

## **Assessment of Occupational Practices Among Artisanal Fisherfolks in Borgu Local Government Area, Niger State**

### **Abstract**

The study was carried out to assess the occupational practices among artisanal fisherfolks in Borgu Local Government Area of Niger State. A total of 110 well-structured questionnaire was used to collect primary data from respondents in the study area. The study examined four fishing villages in New Bussa where it was observed that the fisherfolks are predominantly youths (33.6%) within the age bracket of 36-45 years having 50.5% with primary school as their highest qualification, and the data shows that 73.6% are into artisanal fish farming for job creation which have reduced migration to urban cities and increase economic activities in their communities, thereby providing skilled and unskilled jobs and foreign exchange for the country while reducing youthful restiveness and anti-social activities. More so, the drive to remodel value chains by supplying quality fish for high value markets is opening up many possibilities in production and processing. Young entrepreneurs have seen this opportunity and are taking it up as a viable business. However, the study revealed that the fisherfolks in the study area usually lack basic social amenities and employ the most traditional gears and crafts in the fishing activity, and therefore, there is need for government to intervene and provide the most basic social amenities like roads and electricity to the communities.

Keywords: Artisanal, Borgu, Fisheries, Occupation, Youths.

### **Introduction**

Artisanal fishing is a small-scale fish business that employs the use of low inexpensive craft and gears during operation. It is also a commercial fishing, where they sell the best of their catches to layer population; leaving the rest for family consumption, their characteristics are as follows, the gear employed are generally simple and land operated, the craft is usually simple and traditional e.g., dugout canoes, calabash, small open boats which may be wooden. With size ranging from 7-18mm length. Their fishing is labour intensive and there by being of low capital investment; their infrastructure facilities such as storage and processing plant are poorly developed.

The fishing unit is generally lightly scattered. In remote hardly accessible villages this makes the distribution of the products rather difficult, there is high percentage of spoilage and wastage under such conditions. Artisanal fishery lacks credit backing from bank and their financial houses, most of them lack collaterals in most instances which will be difficult to attain loan from the Bank. (Ogbe and Odiba 1996)

Apart from full time fishermen, there are part time fisherfolks who engage in other activities such as farming. Thousands of fisherfolks migrate seasonally from their villages to other fishing communities or settlements. Both within and outside the country. Fisherfolks from Cameroon, Ghana, Benin Republic have migrated and settled in far coastal villages since the 19<sup>th</sup> century (Solarin 2003).

The small-scale Artisanal fishery sector remains the backbone of fish production in Nigeria, contributing a minimum of 70% of the total fish production in the last decade. In 2000, a total 101, 101 fishing units operated by 283,292 fishermen produced 325,100 tons of fish (Solarin 2003).

The potential for further growth of artisanal fisheries in the region is promising. Such growth could be realized through improvements in technologies and resource use, intensification, integration of aquaculture with other farming activities, and development of additional areas for aquaculture.

The pressure created by the supply gap deficiency of consumable alternative protein sources (fish) is not far-fetched from dwindling natural fish stocks (FAO/World Fish 2015) growing demand for fish (Sangaralingam, 2013; Adewumi, 2015) and human population increases (Stefania, 2015) to say the least.

Fish is one of the most paramount and well-known aquatic creatures whose production harvests and activities goes beyond food production. It provides raw materials to industries, especially the pharmaceutical and animal feed industries.

The economic contribution and the significant roles played by artisanal fish farming in nourishment, employment creation, income generation, income diversification, revenue generation, food security continues to rise. Available observations and information on the activities of artisanal fish farming in Borgu Local Government shows that more than half of

the fish products taken out of Borgu Local Government either fresh or smoked are harvested from artisanal fisherfolks.

Inadequate access to finance, which prevents the fishermen from expanding their artisanal fishing business and diversifying into other agro business to improve livelihood, and there are inadequate extension services to educate the rural populace that are mainly fisherfolks in the study area. There is a decay in already established infrastructures and lack of modern infrastructure and social amenities such as motorable road, electricity supply, pipe borne water, primary health centre.

The present study, therefore, aimed towards the assessment of occupational practices among artisanal fisherfolks in Borgu Local Government Area, Niger State.

