et al*. (2015) to measure the multidimensional poverty index of some category of people. Because the developers of the module encouraged researchers to modify the indicators of the module to suit their locality, the module for this study was modified to cover four poverty dimensions (health, education living standard and financial standard).

Analytical techniques

Descriptive statistics was used to describe the socioeconomic characteristics of the respondents. Gross margin analysis was used to comparing the profitability of the MPT and MT artisanal fisherfolks, using the equation thus:

Net Income = Total Revenue (TR) – Depreciation n…1
Total Revenue (TR) was computed as the mean of the three months revenue as given by the fisherfolks = Gross Income –Total Expenses …. 2
Total Expenses (TE) was computed thus;
$TE_{ij} = TVC_{ij} + TFC_{ij}$.... 3
TVC_{ij} = Total Variable Cost incurred by the ith fisherfolks using the jth technology (₦) within a year
TFC_{ij} = Total Fixed Cost incurred by the ith fisherfolks in the jth technology (₦) within a year

The value of the fixed cost items like the craft, gears and propulsion technology were depreciated estimates using the straight-line method based on the assumption that canoes and engines were used for a period of five years before scrapping them without salvage values (Anyanwu *et al*., 2009).

The poverty statuses of the two strata were analyzed using the following steps:

1. Dimensions and indicators of deprivation were identified and weight and scores attached to them

2. Two poverty cut-off points were used when identifying the poor households;

i. Deprivation cut-off – Each respondent household was assigned a deprivation score according to the deprivations in the component indicators.

ii. The Poverty Cut Off (k)-Households whose sum of weighted deprivation experience were greater than 25%, i.e., more than one-fourth of the weighted considered indicators, were classified as multidimensionally poor. That is the deprivation.

3. The deprivation scores were censored for households whose deprivation scores were below the poverty cut-off by replacing their scores with a value of 0, without considering any existing deprivations.

4. Two components of MPI; Head count ratio (H) and Intensity of poverty(A) were

I. The headcount ratio, H, of the multidimensional poor household

ii. The intensity of poverty, A,

iii. The Multidimensional Poverty Index, MPI, was calculated thus:

MPI = H x A ….4

Results and Discussion

The analysis of the socioeconomic data displayed in Table 1, showed that 44.3% of the respondents were MPT fisherfolks while 55.7% were MT fisherfolks. Majority (89.6%) of the respondents were male, validating the findings of Akanni (2008) and Okeowo *et al*. (2015), that the artisanal fishery sector in Lagos State is predominantly a male profession, as well as the position of Olubanjo *et al*. (2007) that men were predominantly the harvester of wild fish species. Although, the result showed the dominance of the sector by men, the contribution of the womenfolk in active fishing in the study area cannot be overlooked because they made up 10.4% of the fisherfolk respondents, confirming Olaoye *et al*. (2012) assertion that it is a common feature to find females in the fishing communities participating actively in lagoon (non-ocean) fishing, while their male counterparts exploit the ocean. Disaggregating the respondents by their means of fishing craft propulsion, revealed that 44.3% of the respondents used MPT, while 55.7% used MT, of which, only 5.1% of the female fisherfolks used MT, while 94.9% of the male fisherfolks used MT. This may be due to the cost of purchase and maintenance of the motorized technology.

Majority of the respondents were within the 21-50 years age range showing that the fisherfolks in the study area comprise of strong and virile people in the productive age. This age category has positive implications for increasing catch and productivity, as well as having a multiplier effect on ease of adoption of innovations and positive implications for the sustainability of the fishing enterprise. Majority of the MPT and MT respondents had household sizes of 5-9 people. This was an indication that the cost of labour will be reduced as it will be borne by the family labour. This also explained how most of the respondents acquired their skills as 89.5% of respondents learnt fishing as their family occupation. Majority of the respondents (92.5%) owned only 1 craft. About 72.5% of the crafts aged from 5-9years showed that the respondents either maintained their crafts well or cannot afford to replace their crafts frequently. Many of the respondents (35.8%), fished every day of the week.

