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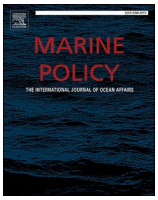

Influence of reciprocal financial resources on shrimp fishers' income sources in Southern Nigeria

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ABSTRACT

The study examines reciprocal financial relationships' influence on shrimp fishers' income sources and their motivation in Rivers State, Nigeria, fishing communities. A mixed methods design was employed using a semi-structured questionnaire, interview guide and checklist to collect data from 125 shrimp fishers and 20 Key informants. Data on shrimp fishers' financial contributions were subjected to UCINET 6.647 Net draw to generate a sociogram. Fishers' income sources and motivating factors were subjected to content analysis and multiple regression. The results showed that shrimp fishers in Rivers State pay dues, contributions and donations to obtain revolving loans from their network and receive remittances from relatives. The sums of money are invested in fishing equipment and off-fishing ventures. 44% of fishers relied on remittances and loans for investment. However, enabling institutional framework and support from external agencies are motivating factors to join a social network which aims at improving income sources among shrimp fishers in line with Sustainable Development Goals 16 and 17. Shrimp fishers who engage in a reciprocal financial relationship have their income sources improved by diversifying into off-fishing ventures. The study recommends that Shrimp fishers register as cooperatives to attract more support from government and donor agencies.

1. Introduction

Shrimp fishing is a lucrative business globally, with Asia as the lead producer, accounting for over 75% [20]. The other 25% is produced mainly in Latin America and Africa. Africa accounted for under five percent of the global export value in 2020 [21]. Nigeria produces 12,000 tonnes of shrimp valued at USD 84 million, potentially generating USD 384 million in 10 years from export. According to the United Nations Food and Agricultural Organisations' State of world fisheries, in 1976, exports of shrimps and prawns were worth USD 1.2 billion, accounting for 15.4% of the value of global exports of aquatic products, whereas, in 2020, they were worth USD 24.7 billion making up 16.4% of the total in value terms ([21,39]. This showed that shrimp exports have increased drastically and account for a relatively stable share of the total value of global exports of aquatic products. In Nigeria, shrimp fishing engages over 23% of Nigerians for a livelihood [2,21,39]. According to FAO [22], Agricultural sector contrition to Nigeria's Gross Domestic Product (GDP) was 22.35%. The dominant communities involved in shrimp fishing are found mainly along the coast [21]. These shrimp fishers leverage social networks to meet their needs as social networks provide access to resources [3,44] through a reciprocal relationship.

2. Reciprocal

2.1. Financial resources

The reciprocal financial relationship has been reported in social networks [16,34,10]. The basic assumption is that social network exchange is embedded in social relations and complex social structures [33]. Reciprocal financial resources were reported among family

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members contributing money to each other through mobile money transfers in Kenya [34]. Dapilah et al. [16] reported financial transactions among actors in social networks in the form of savings, loans and donations. Obtaining financial benefits from social networks is a driving force for strengthening social networks. Hence, examining the reciprocal financial relationship among shrimp fishers in southern Nigeria can provide a basis for strengthening social networks among fishers in the region. Therefore, in analysing reciprocal financial relationships, we looked at reciprocal relationships built around dues, contributions, remittances and donations in the shrimp fisher network.

The concept of a social network (though not labelled as such) has existed ever since small communities formed, and humans interacted with the expectation of reciprocation and trust [10]. It entails purposefully establishing relationships and employing them to generate intangible and tangible short-term or long-term benefits [36]. This formed the basis for the dependent variable of this study. Turner et al. [54] argue that a social network improves access to resources among fishers.

2.2. Statement of the problem

The significance of strengthening social connections through financial benefits derived from social networks is widely acknowledged. However, a research gap exists regarding the specific dynamics of reciprocal financial relationships among shrimp fishers in Southern Nigeria. The influence of reciprocal financial resources on the revenue sources of fishers has not been comprehensively explored despite the significant relevance of these networks to their livelihoods. Hence, the primary objective of this study is to fill this research gap by investigating the interdependent financial connections established through dues, contributions, remittances, and gifts within the shrimp fishing network in Southern Nigeria. This study aims to ascertain how these financial connections contribute to shrimp fishers' revenue and economic viability, ultimately providing insight into viable approaches for bolstering social networks and improving the welfare of shrimp fishers in the area. Hence, the study examined the reciprocal financial relationship and its influence on income sources among shrimp fishers in fishing communities of Rivers State.

2.3. Overview of shrimp fishery in Nigeria

In Nigeria, shrimp fishing is divided into industrial trawler fishing and artisanal shrimp fishing. The first category uses a fleet of vessels with sophisticated fishing gear operating on the high sea beyond the first five nautical miles from the shore, and their vessels are licensed by the Federal Department of Fisheries (FDF). The second category is the artisanal shrimp fishers who use dugout canoes and engine boats with different types of nets to catch shrimps within the first five nautical miles from the shore [4,42]. The artisanal shrimp fishers contribute about 95% of the shrimps consumed locally, bridging the country's protein need gap.

There are four main stages in the shrimp business, i.e.: the producer stage, the wholesaler stage, including processing; the retailer stage, and the consumer stage, including the export, institutional and final household consumer markets [19]. Further, fish marketing channels are more complicated, as market operators may perform multiple marketing functions. This study focuses more on the producer stage, where shrimp fishers dominate. Shrimp fishers are a category of actors at the base of the production chain who engage in fishing activities in streams, rivers, and seas to catch/capture or harvest shrimps from the wild. Their harvest (shrimps) is sold, the money generated is used for daily living, and some are saved for other investments. These fishers form unions/associations where they share information on fishing and the welfare of their members. As part of welfare, they engage in daily savings and monthly contributions of a specific amount as agreed to by members. Each member collects the monthly contributions according to their turn in a rotational manner. The depositors withdraw the daily savings at agreed intervals (E. Ansa, personal communication, 18th March 2018).