## **Methodology**

### **Study area**

Borgu Local Government is an administrative region in Niger State, Nigeria, with its headquarter in New Bussa. It has a population projection of 242,800 according to the 2006 Census. Borgu Local Government has an area of 11,267km<sup>2</sup> with a density of 21.55/km<sup>2</sup>. It lies in the northwestern area of the state and covers the districts of Borgu, Dugga, Babanna, Karabonde, Konkoso, Malale, New Bussa, Shagunu, Wawa and Riverine areas. Borgu Local Government is bordered by Agwara, Mashegu and Mokwa Local Governments. Borgu Local Government Council controls the public administrative council makes law that governs the local government area.

This study covers four, fishing villages, Awuru, FakunYuna and Monnai in the lake (Kainji). The Artisanal fisherfolks in all these villages were the main focus of this research work.

### **Method of data collection**

Primary data was utilized in this study. The primary data was collected with the use of structured questionnaire designed to address the objectives of the study which is complemented with interview schedules. The questionnaire contained both open and close ended questions which elicit answer to questions concerning demographic Information and non-demographic information, which borders on fishing activities and problems encountered. A simple random sampling method was employed in administering the questionnaire. Four villages were identified (Awuru, Fakun, Yuna and Monnai and One hundred and Ten(110) questionnaires were dispersed into the four fishing villages.

### Data analytical techniques

The primary data collected with the aid of well-structured questionnaires administered on artisanal fisherfolks was analysed using SPSS Software by employing descriptive statistics, frequencies, and percentages.

## Results

### Section A: Demographic information of respondents

**Table 1: Personal characteristics of the respondents**

Parameter	Number of respondents	Percentage (%)
<b>Sex</b>		
Male	90	81.8
Female	20	18.2
<b>Total</b>	<b>110</b>	<b>100.0</b>
<b>Age Bracket</b>		
18 -25 years	18	16.4
26-35 years	29	26.4
36-45 years	37	33.6
46 years and above	26	23.6
<b>Total</b>	<b>110</b>	<b>100</b>
<b>Level of Education</b>		
No formal Education	14	12.7
Primary Education	24	21.8
Secondary Education (Complete)	34	30.9
Secondary Education (Incomplete)	24	21.8
Tertiary Education	14	12.7
Others (Please specify)		
<b>Total</b>	<b>110</b>	<b>100</b>

<b>Occupation</b>		
Artisanal Fishing	81	73.6
Crop Farming	19	17.3
Trading	10	9.1
<b>Total</b>	<b>110</b>	<b>100</b>
<b>Marital status</b>		
Single	19	17.3
Married	65	59.1
Divorced	10	9.1
Widowed	16	14.5
<b>Total</b>	<b>110</b>	<b>100</b>
<b>Religion</b>		
Christianity	45	40.9
Islam	63	57.3
Traditional religion	2	1.8
<b>Total</b>	<b>110</b>	<b>100</b>
<b>Tribe</b>		
Yoruba	11	10.0
Hausa	42	38.2
Igbo	6	5.5
Urhobo	51	46.4
<b>Total</b>	<b>110</b>	<b>100</b>
<b>Are you migrating in your fishing activity?</b>		
Yes	76	69.1
No	34	30.9
<b>Total</b>	<b>110</b>	<b>100</b>
<b>Number of Family Member</b>		
1 -3	6	5.5
4-6	32	29.1
7-9	53	48.2
10 above	19	17.3
<b>Total</b>	<b>110</b>	<b>100</b>

**Table 2: Social amenities within the four fishing villages.**

Items	Yes	Percentage (%)	No	Percentage (%)
Do you have a school in your locality	101	91.8	9	8.2
Primary	101	91.8	9	8.2
Secondary	89	80.9	21	19
Both	89	80.9	21	19
Is there a health Centre/Clinic?	109	99.1	1	0.9
Do you have a marketplace?	110	100.0	0	0.0
Is there a jetty at your landing point?	86	78.2	24	21.8
Is there a road network linking villages in your locality?	81	73.6	29	26.4
Do you have a meeting place?	109	99.1	1	0.9