The Gross Margin Analysis shown in Table 2, revealed that the monthly total variable costs was N18,538.57 and N 68,064.80 for MPT and MT respectively. However, the average income per month for MPT was N110,475.00 and N300,989.90 for MT. This is far more than the Nigeria National monthly minimum wage of N30,000 according to the National Minimum Wage Act of 2019. The monthly gross margin for MPT was N91,936.43, while MT was N212,925.1. These results implied that the operators of MT made more revenue and profit compared to the MPT fisherfolks. These may be because MT fisherfolks had the advantage of covering a more distant area along the coast to achieve better catch of higher-priced fish species compared to the operators of the MPT fisherfolks. This corroborated the high net revenues of artisanal fisherfolks reported in Oguta, Imo State and higher monthly revenue earned by MT fisherfolks in Ijebu Waterside, Ogun State (Anene *et al*., 2010, Kareem *et al.,* 2012).

Although both technologies were profitable because their Benefit-Cost ratios were greater than 1, MPT appeared to return more profit as every N 1 invested in the MPT business, returned N2.77, unlike the MT that returned N2.01. The MT appeared less beneficial because of the high cost of maintenance of fishing crafts and outboard engines, cost of fuel and cost of engine and engine maintenance.

Multidimensional Poverty Index (MPI) of the respondent fisherfolks

Based on the poverty cut-off of above 25% or one-quarter of the deprivation indicators, the headcount (H) of multidimensional poor households was 86.43% for MPT fisherfolks and 53.4% for MTs, as shown in Table 3. Comparing this percentage with the most recent 2018 survey data for Nigeria, which put the headcount of multidimensional poor in Lagos State at 4.1% in 2018 (www.OPHI.org.uk, 2021) the headcount of multidimensionally poor artisanal fisherfolks in Epe may have contributed a large percentage to the state's poverty headcount, while the MPT fisherfolks contribute by far a larger percentage to the headcount of multidimensional poor households than MT fisherfolks. The breadth or intensity of deprivation (A), indicated that the average poor MPT respondent was deprived in

32.11% of weighted indicators, while an average poor MT respondent was deprived in 33.47% of the same weighted indicators. The MPI, which is the share of the population that is multidimensionally poor, adjusted by the intensity of the deprivations, is 0.276 for MPT fisherfolks and 0.1787 for MTs. According to the 2021 OPHI report, the MPI of Lagos State in 2018 was 0.1023, while the Nigeria national MPI was 0.254, thus the MPI of the MPT fisherfolks shows a high level of deprivation in that sector.

Analysis of contributions of the four dimensions to deprivation, as shown in Table 4, showed that the living standard and financial standard of the artisanal fisherfolks contributed most to the deprivations faced by the artisanal fisherfolks, contributing 50.04% and 47.59% respectively for MPT fisher folks and 44.4% and 45.72% for MT fisherfolks. These findings go to a large extent to confirm Israel *et al*. (2015) assertion that fishing is a low-status occupation and fishing communities suffer from poor community infrastructure and living conditions. However, education and health contributed least to the deprivation faced by both the MPT and MT fisherfolks, both contributing 2.86% and 0% for MPT and 11.29% and 3.88% respectively for MT fisherfolks. A further breakdown of the indicators of the living standards and financial standards dimensions of MPT and MT fisherfolks are displayed in Figs. 1 and 2. The figures showed that the contributions of living standard indicators to deprivation for MPT fisherfolks shows that among the living standard indicators of the MPT respondents, lack of flush toilet contributed most to their deprivation, while lack of potable water contributed most to the deprivation in the living standards of MT respondents. This is so because the lagoon not only provided a means of livelihood but also served as the source of water and also a toilet. Infrastructural development was a major deprivation for both the MPT and MT fisherfolks. The infrastructure in the study area as seen was displayed in Plates 1, 2, 3, 4 and 5. Fig. 1 showed that over 50% of the MPT respondents had land which can be used as collateral for credit.