Shrimp fishers used their savings to acquire assets, increasing their income/capital base.

According to FAO [19], men dominate fish capture while women are more involved in processing, providing credit facilities, selling and bringing economic returns for the family. There is, however, significant motivation to participate in a network when it provides some financial resources for members [11,19,24,50,8]. Albeit, social relationship helps in financial resource pooling through cooperatives' contributions [47]. For example, Institutional arrangement exists in the Republic of Korea as in Japan, where the law empowers fisher's cooperatives to co-manage fisheries resources. Many cooperatives in fishing communities regulate the types of net used at sea to ensure sustainable harvest of fisheries resources but also lobby for financial support from members, government and donor agencies [19].

3. Theoretical framework

This study drew on Lin's Network Theory of social capital (1999). The theory holds that access to and use of resources is embedded in social networks. Hence, shrimp fishers form social networks to enable continuous access to fishing infrastructure and improve the living conditions of members [19,52]. Social networks are patterns of vertical and horizontal relationships, or "ties", among actors [38], which comprise various types of social relationships, from casual to close bonds. Members accrue income that provides advantages for livelihood outcomes, such as financial resources for fishing intensification or diversification to off-fishing income sources [14,35,47,57].

From a social network perspective, the study systematically examined the shrimp fishers' social systems in Rivers State regarding their relationship for financial resource pooling, factors that attract them to partake in social networks, and shrimp fishers' investments. The study assumed that access to financial resources by social network members influences fishers' investment, and it sought to determine the factors motivating shrimp fishers to form/ join social networks. The network theory of social capital supposes access to and use of resources embedded in social networks, solidarity and group formation for members of social networks or groups [35]. The access to such resources could be analysed based on individuals in the network [35] or collectively as a group of individuals [14]. Indicators for measuring network resources among shrimp fishers were the various resources that the shrimp fishers used or acquired, such as more fishing equipment, land, tricycles, motorcycles, boats, and shops. The resources were also considered assets in networks [35]. In the present study, social network members' pooling of financial resources was mirrored against their investments and income sources to establish the contributions of social networks to shrimp fishers' access to resources. The motivation to be part of a social network can be external and internal factors [56]. For example, when the donor agencies and government impose membership to a social network as a condition for accessing funds, it is considered an external factor.

On the other hand, when actors, by their initiative, form a network to pool finances, it is referred to as an internal factor. FAO [19] identified income generation as a motivation for fisherfolks to conserve the aquatic ecosystem through advocacy through social networks. Another is Institutional arrangements. For example, in the Republic of Korea and Japan, access to fisheries requires cooperative membership. The law gives fishery cooperatives a major role in fisheries management and regulation [19]. At the same time, interest in the group goal/information-searching behaviour and perceptions of power relations inform network participation [49]. In addition to being convinced about and interested in the potential of the local network to lead to higher benefits and returns than other alternatives, an enabling institutional framework for local network performance through regulations, infrastructure, and logistical support was vital for people's

motivation to the social network [23]. According to Sseguya [49], in some countries, women are barred from playing certain roles in groups or even participating due to cultural barriers. Whereas in others, for political reasons, community-based associations may be discouraged altogether [11,43,8].

4. Materials and methods

4.1. Study area

The study was conducted in nine fishing communities/social systems grouped into three axes, namely; Andoni axis (Okokiri, Oyorokoto, Ibot-Okpo and Muma); Borokiri axis (Ikpukulu, Andoni waterfront and Bundu waterside) and Eagle Island axis (Nkpor Village, Mgbuodohia) in Rivers State, the Niger Delta Region, Southern Nigeria. The choice of Rivers State and the fishing communities were purposively selected since they were active shrimp producers with varying socioeconomic conditions. The study sites account for over 90% of the country's shrimp production [18,42]. Andoni axis is arguably the largest fishing port in Nigeria in a rural setting with limited access to potable water, electricity and road network. Borokiri shrimp fishers' social system, being a semi-urban axis, had both characteristics of rural and urban centres. Eagle Island shrimp fishers' social network operated in a restructured waterfront because the government had developed the waterfront, destroying previous structures. Rivers State (Fig. 1) has many rivers and creeks with fishing communities inhabited by mostly artisanal (small--scale) fishers. Rivers State is bounded south by the Atlantic Ocean, to the North by Imo, Abia and Anambra States, to the East by Akwa-Ibom state and Bayelsa and Delta States to the West.

4.2. Research design

A cross-sectional research design was conducted from February to May 2018 using mixed methods of qualitative and quantitative approaches. The qualitative approach used a checklist for observation. Twenty key informants were purposively selected actors knowledgeable and willing to provide the needed information. Key informants provided data on the savings and assets of the shrimp fishers as well as the actor's motivation to join social networks. An interview guide was employed to collect the data. A sample size of 20 key informants was within Kumar [32] 15 to 35 sample size recommendation. The quantitative approach used a semi-structured questionnaire to elicit data on actors' relationships in financial resource pooling.

4.3. Study population and sampling procedure

A census of shrimp actors in each of the fishing communities was used. The study population was 200 shrimp fishers. A sample size of 125 was selected from the study population (200 shrimp fishers), as described by Krejcie and Morgan [30]. One hundred twenty-five shrimp fishers, accounting for 60% of the study populations, were purposively selected and interviewed using a semi-structured questionnaire to capture data about whom each actor relates with and the mode of financial resource pooling they were engaged in. The semi-structured questionnaire was pretested on a different population, and the tools were adjusted to ensure it accurately measured what was intended.