**Section B:****Table 3: Fisherfolks practices in the four fishing communities.**

Type of fishing	Frequency	Percentage
Artisanal	80	72.7
Industrial	15	13.6
Subsistence	15	13.6
<b>TOTAL</b>	<b>110</b>	<b>100</b>
Type of fishing crafts mostly used	Frequency	Percentage
Canoe	89	80.9
Boats	21	19.1
<b>TOTAL</b>	<b>110</b>	<b>100</b>
Age of Crafts	Frequency	Percentage
1 Year	68	61.8
1 <sup>1/2</sup> Years	24	21.8
2 years	18	16.4
<b>TOTAL</b>	<b>110</b>	<b>100</b>
Mode of Propulsion	Frequency	Percentage
Paddle and Pole	91	82.7
Outboard Engine	18	16.4
Wind Skills	1	0.9
<b>TOTAL</b>	<b>110</b>	<b>100</b>
Cost of Craft	Frequency	Percentage
₦12,000 - ₦15000	29	26.4
₦16,000 - ₦17,000	68	61.8
₦18,000 - ₦20,000	13	11.8
<b>TOTAL</b>	<b>110</b>	<b>100</b>

Place of Purchase	Frequency	Percentage
Malale	91	82.7
Fakun	19	17.3
<b>TOTAL</b>	<b>110</b>	<b>100</b>
Types of fishing gear employed in fishing	Frequency	Percentage
Cast net	33	30
Long line	9	8.18
Malian Traps	14	12.73
Gillnet	52	47.27
Others	2	1.82
<b>TOTAL</b>	<b>110</b>	<b>100</b>

**Table 4: Benefits derived from resettlement programme.**

S/No.	Benefits Derived	Always	%	Someti me	%	Not at all	%	Total
1	Occupation	86	78.2	12	10.9	12	10.9	110
2	Source of Income	99	90.0	8	7.3	3	2.7	110
3	Self-reliance	48	43.6	48	43.6	14	12.7	110
4	Housework	59	53.6	46	41.8	5	4.5	110
5	Irrigation	60	54.5	32	29.1	18	16.4	110

**Table 5: Percentage distribution of the benefits derived from respondents' spouse.**

S/No.	Benefits derived	Frequency of derived benefits	Percentage (%)
1	Assist in processing	72	65.5
2	Selling of fish	90	81.8
3	Assist in training the children at home	110	100.0
4	Assist in training the children at School	56	50.9
5	Cooking of food	110	100.0
6	Washing of cloths and plate	110	100.0

**Table 6: Distribution showing the benefits derived from respondents' children.**

S/No.	Major benefits derived from children	Frequency of derived benefits	Percentages
1	Processing of fish	30	27.3
2	Assisting in Settling net and amendment	60	54.5
3	Selling and marketing of fish	9	8.2
4	Cutting of grasses for the cows	25	22.7
5	Removing fish from net and boat canoe	15	13.6

**Table 7: Percentage distribution of problems encountered by fisherfolks.**

Problems encountered by fisherfolks	Strongly agree	Agree	Disagree	Strongly disagree
Receding of water position	6.4	40.3	31.9	5
Cost of transportation to water site	12.7	15.1	33.3	23.5
Use of small mesh size of net	7.7	73.9	5	5

**Table 8: Percentage distribution of the priority of problems in artisanal fisheries.**

S/No.	Problems in artisanal fisheries	Frequency of derived benefits	Percentage
1	Lack of access to Loan from Government or banks	46	41.8
2	Use of illegal mesh size of net	9	8.2
3	Cost of Materials use	19	17.3
4	Inadequate facilities for irrigation	16	14.5
5	Lack of motorable roads to market	20	18.2
	<b>TOTAL</b>	<b>110</b>	<b>100.0</b>

### Discussion

The results of the investigations were discussed and presented in eight tables below, Table 1 is on the selected personal characteristics of the respondents. Response on the age bracket revealed that majority (33.6%) of the respondents in the study area fall at the age range of 36 – 45 years of age followed by 26-35 years of age bracket with 26.4%, 46 years and above has 23.6% while 18-25years has a percentage of 16.4%.

Response on level of education shows that secondary school levelers have the highest with 30.09% followed by both drop out of Secondary school and Primary Education have 21.8% closely follows by both no formal education and tertiary education respondents with 12.7%.

Response on occupation indicates that 73.6% engages in Artisanal fishing while 17.3% engages in Crop farming while a little as 9.1% are traders. This indicates that most of the respondents are artisanal fishermen and take crop farming and trading as an alternative source of income. 59.1% of the respondents are married and 17.3% are single but 14.5% are widowed with 9.1% being divorced. This indicates that most respondents are engaged and

responsible and fully engaged in artisanal fishing activities. On religion, 57.3% of respondents are Muslims while 40.9% are Christians, about 1.8% practices traditional religion.