Figs. 3 and 4 showed the deprivations faced by the respondents in their living standard dimension. As many as 78% of MPT and 79% of MTs do not belong to any cooperative society. This indicate the non-existence or inactivity of a cooperative society in the study area. This may make it difficult for them to engage in self-help projects and for governmental and non-governmental bodies to reach out to them. Among the MPTs, 36.65% of the respondents were deprived of their ability to save, which may be attributed to the unreliability of their income from saving as noted by 56.11% of the respondents. For the MT stratum, 45% of the respondents are deprived of savings, while 70.4% indicated the income from artisanal fisheries as unreliable. This may be because of the high variable cost incurred by the MTs, especially with the maintenance of the engines and the soaring cost of fuel. Both strata are deprived of quick access to loans. This may be due to their inability to meet the prerequisite documentation required by banks and other credit agencies

Conclusion

Acquiring outboard engines by most respondents is limited by the difficulty of savings due to unreliability of income, difficulty to access financial aid due to the non-existence of cooperative societies, and inability to provide documentation for bank loans such as utility bills which are non-existent in the study area. Although the MTs had a higher net income, MPTs had a higher Benefit-Cost ratio which can be attributed to the price of procuring and maintaining the outboard engine. The MPI of the respondents showed that MPTs had a higher MPI index (27.8%) than the MTs (17.87). The headcount of multidimensional poor among the MPTs was 86.43%, while that of MTs was 53.4%. The respondents were most deprived in their living standard and financial standard, as no electricity from the national power grid was available in the study area, and their only source of water, the Epe lagoon, also served as their toilet, while they still cooked with firewood. The United Nations Sustainable Development Goals (SDGs) 6 (clean water and sanitation), 7 (affordable and clean energy), 9 (Industry, innovation and infrastructure), 10 (reduced inequality), 12 (responsible consumption and production), 14 (Life below water) and 16 (peace, justice and strong institutions) are far from being achieved in Nigeria. There is need therefore for the State government to urgently look into the living standard of the fishing communities on the lagoon and provide basic infrastructure such as potable water for cooking and drinking to prevent the risk of the outbreak of water-borne diseases. The State government should prohibit the discharge coolant water from the Egbin power into the lagoon. This is worrisome because the lagoon is the source of water for household use by the communities on the bank of the lagoon. These effluents contain heavy metals which are poisonous not only to the inhabitants of the communities but also to the aquatic lives on the lagoon and finally end up in the system of the final consumers. The State government should provide electricity from the national grid to these communities. Electricity supply will encourage the set-up of rural industrial fish drying and processing and so create more sources of income and also reduce the pressure on the fisherfolks to sell off all their daily catch to the middlemen who do not offer good prices for their catch. If an access road is constructed in the communities, consumers can access the fisherfolks and reduce exploitation by middlemen. The Lagos State Ministry of Agriculture and Ministry of Commerce, Industry and Cooperatives should liaise and send extension agents to the study area to help the fisherfolks set up cooperative societies. The politicians should include giving outboard engines to artisanal fisherfolks as part of their community empowerment programme. The government should evolve a hire purchase scheme for the fisherfolks to enable them to procure motorized crafts or outboard engines.

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Table 1: Socioeconomic characteristics of respondents