KIIs were conducted with purposively selected Twenty (20) stakeholders, namely the director of research at Nigeria Institute for Oceanography and Marine Research, the Head of Communication National Institute for Freshwater Research, the Head of M&E Federal Department of Fisheries (FDF), the Chairman of Fisheries Society of Nigeria (FISON) Rivers State, Director of extension Federal Ministry of Agriculture and Rural Development, Head ICT and statistics Rivers State Department of Fisheries, Chairman artisanal fishers association, Fishing community leaders and selected knowledgeable fishers. The respondents were coded R1 to R20. Data collected include fisher's savings and investments (other sources of income, what they spend their money on) and the factors that motivate shrimp fishers to join social networks. Shrimp fishers' investments were enumerated. The quantitative analysis was subjected to emerging factors motivating shrimp fishers to join social networks, support from an external agency, proximity to network members (km), Daily income (₦) and enabling institutional framework.

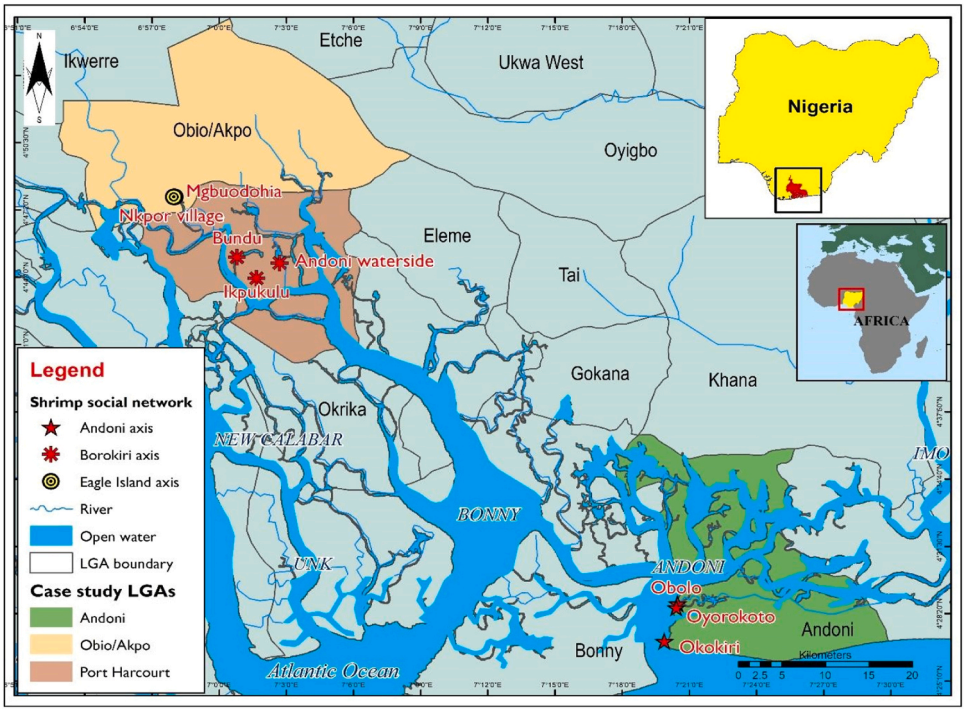

Fig. 1. Map of Rivers State showing the study area.

4.4. Analytical framework

The UCINET 6.647 Net draw generated a sociogram of actors' relationships to mobilise financial resources. Social network analysis provides three principal ways of measuring the extent to which a node is at the centre of a cohesive network: degree centrality, eigenvector centrality and closeness[15]. This paper uses degree centrality to explain the connections between nodes (shrimp fishers) and means of pooling funds in their network. Multiple Regression analysis was used to determine the relationship between the socioeconomic variables and factors that motivate shrimp fishers to join social networks. Socioeconomic characteristics such as gender, education, age, and years of experience in the shrimp business; and the purpose/factors motivating shrimp fishers to join social networks such as support from an external agency, proximity to network member (km), Daily income (₦) and enabling institutional framework were subjected to multiple regression. The implicit form of the multiple regression models is expressed as:

$$M=f(x_1, x_2, x_3, x_4, x_5, x_6, x_7, e) \ldots \ldots \ldots \quad (1)$$

Where:

M = motivation to join a network (a binary variable of yes/no. Yes = motivated by the factor to join the social network, no = not a motivating factor to joining the social network).

X_1= Sex (Dummy; 1 =male, 0 = female).

X_2= education level (years).

X_3 = age (years).

X_4 = years of experience in the shrimp business (years).

X_5 = support from external agency (Dummy;1 =received support, 0 = does not receive support).

X_6 = proximity to network member (Dummy;1 =close to network member, 0 = not close to network member).

X_7 = income (₦).

X_8= Enabling institutional framework (Dummy: 1 = institutional framework established, 0 =absent) e = error term.

It is expected a priori that $X_1, X_2, X_3, X_4, < 0$; $X_5, X_6, X_7, X_8 > 0$. Four functional forms (linear, exponential, semi-log and Double-log function) of the specified model were fitted to the data. The lead equation was selected based on the values of the coefficient of multiple determination, the magnitude of the F-ratio, the conformity of signs of the coefficient to a priori expectation, and the number of significant parameters.