Fisherfolks in the four-fishing villages have garnered fishing experience that spanned from 3 years to 16 years but those that have more than 6 years fishing experience are over 50% of the respondents which collaborates with artisanal fishing as their major occupation.

On tribe, majority of the respondents are Urhobos with a percentage rate of 46.4%, they dominate the artisanal fishing activity with the Hausas with 38.2% which is followed by Yorubas with 10%. On the number of members of the family, 48.2% have 7-9 households' members with 4-6 household members having 29.1% while 10 and above have 17.3% with 1-3 have the least with 5.5%.

Most of the fishermen engages in fishing activities by migrating from one source to another due to receding of the water bodies which makes about 69.1% migrating while 30.9% don't migrant for their fishing activities.

Table 2 shows the Percentage distribution of respondents that responds to social amenities and fishing facilities in their surroundings. 91.8% of the respondents have school in their locality while 91.81 have Primary school and 80.9% have Secondary which implies that same 89% have both Primary and Secondary in their various locality but a little percentage have no school as indicated in Table 2 above. 19% of the respondents have neither Primary nor Secondary in their locality. 99.1% have access to medical care due to the presence of Health centre/ Clinic but 1% have no access to Clinic.

All the respondents have market in their locality, this implies that there is a ready market for the artisanal farmers to sell their harvest, but the price and demand is not encouraging. 78.2% have a jetty at their landing point but 21.8% have either no jetty or landing site. 73.6% accepted that they have access roads that link their villages and neighboring communities

while 26.4% have no link of roads within their communities, which makes it difficult for them to move their harvest to the nearby market, which affects their means of livelihood. 99.1% of the respondents have meeting place but only 0.9% have no meeting place. The respondents have a meeting place where decision reached on happenings around them are discussed.

In table 2, it indicates that 72.7% of the respondents are engaged mostly in artisanal fishing and it is their major source of income and means of livelihood while 13.6% are engaged in Industrial fishing and subsistence fishing. Those that are engaged in Industrial fishing mainly migrate into the deep river while those in subsistence fishing engage in just little catch for their family members consumption only.

Majority of them use canoe (80.9%) as against those that use boats (19.1%) as fishing crafts. While 61.8% crafts are within the period of one year with the least value of 16.4% of those that their crafts are more than 2 years. 82.7% of the respondent's mode of propulsion uses paddle and pole while 16.4% mode of propulsion uses Outboard Engine with the least mode of propulsion that uses wind skills. 26.4% cost of crafts they purchase is within the range of ₦2,000.00 to ₦15,000.00 while most of them purchase their craft in the range of ₦16,000.00 to ₦17,000.00 with a high value of 61.8% which indicates that they got the genuine ones within the range.

Majority of the fisherfolks purchase their crafts from Malale with a percentage of 82.7% while 17.3% make their purchases from Fakun. 47.27% of respondents use gillnet as gear with a least value of 8.18% with long line as their fishing gear.

Table 4 shows the benefits derived from resettlement programme shows that 90.00% create occupation for the fishermen and thereby create sources of income which makes them self-reliance but 78.2% of them take it as their major occupation. 10.9% did not take it has

occupation and 29.1% sometimes benefits from the irrigation projects in their community. The housework of fishermen as party only 53.6% are engage at home while most are fishing due to large farms but very few enjoys the irrigation fishing as some are able to acquire pumping machines that are used for irrigation purposes.

Table 5 shows that the benefit from spouse indicates that 65.5% of their spouse assist in processing their harvest. This is done by cutting, smoking, salting, and drying to edible taste for either consumption or marketing purposes. 100% cooks the food, washes cloths and assist in training the children at home and this is done by inculcating to them domestic and moral knowledge that will impact in their live.

Table 6 indicates that the major benefits derived from their children are as outlined and over 50% agreed that their children assist them mostly in settling net and amending the tore nets for next fishing expedition, this is follows by cutting of grass for cows and other domestic animals which serve as an alternative for them. Their children assist in providing the feeds for those animals, but they are not too involved in selling and marketing of the harvested fish as this is mainly the job function of their mothers who process by cutting into slices, smoking, salting and drying for the purpose of either marketing or consumption. While 13.6% help in removing fish from net and boat after harvest, though this is done by both the dad and the kids.