		Means of fishing craft propulsion		
		Manual Propulsion Technology MPT n=47(44.3%)	**Motorized Technology MT n=59(55.7%)**	**Total n=106**
Sex	Male	39(36.8%)	56(52.8%)	95(89.6%)
	Female	8(7.5%)	3 (2.8%)	11(10.4%)
Age (years)	≤ 20	1(0.9%)	0(0.0%)	1(0.9%)
	21-30	12 (11.3%)	9(8.5%)	21(19.8%)
	31-40	12(11.3%)	25(23.6%)	37(34.9%)
	41-50	11(10.4%)	16(15.1%)	27(25.2%)
	51-60	7(6.6%)	7(6.6%)	14(13.2%)
	≥70	2 (1.9%)	1(0.9%)	3(2.8%)
Household size	≤ 4	18(17.0%)	10(9.4%)	28(26.4%)
	5-9	26(24.5%)	43(40.6%)	69(65.1%)
	10-14	3(2.8%)	5(4.7%)	8(7.5%)
	≥ 20	0(0.0%)	1(0.9%)	1(0.9%)
Educational level	None	15(14.2%)	10(9.4%)	25(23.6%)
	Primary	17(16.0%)	31(29.2%)	48(45.3%)
	Secondary	12(11.3%)	18(17.0%)	30(28.3%)
	Tertiary	3(2.8%)	0(0.0%)	3(2.8%)
Civil status	Married monogamous	28(26.4%)	27(25.5%)	55(51.9%)
	Married polygamous	10(9.4%)	27(25.5%)	37(34.9%)
	Divorced/separated	6 (5.7%)	0(0.0%)	6(5.7%)
	Never married	3(2.8%)	5(4.7%)	8(7.5%)
Primary occupation	Fishing	37(34.9%)	53(50.0%)	90(84.9%)
	Non-fishing	10(9.4%)	6(5.7%)	16(15.1%)
Years of fishing experience	1-10	5(4.7%)	5(4.7%)	10(9.4%)
	11-20	22(20.8%)	22(20.8%)	44(21.5%)
	21-30	12(11.3%)	23(21.7%)	35(33.0%)
	31-40	5(4.7%)	8(7.5%)	13(12.3%)
	≥ 41	3(2.8%)	1(0.9%)	4(3.8%)
Source of fishing experience	Innate	1(1.0%)	2(1.9%)	3(2.9%)
	Family occupation	41(39.0%)	53(50.5%)	94(89.5%)
	Learnt	4(3.8%)	4(3.8%)	8(7.6%)
Number of crafts owned	1.00	43(40.6%)	55(51.9%)	98(92.5%)
	2.00	4(3.8%)	3(2.8%)	7(6,6%)
	4.00	0(0.0%)	1(0.9%)	1(0.9%)
Age of craft(years)	0-4	11(10.4%)	14(13.2%)	25(23.6%)
	5-9	35(33.0%)	45(42.5%)	80(75.5%)
	10-14	1(0.9%)	0(0.0%)	1(0.9%)
Weekly frequency of fishing (days)	1.00	1(0.9%)	0(0.0%)	1(0.9%)
	2.00	0(0.0%)	1(0.9%)	10.9%)
	3.00	0(0.0%)	2(1.9%)	2(1.9%)
	4.00	11(10.4%)	4(3.8%)	15(14.2%)
	5.00	8(7.5%)	14(13.2%)	22(20.8%)
	6.00	10(9.4%)	17(16.0%)	27(25.5%)
	7.00	17(16.0%)	21(19.8%)	38(35.8%)

Source: Field survey data, 2021

Table 2: The gross margin analysis of an average fisherfolk in the study area per month