5. Findings and discussion

5.1. Shrimp fishers' reciprocal financial resources

The study showed that shrimp fishers relate with one another to pool the financial resources needed to grow their fishing business (Table 1). Actors from the three axes in Rivers State are interlinked by financial commitment with a denser cluster (27.04%) for remittances and 24.71% for dues, respectively. The findings implied that most shrimp fishers received money from family members and relatives to invest in shrimp fishing. They also pay dues to the network from where they can obtain loans (17.06%) to buy fishing and processing equipment.

The sociogram (Fig. 2) used degree centrality, and the findings are that Dues had 42 connections, daily contribution (18), weekly contribution (17), Monthly contribution (14), loan from the network (29), donations (4) and remittances had the highest degree centralily of 46. This implied that most of the shrimp fishers received remittances.

Table 1
Sources of fund degree centrality.

Sources of fund	Degree	Percentage
Dues	42	24.71
Daily Contribution	18	10.59
Weekly contribution	17	10
Monthly contribution	14	8.24
Loan from network	29	17.06
Donations	4	2.35
Remittance	46	27.06

According to Hunter et al. [28], social network encompasses social interactions and personal relationships with friends, family members, colleagues and others with whom you share interests. In Rivers State of Nigeria, shrimp fishers' social network is based on individual fisher interaction with other actors. The shrimp fishers relate with other fishers in neighbouring fishing communities and have business partners who buy the shrimp from them to sell in local markets and supermarkets. This form of networking is similar to what is obtainable in places like Sweden [45], Hawaii [7] and Mozambique [12]. Studies by Barnes-Mauthe et al. [7] and Barnes et al. [6] have analysed individual fishers on how they relate with other actors and suggest that the stronger and more diverse a network, the better for fishers' access to resources. Blythe et al. [12] opined that those benefits, such as improved access to resources, can be achieved through conscious savings and investment, which builds the capital base of the shrimp fisher.

There are seven principal components of financial resource mobilisation among shrimp fishers (Fig. 3): donations, daily contributions, weekly contributions, monthly contributions, dues, loans and remittances. Degree centrality of the components indicates remittance as the strongest means of raising funds for the shrimp fishing business, while funds from donations by government, industries or agencies were the least.

Some shrimp fishers get a loan from social networks from members' contributions and dues with which they buy fishing equipment at the open market. Shrimp fishers' social networks in the three fishing axes of Rivers State were weak in lobbying for financial support to its members as they rarely visited political office holders or captains of industries seeking their support but expected the politicians to donate money or fishing inputs. The contributions and dues generated by social network members provide a financial pool/resources for poor shrimp fishers to acquire fishing equipment. When the fishers were asked how many times they visited the lawmaker representing them or any captain of industry for support, one said, *"Our political leaders come to us to seek our support to win elections, but after the elections, they remain in the city"* (Leader of a fishing settlement in Andoni 18th February 2018). Another respondent said, "*They like us to be underdeveloped, so they can have evidence to seek more allocations which enter their pockets"* (Middle-aged female fisher in Borokiri axis 25th February 2018). There is, however, the need to enlighten network actors on their role in lobbying for financial support from sources other than the network. There was a weakness in the social network to lobby for support from the government and industries.

5.2. Factors motivating shrimp fishers to belong to a social network

From Fig. 4, Eleven respondents (8.8%) said they did not join shrimp fishers' social network because there was an enabling institutional framework. However, enabling an institutional framework was a strong motivation for joining social networks. As a culture, fishing was another drive to join and become a member of social networks, as claimed by 70.4% (88) of the respondents. Political influence is not a motivation to join networks for 96.8% (121) of the respondents. Interest in group goals influenced (48.8%) the motivation of shrimp fishers to join social networks. However, 121 (96.8%) of the shrimp fishers favourably accepted that social networks improved their daily income; hence, they were motivated to belong to the social networks.

5.3. Relationship between some factors motivating shrimp fishers to join social networks and fishers' socioeconomic characteristics

Of the four variables related to motivation used in the multiple regression with socioeconomic variables, *enabling the institutional*

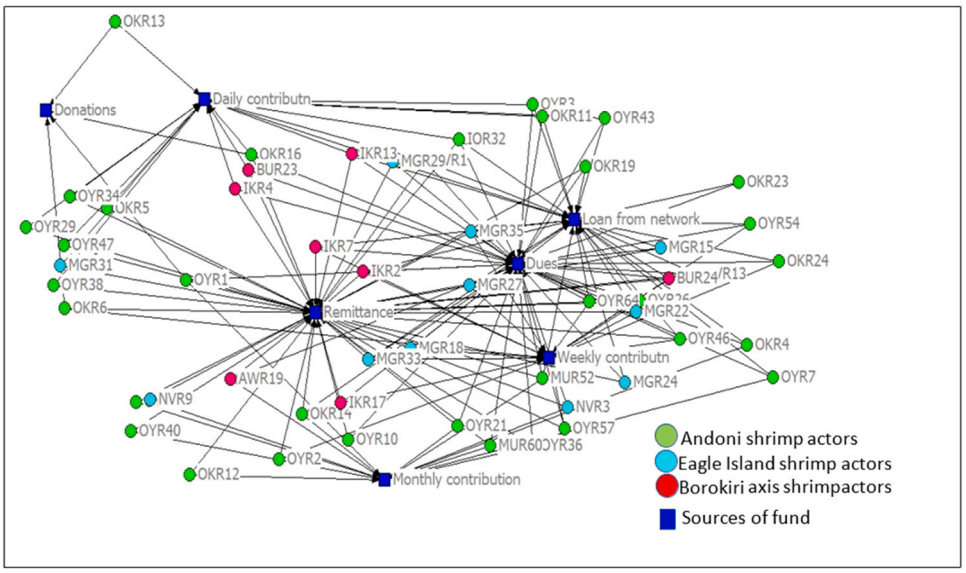

Fig. 2. Shrimp fishers' relationships and financial resources pooling.