Table 7 indicates the problems encountered by fisherfolks in relation to resettlement are based on either agreed or disagreed by fisherman and this may be due to his or her location and means of livelihood. Most percentages totally agreed that the receding of water affects their catch rate during dry season because the water level reduces, and the fishes follow the water to its destination which makes the fishermen go into deeper waters to get little harvest unlike the rainy season that they get catch closer to the riverbank. 12.7% agreed that cost of

transportation to water site is a major challenge they face while 23.5% are of the opinion that the cost of transportation is not a challenge, and this is mainly because they reside along the riverine area and their various catching site is closer to their various homes.7.7% opined that the use of small mesh size of net affects their harvest, and this makes most of them to resettle to places where catch is high and where the use of small mesh are officially discourage and the promulgation of the State edict exist.

Table 8 clearly shows the problems encountered by farmers are too numerous and it have been highlighted based on the priority of the challenges faced by farmers. The major problems faced by artisanal fisherfolks are lack of total access to loans and grants by Government and very high interest rate by both Government owned Banks and commercial Banks which shows the high value of 41.8%.The fisherfolks are faced with high cost of fishing materials with a percentage value of 17.3%, which have disallowed them from having large catch as expected thereby affecting market demand of fish in the market, and some fisherfolks use illegal mesh size of nets in catching fish which are supposed to grow up to table size before harvesting affect fisherfolks and fishery industry at large.

Inadequate facilities for irrigation show 14.5% is a problem which would have enable fisherfolk farm fish all through the year to be able to meet up the demand in the market. Irrigation facilities that are readily available are very expensive and some go for leased which do not meet up the standard of fishing.

Finally, 18.2% shows lack of accessible roads to farms and to markets and especially urban centres where products are transported to before exporting are not accessible. The state of the roads is very bad and not motorable.

## **Conclusion**

As indicated in the result of this study, most of the artisanal fisherfolks in the study area are using dugout canoes, gill net, which mostly lack basic accessories, at the same time there is lack of basic social amenities such as good roads in the localities which will improve fish supply from the artisanal fisherfolks in the study area to urban areas that will greatly enhance fish productivity. From problems noted above, artisanal fisherfolks in the study area can be supported through the following ways: supply of input as subsidized price e.g., canoe, outboard engine and fishing gear, having accessibility to loan from agriculture banks, through enlightenment campaign, government should focus on techniques of fishing through extension agents on production.

## References

- Abubakar, U. (2015). Economics of fish farming in Borgu local government area of Niger State, Nigeria. Unpublished national diploma of fisheries technology project, federal college of freshwater fisheries technology, New Bussa, Niger State, Nigeria, 5 – 9.
- Adegbiji, J. A. (2001). Investigating public relations as agent in fishermen adoption of fisheries edict in kainji lake basin, Nigeria.unpublishedmaster's thesis.university of Ibadan. Oyo State, Nigeria. 37-38
- Adetunji, A. A. (2011). Fish production, poverty alleviation Nigeria. unpublished bachelor of aquaculture and fisheries management project, university of agriculture Abeokuta, Ogun State, Nigeria.
- Agboola, W. L. (2011). Improving fish farming productivity towards achieving food security in Osun State, Nigeria: Socio- economic analysis. *Scholars research library, Annals of biological research*, 2 (3), 62 – 74.
- Ajibefun I. A. & Daramola, O. (2003). Determinants of technical and allocative efficiency of micro enterprise firm level evidence from Nigeria. *African development bank*, 353-395.
- Amao, J. O., Oluwatayo I. B., &Osuntope F. K (2006). Economics of fish demands in Lagos State, Nigeria. *Journal of human ecology*, 19 (1), 25 – 30.
- Bolorunduro, P. I. &Faleye, A. E. (2003). Socio-economic characteristics as predictors of adoption of improved fish smoking kiln by fish processors in North-Western Nigeria. *Journal of fisheries society of Nigeria*, 1, 70 – 84.
- Chilaka, Q. M., Nwabeze, G. O. &Odili, O. E. (2014). Challenges of inland artisanal fish production in Nigeria: Economic perspective. *Journal of fisheries and aquatic science*, 9 (6), 501 – 505.