Items	Manual Propulsion Technology, MPT		Motorized Technology, MT	
	Amount (₦)	% of TC	Amount(₦)	% of TC
Variable cost VC per fisherfolk per month				
Hiring of a fishing boat	200.00	0.50	0,00	0.00
Hiring of an outboard engine	0.00	0.00	0.00	0.00
Hiring of fishing gears	0.00	0.00	0.00	0.00
Fuel	0.00	0.00	27,539.39	18.36
Kerosene	1,490.00	3.74	1,623.08	1.08
Engine oil	0.00	0.00	4,828.78	3.22
Bait	8,362.50	20.97	10,904.76	7.27
Battery	1,657.50	4.16	1,034.38	0.69
Repairs and maintenance of fishing boats	4,150.00	10.41	6,931.818	4.62
Repairs and maintenance of engine	0.00	0.00	11,765.15	7.84
Repairs and maintenance of fishing gears	2,375.00	5.96	3,133.87	2.09
Cooperative society annual membership dues	0.00	0.00	0.00	0.00
Landing / fishing levy	0.00	0.00	0.00	0.00
Government levy	0.00	0.00	0.00	0.00
Miscellaneous expenses	303.57	0.76	303.57	0.20
Total variable cost TVC	**18,538.57**	**46.94**	**68,064.8**	**45.38**
A. Fixed cost per fisherfolk per month				
Depreciation (at 5 years with zero salvage value):				
Cost of one craft	18,200.75	45.65	28,720.00	19.15
Cost of one outboard engine	0.00	0.00	50,209.38	33.47
Cost of one paddle	283.00	0.71	0.00	0.00
Cost of fishing gears	2,850.13	7.15	3,000.25	2.00
Total fixed cost TFC	**21,333.88**	**53.51**	**81,929.63**	54.62
B. Total cost TC= TVC +TFC	**39,872.45**	**100.00**	**149,994.43**	**100.00**
C. Total revenue TR per fisherfolk per month	**110,475.00**		**300,989.90**	
D. Gross margin GM = TR-TVC	**91,936.43**		**212,925.10**	
E. Net income NFI = GM –TVC- TFC	**70,602.55**		**130,995.47**	
G. Benefit-cost ratio BCR = TR/TC	**2.77**		**2.01**	

Source: Field survey data, 2021

Table 3: Multidimensional Poverty Index (MPI) of Respondents

Multidimensional poor	Percentage		Multidimensional non-poor	Percentage MPT	
	MPT	MT			MT
Head count (H)	86.43	53.4	Head count (H)	13.57	46.6
Intensity of poverty (A)	32.11	33.47	Intensity of poverty (A)	67.89	66.53
Multidimensional poverty index, MPI	27.8	17.87	Multidimensional poverty index, MPI	72.2	82.13
Education	2.86	11.29	Education	97.14	88.71
Health	0	3.88	Health	100	96.12
Living standard	50.04	44.44	Living standard	49.96	55.56
Financial standard	47.59	45.72	Financial standard	52.41	54.28

Source: Field survey data, 2021

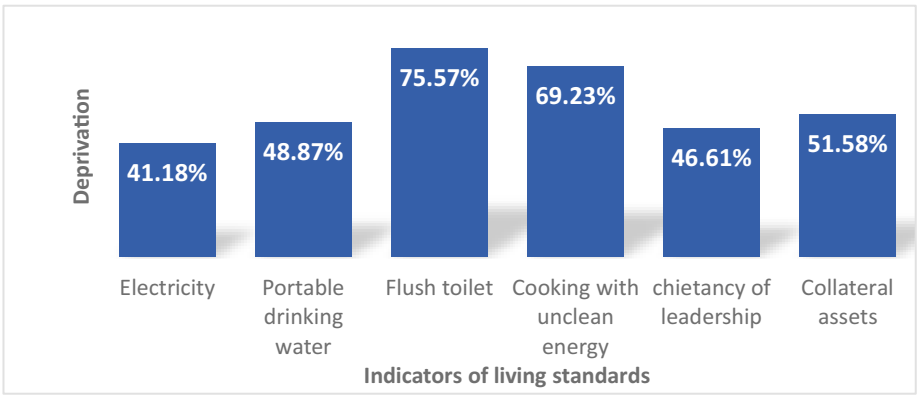

Fig. 1: Contributions of living standard indicators to deprivation for MPT fisherfolks
Source: Computed from field survey data, 2021