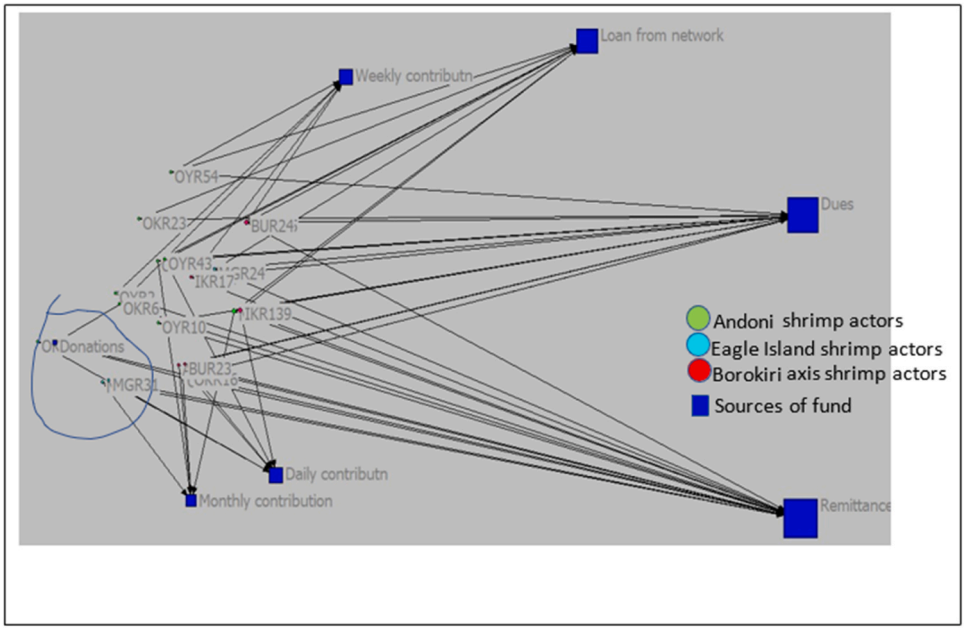

Fig. 3. Degree centrality of principal components of fishers' financial resources pooling.

framework makes the greatest contribution to motivation (Table 2). This is followed by *support from an external agency*, *proximity to network members*, and *marital status*. However, sex, age, education, experience, and income did not correlate significantly to motivation, suggesting that they did not influence the motivation of the respondents involved in the study.

Enabling institutional framework, support from external agencies and proximity to network members were significant ($p < 0.05$) motivating factors to join a social network.

6. Shrimp fishers' income sources and access to facilities

The shrimp fishers enumerated their fishing equipment as part of their income sources (Fig. 5). They acquired more fishing equipment, including nets, canoes, and engine boats. These investments are used to measure the shrimp fishers' wealth. For example, one of the respondents said he has fifteen nets of different mesh sizes. Another shrimp fisher said, "As *for me, I have four canoes which I give on hire, and sometimes I give to other fishers, and we share whatever fish that was caught*" (Elderly male shrimp fisher at Borokiri, 22nd April 2018). One of the fishers with three engine boats also has two blockhouses and four plots of land (50 m X 50 m). In some places, including the Andoni axis, where land ownership is restricted, some fishers have one to two plots depending on the availability of land. Shrimp fishers have diversified into non-fishing ventures such as 'okada' riding (motorcycle) and 'Keke' (tricycle) transportation. Some are involved in tailoring, craft making, carpentry and boat mechanics. Similarly, some fishermen established provision shops for their spouses as alternative businesses.

From Fig. 5, the Andoni axis, being more rural, had very limited access to hospitals and schools compared to the Borokiri and Eagle Island axes. Hence, the percentage of shrimp fishers with no formal education in Andoni was 60% compared to Borokiri and Eagle Island, which