- Debreu, G. (1951), "The coefficient of resource utilization," *Econometrica* 19, (3), 273 – 292.
- Dey, M. M; Rab, M. A., Parajuas, F. J., Piumsombun, S; Bhatta, R; Alam, F.M; Koeshendrajana, S. & Ahmed, M. (2002). Socio-economics of freshwater fish farm in Asia. Strategies and options for increasing any sustaining fisheries and aquaculture production to benefit poor households in Asia. File ///AI/fish supply and demand in Asia progress report 2002: world fish center.1-14.
- Ekanem E., Damian, A. & Etim, G. (2012). Analysis of fish farming in Cross River State, Nigeria: Implication for Food Security *Tropentag*, Gottingen resilience of agricultural systems against crisis
- Ekunwe, P. A. & Emokaro, C. O. (2009). Profitability and viability of catfish farming in Kogi State, Nigeria. *Research journal of agricultural and biological sciences*, 6 (3), 215-219.
- Ekunwe, P.A and C.O. Emokaro, (2009). Technical efficiency of catfish Farmers in Kaduna, Nigeria. *Journal of applied sciences research*, 5 (7), 802 – 805.
- Erie, G.O. (2008). Gender differentials in productivity efficiency in food crop farmers in Edo State, Nigeria. Unpublished PhD Thesis. Ambrose Alli University, Ekpoma.
- Federal Department of Fisheries (2008). Nigeria Fish Import and Value (1993-2000).
- Food and Agriculture Organization (FAO) (2007). The state of world fisheries and aquaculture. *FAO fisheries department, Rome Italy* (30).
- Food and Agriculture Organization (FAO) (2009). Food and agriculture organization of the united nation fish state.universal software for fisheries statistical time Series 4.23. data and statistic of unit FAO. Rome. Italy.
- Ibitoye, S. J. (2010). The influence of farm size, educational status, and farm income on the adoption of maize varieties in Kogi State, Nigeria. *American- Euro- Asian Journal of Sustainable Agriculture*, 4 (1), 20 – 25.
- Ibrahim,H.Y& Yahaya H., (2011). Women participation in homestead fish farming in north central Nigeria. *Livestock research for rural development*. 23(2)
- Kareem, R. O., Aromolarah, A. B. & William, S. B. (2008). Economic Efficiency in Fish Farming. Hope for Agro-allied Industries in Nigeria. *Chinese Journal of Oceanology and limnology*, 26 (1), 104 – 115.
- Mohammed, S. T., Ghide, A. A., Shettima, B. G., &Umoru, M. Y., (2014). Resource – use efficiency of male and female fish farmers in Maiduguri: A comparative analysis. *Nigerianjournal of fisheries and aquaculture* 2(1): 6-14.
- Mutume, G. (2002). Africa seeks to safeguard its fisheries. *Africa Recovery*, 16 (1), 12

- Nwabeze, G. O. & Erie, A. P. (2013). Artisanal Fishers' Use of Sustainable Fisheries Management Practices in Jebba Lake Basin, Nigeria. *Journal of Agriculture Extension*, 17 (1), 11 – 19.
- Olagunju, F. I., Adesiyun, I. O. & Ezekiel, A. A., (2007). Economics viability of catfish production in Oyo State, Nigeria. *Human Ecology*, 21 (2), 121 – 124.
- Oyinbo, O. &Rekwot, G. Z. (2013). Fishery production and economic growth in Nigeria.Pathway for sustainable economic development. *Journal of sustainable development in Africa*, 15 (2), 23 – 28.
- Sanni, A.O., Olowosegun, T., Sule A. M., Muhammed, A.,Yem, I. Y. &Onimisi, H. U. (2009). Capacity building and training requirement for effective fisheries and aquaculture extension in Nigeria.*A review of nature and science*, 7(4), 66 – 71.
- Tafida, A. A., Adebayo, A. A., Galtima M., Raji, A., Jimme, M. & John, C. T. (2011). Livelihood strategies and rural income: the case of fishing communities in kainji lake basin, Nigeria. *Agricultural Journal*, 6 (5), 259 – 263.
- World Bank (2014). Fish to 2030, Prospects for Fisheries and Aquaculture. World Bank Report Number 83177-GLB
- Yu sheng, Tom J., Dandan Z. &Shiji, Z. (2013). Measuring output, input and total factor productivity in Australian agriculture: An index- level analysis. *IARIW-UNSW conference on productivity: Measurement, Drivers and Trends*, Sydney, Australia.
- Zhao, S., Sheng, Y., & Gray, E (2012). 'Measuring productivity of the Australian broadacre and dairy industries. *Productivity growth in agriculture: an international perspective*, CABI publishing house, Washington, D.C. 73-107.