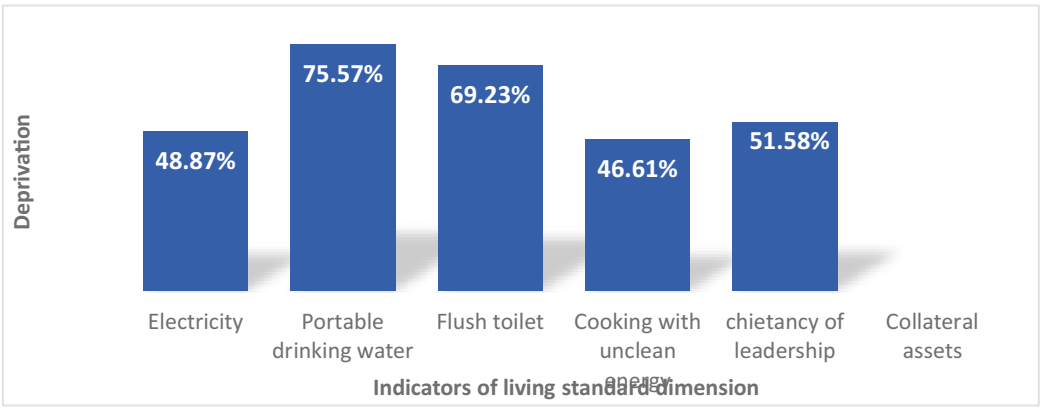

Fig. 2: Contributions of indicators of living standard to deprivation for MT
Source: Computed from field survey data, 2021

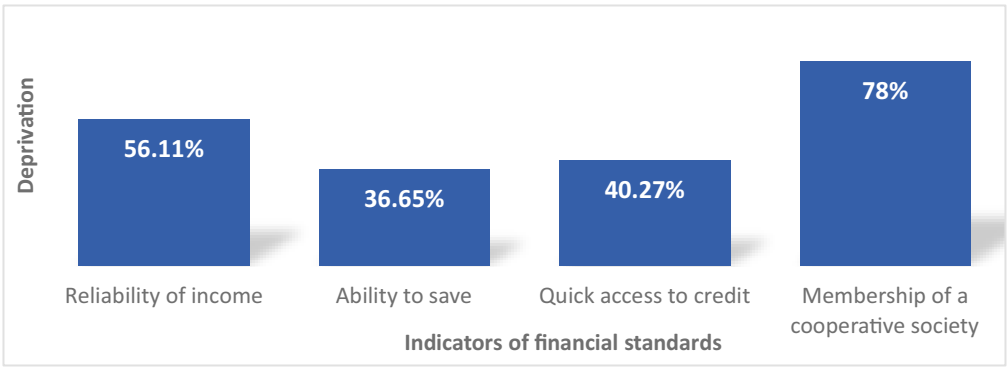

Fig. 3: Contributions of financial standard indicators to deprivation for MPT fisherfolks
Source: Computed from field survey data, 2021

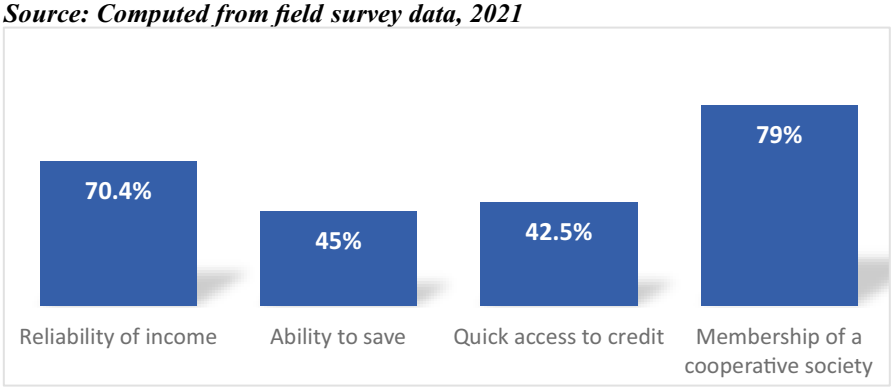

Fig. 4: Contributions of financial standard dimension to the deprivation of MT
Source: Computed from field survey data, 2021