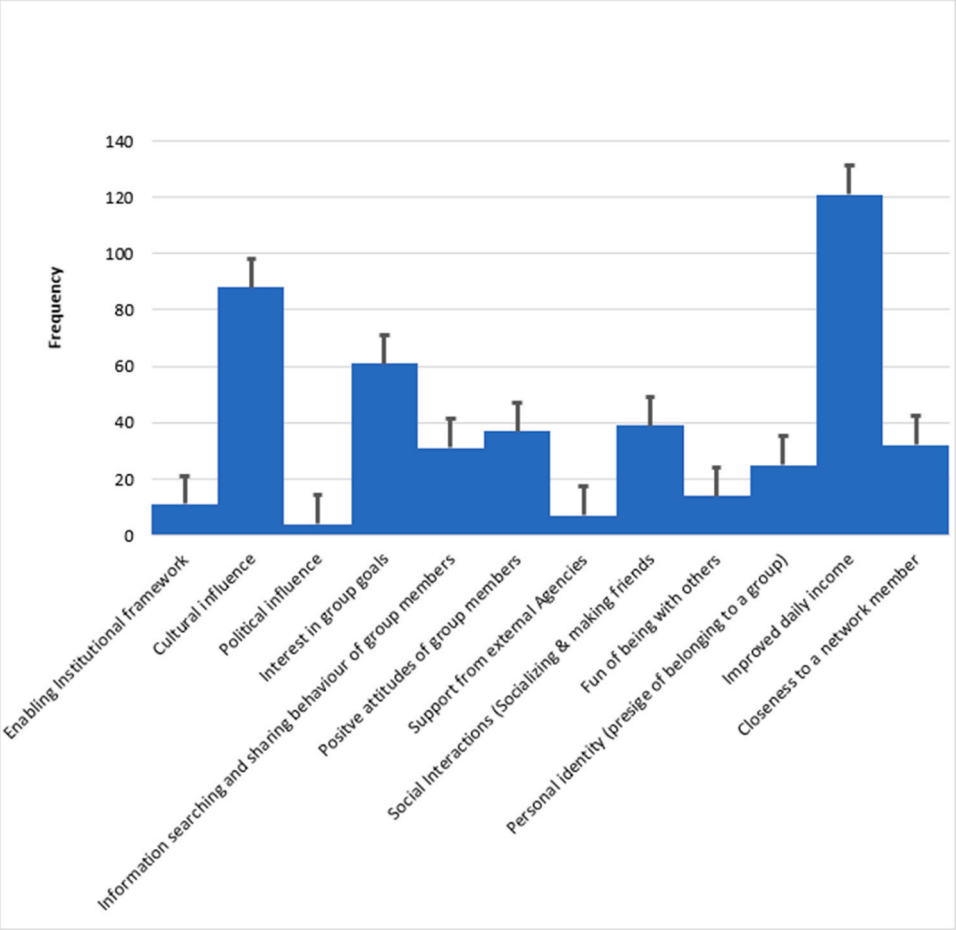

Fig. 4. A survey of motivating factors for social network.

were 20% and 10%, respectively. Because shrimps were a common pool resource, all the fishers had equal access. However, access to land among shrimp fishers varies based on heritage, availability of land and purchasing ability. Hence, the proportion of shrimp fishers investing in the land was highest (44%) in Andoni, followed by Eagle Island (30%) and least in Borokiri (20%).

The common water sources in the fishing communities in Rivers State were wells and boreholes. About 90% of shrimp fishers in Andoni accessed well water. At the same time, in Borokiri and Eagle Island, 30% and 40% accessed drinking water from the wells. Shrimp fishers also engaged in non-fishing activities such as commercial Okada (motorcycle) riding and Keke (tricycle) transportation. Okada was popular only in the Andoni axis, while Keke driving was common in the Borokiri and Eagle Island axes. Investments in a dugout canoe, engine boats and fishing nets were common among shrimp fishers, but the depth, size and location of fishing grounds, as well as distance from the shore, determined the net quality to be deployed. A fishing community leader said, "*Those who have engine boats can afford to go farther into the sea to catch the big shrimps' oporo' with different nets on board, whereas us that have the dugout canoes do not go far from the shore to avoid canoe cap side*" (Leader of fishing settlement in Andoni). Investment in children's education and establishing businesses for spouses and children created alternative income sources.

Oyorokoto, a major fishing settlement in the Andoni axis, was observed to have most of the expensive fishing gear. Blockhouses with metal roofing sheets measured wealth with over 80% in Eagle Island and less than 60% in Andoni and Borokiri axes. However, due to urbanisation in the capital city of Port Harcourt, Borokiri and Eagle Island, axes had received a boost in infrastructure. One common practice among shrimp fishers was establishing petty trade/supermarkets for their spouses, generating non-fishing income (Fig. 5). The shrimp fishers enjoyed social network with other fishers and actors in the shrimp business. Their family members lived with them in the same settlement, as well as their spouses. Over 70% of the shrimp fishers in the Andoni axis had strong social capital, followed by over 60% in Eagle Island and Borokiri axes.

7. Reciprocal financial relationship on income sources

More resources pooled through remittances from relatives and family members suggest that fishers relied strongly on funds obtained from external sources for investment rather than what they generated from the shrimp enterprise. However, combined financial resources from dues and contributions, which members access as loans, equally fund the intensification of fishing efforts [53] and the diversification of off-fishing enterprises (Scoone, 1998). Mobilising the least amount of funds through donations implied the weakness of social networks in Rivers State. Lin [35] reported that lobbying for financial support was a critical role of a social network. Bebbington [9] and Kusimba et al. [34] indicated that finance mobilisation strengthens the social network and enables the individual members and the network to raise money for their desired purpose. Lobbying has been reported to enable access to resources. For example, lobbying by the social network is known to provide access to water resources [27], wetland and forest reserves [26,55], loans and credit facilities [10] and fisheries [54]. Further, lobbying for support for network members is a critical function of social networks. Network Advocates for Catholic Social Justice [40] highlighted ways to lobby for support, including telephone calls, emails, social media

Table 2
Multiple regression for motivation to network with some socioeconomic characteristics of shrimp fishers (from survey).

_coefficients	Standardised coefficients				
Variables	B	Standard Error	Beta	T-values	P-values
(Constant)	-4.059	1.773		-2.289 *	0.024
Sex(dummy)	0.385	0.323	0.093	1.190^{NS}	0.236
Age (Years)	-0.020	0.015	-0.133	-1.321^{NS}	0.189
Marital status (dummy)	0.752	0.403	0.164	1.867 * *	0.064
Education (years)	0.046	0.037	0.104	1.255^{NS}	0.212
Experience on shrimp (Years)	-0.020	0.016	-0.115	-1.260^{NS}	0.210
Enabling institutional framework (dummy)	2.584	0.541	0.366	4.779 *	0.000
support from external agency (dummy)	2.162	0.646	0.249	3.346 *	0.001
Proximity to network member (dummy)	1.078	0.344	0.236	3.132 *	0.002
Income (₦)	6.559E-6	0.000	0.027	0.367^{NS}	0.714
F-ratio	9.8585				
R^2	0.429				
N	124				

*Significant at 5% level; * *Significant at 10% level; NS= Not significant.

advocacy, visiting congress members representing the constituency, and writing a letter to the editor of national newspapers and Magazines.

Similarly, increased daily income, the most motivating factor for fishers to join a social network, suggests actors' priority in network formations. For example, the fish trading network on Kenya's coast showed that 54% of males and 15% of females engaged in fish trading lived above the poverty line [19]. FAO [19] fisheries report in West Africa showed a fishing niche among fishers in which the men are more involved in fishing deep into the sea, whereas women fish nearer the coast. Additionally, the women process the fish, sell them at the market, and provide credit facilities for other fishers. Bebbington [10] reported that savings and credit facilities among social network members create investment opportunities. However, Gunawan [25] reported that 82% of trammel net fishers and 94% of mini trawl fishers of shrimps in Berau, Indonesia have no savings. According to him, "*some of the fishers have alternative livelihood on lands like gardening and upland rice cultivation. Some others cannot afford to buy land as it is expensive*" ([25] *p. 70*). Similarly, shrimp fishers' income source depends not only on savings from shrimp fishing.

8. Shrimp fishers' motivation for social networks

Several factors motivated shrimp fishers to be part of a social network. The most important motivating force identified by respondents was improved daily income (96.8%). This finding implies that opportunities for enhancing their economic power were possible with shrimp fishers' social networks. This finding agrees with Ekong [17] and FAO [19], who noted that group membership offers economic gains to its members, especially in income generation and food security. Asiabaka and Asiabaka [5], Blythe et al. [12] and FAO [19] observed that social networks provide access to markets for fishers, and they have the resources to provide the necessary logistics to sell their produce.

The next important motivating factor identified by respondents was cultural influence (70.4%). It has been observed [1] that group membership enhances socialisation, such as enforcing social norms in families and kindred groups and fostering socio-cultural development. Also, respondents indicated that interest in group goals (48.8%) motivates people to belong to a social network. This agrees with Agumagu and Adesope's [1] assertion that motivation to belong to a network revolves around need and satisfaction. According to Slater [48], the more people walk together and rely on each other, the more the team functions successfully. Asiabaka and Asiabaka [5] stated that group members interact in such a way that one member's behaviour influences the others' behaviour. This is related to what Katzenbach and Smith [29] reported as a collective work product which reflects the joint, real contribution of team members.

From the findings, 25.6% of the respondents identified closeness to a network member as a motivating force to suggest that Man is naturally a social animal. Every human being is fundamentally a member of one group or the other [1]. Ekong [17] has explained that the group serves to satisfy the need for affiliation. Information searching and sharing behaviour of group members (24.8%) motivated respondents, suggesting the collective function of group dynamics. Another motivating force identified by respondents was personal identity (20%). This referred to members who take pleasure and pride in being identified to a social network. This is more prominent in Peru, where membership in fisheries cooperative earn fisher access to fish and access to the market [19].

According to Hoffman [27], feelings of trust and safety enhance participation in a network like the shrimp fishery. This is true, especially when the safety of fishers is threatened, and every other fishing boat comes to the rescue. The motivation for networks and participation in them depends on the expected benefits accruable to both participants and the networks themselves [46,51]. Network interactions linking individuals in communities are critical in enabling access to information,

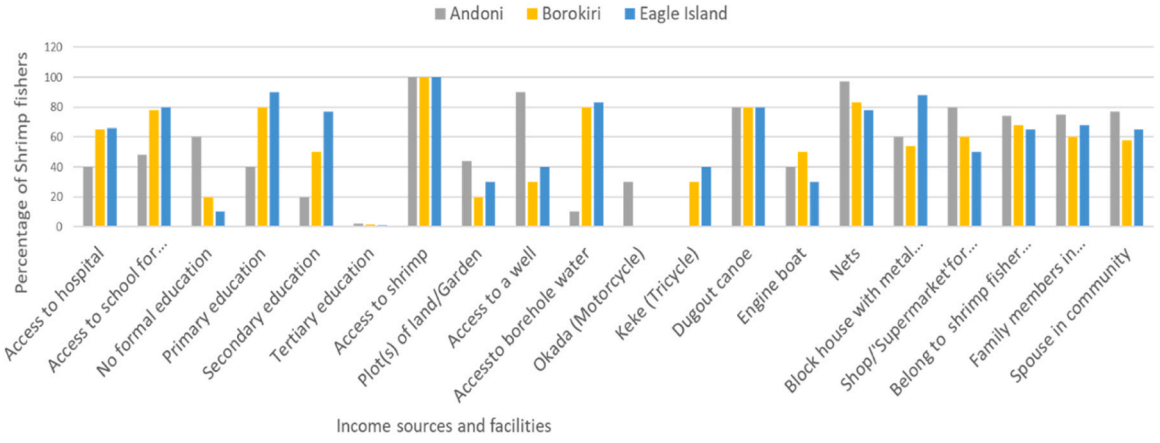

Fig. 5. Shrimp fishers' income sources and facilities in fishing axes of Rivers State.

income and other resources. Further, strong networks of interactions linking market actors help open market possibilities to rural producers and increase their ability to turn their assets into income for improved access to resources [9,41,50]. Since they serve in group leadership positions, educated fishers are needed in social networks. However, they are not motivated to identify with local networks, and many often want to migrate to urban areas where they have access to basic facilities [31, 37,47].

On the other hand, enabling institutional framework (EIF) was significant and positively (4.779, $p < 0.05$) correlated as a motivation factor to make shrimp fishers join social networks. This implies they will likely cooperate when a social network is established as an institutional framework among shrimp fisher folks. This is true of the Republic of Korea and Japan, where the government empowers cooperatives to make laws and manage the fisheries. As such, cooperative membership gives one access to the fisheries [19]. A one standard deviation change on *enabling institutional framework* produces a 0.37 standard deviation in *motivation.*

Further, there was a positive and significant (3.346, $p < 0.05$) relationship between support from external agencies and shrimp fishers' motivation to form social networks. This indicates that support (aid) from external agencies would motivate shrimp fishers to work as a team through social networks compared to when there is little or no support from an external agency. A change of one standard deviation in *support from an external agency* produces an increase of 0.25 of a standard deviation in *motivation*. Proximity to network members was also positive and significant.

(3.132, $p < 0.05$) correlated as a motivation factor to shrimp fishers' social network. Proximity/closeness fosters interaction among individuals, which may strengthen ties among members of social networks. A change of one standard deviation in *proximity to a network member* produces a change of 0.24 of a standard deviation in *motivation*.

9. Shrimp fishers' investment

Shrimp fishers in Rivers State, like any other traditional fishers, get income mainly from fishing and the sale of the fish, though they have off-fishing businesses which also generate income [13,24] from where the shrimp fishers make savings by engaging in daily and/or monthly contributions [12]. FAO [19] identified savings in peak capture seasons to build the fishers' capital base. The report further recognised fishers' productive investments in boats and fishing gear, technology, and services such as technical skills. The shrimps as natural resources are valued to contribute over $70 Million US dollars per year to Nigeria's economy [39]. Blythe et al. [12] concluded that fishers with higher investment in fishing gear, more livelihood options, social groups and family networks had higher chances for intensification of fishing and diversification into other means of livelihood in the event of stress. However, shrimp fishers' investments varied with geographical locations.

Ghosh et al. [24] showed that fishing was the main occupation in Teknaf Bangladesh; however, their non-fishing activities also generated income for livelihood. While Bebbington [10] suggested that monetary contributions among network members influence investment, Ghosh et al. [24] reported that fishers who do not engage in monetary contributions have no savings from their fishing enterprise. However, actors in a social network that engages in monetary contributions are likelier to invest a portion of their profits [10]. Bebbington [10] reported that credit facilities among social network members create investment opportunities. However, Gunawan [25] reported that 82% of trammel net fishers and 94% of mini trawl fishers of shrimps in Berau, Indonesia have no savings but rather investments. According to him, "some fishers have alternative livelihood on lands like gardening and upland rice cultivation. Some others cannot afford to buy land as it is expensive" ([25]:70).

10. Conclusions and recommendations

The study concludes that the shrimp fishers in Southern Nigeria have limited income sources to remain in the shrimp business. Their engagement in reciprocal financial relationships and investment successes were evident in diversifying into off-fishing ventures such as establishing shops, supermarkets and transportation (tricycle and motorcycle) businesses, thus improving their income sources.

The study further offers some comprehensive and actionable frameworks for policymakers, government agencies, and stakeholders to enhance the economic prospects of shrimp fishers in Southern Nigeria.

1. Policies to enhance financial inclusion among shrimp fishers should be developed. This could involve collaborating with local financial institutions to create tailored financial products and services that cater to the unique needs of fishers, making it easier for them to access credit, savings, and insurance.
2. Training programs should be implemented to improve financial literacy and management skills among shrimp fishers. Such programs can empower them to make informed decisions about managing their income, investments, and financial contributions.
3. Policies to support and strengthen social networks within the fishing communities should be developed. This can include initiatives to foster collaboration, trust, and effective communication among fishers. Government or non-governmental organisations can provide resources and guidance to help fishers create and maintain these networks.
4. There is a need to collaborate with financial institutions to provide easier access to microcredit and loans for shrimp fishers. Mechanisms should be established to ensure fair and transparent loan approval processes, affordable interest rates, and flexible repayment terms.
5. The establishment of off-fishing ventures by providing incentives or grants to shrimp fishers who diversify their income sources should be encouraged. This can involve creating targeted programs that support the development and sustainability of these ventures.
6. Align policies with SDG 16 (Peace, Justice, and Strong Institutions) and SDG 17 (Partnerships for the Goals) to emphasise the importance of building strong social networks and partnerships to support sustainable economic development.
7. A regulatory framework that formalises the reciprocal financial relationships among shrimp fishers should be developed. This framework can provide legal recognition and protection for these practices, making them more secure and transparent.
8. A system for collecting and monitoring data on shrimp fishers' financial interactions and income sources should be developed. This data can inform policy decisions and help evaluate implemented policies' impact over time.

CRediT authorship contribution statement

Komi, Gentle Wilson: Conceptualization, Methodology, Writing – original draft. **Turyahabwe, Nelson:** Supervision, Review & Editing. **Isubikalu, Prossy:** Supervision, Review & Editing. **Adesope, Olufemi Martins:** Supervision, Review & Editing. **Okodudu, Stephen:** Supervision, Review & Editing. **Sunday Nkopuyo Udoekpo:** Data collection, Data analysis, Writing – original draft.

Declaration of Competing Interest

All authors must disclose any financial and personal relationships with other people or organisations that could inappropriately influence (bias) their work. Examples of potential conflicts of interest include employment, consultancies, stock ownership, honoraria, paid expert testimony, patent applications/registrations, and grants or other funding.

Data availability

The datasets used and/ or analysed during the current study are available from the corresponding author upon reasonable request.

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