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## Stimulating Research and Extension in Root and Tuber Crops for Economic Diversification and Employment Generation Policy in Nigeria

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### Abstract

The study examined the recent developments in research and extension in roots and tuber crops in Nigeria. It used mainly secondary data derived from various sources, descriptive statistics and value chain model in realizing the study. It showed inadequate and distorted funding of research and extension in roots and tubers despite outstanding successes in the development of new high yielding varieties and the economic values and opportunities that are available under various root and tuber value chains. This calls for urgent Policy attention in the various opportunities in value chain management in roots and tubers toward arresting youth restiveness and wealth creation.

**Keywords:** Agricultural innovations; agricultural extension; policy reform, economic diversification.

### 1. Introduction

Nigeria has a well developed root and tuber research system with adequate technologies capable of stimulating farmers output for increased income and employment generation. This is realizable by the number of institutions and agencies established to ensure that farmers are aware and adopt these innovations relevant to their needs and situations, yet the gap between the actual yield and potential yield seems to be large. The overall goal of agricultural extension transformation agenda is to develop well trained and motivated staff that will effectively cater for a variety of actors along root and tuber crops. It is on record that the largest provider of extension services, Agricultural Development Programme(ADP) is seriously limited in performance which has invariably contributed to the gap between research output and the field output. This has been clearly manifested in the very high food prices,

food insecurity and malnutrition especially in children(Umeh and Nwachukwu, 2015).

The role of research is to develop technologies and prove their worth to a relatively small number of farmers/audience using various combinations of upstream and downstream research. The extension service on the other hand complements research through diffusing of innovations/technologies to as many farmer-entrepreneurs as possible using appropriate strategies. In other words, the extension service is artificial in informing, advising and teaching the general public about new and improved technologies and getting feedback to research and other input agencies in a timely fashion. Since the adoption of Research Extension- Farmers- Inputs- linkage Systems(REFILS) in Nigeria, the role of extension has been orchestrated and recognized as crucial in enhancing agricultural development (Nwachukwu, Unamma and Nwosu, 2004).There is observable gap

between research and extension. Sometimes it is assumed that research output means extension output. They are two parallel lines. Discovery and innovation require feedback, hence the need to value the role of extension at the conception level of research especially as extension output is the face of research among the stakeholders.

which are capital intensive. According to Adesina (2013), every effort of government on the transformation agenda was to produce high quality cassava flour to replace wheat flour in bread and confectionaries, dried chips for export, cassava starch to replace corn starch, production of sweeteners to replace sugar in juice and beverages, production of

**Table 1: Funding of Root and Tuber Crops in Nigeria 2005 – 2015**

S/N	Year	Approved	Actual Release	% Released
1	2005	252,782,000	114,362,379	45.24
2	2006	252,782,200	180,920,000	71.28
3	2007	150,184,000	82,920,000	55.21
4	2008	450,530,000	387,030,000	85.91
5	2009	250,000,000	223,504,888	89.4
6	2010	153,773,449	84,545,397	55.0
7	2011	138,637,785	107,035,960	77.21
8	2012	850,488,096	309, 147, 829	36.35
9	2013	823,950,000	383,273,325	46.52
10	2014	490,290,250	225,636,840	46.02
11	2015	184,177,073	92,088,536	49.99

Source: World Bank & FMARD (2015)

Research and Extension in root and tuber crops are constantly evolving. They have applied various strategies to extend improved root and tuber production technologies to farmers and other stakeholders. According to Asawalem (2014), demonstration farms, farmers’ field, adopted villages, outgrowers, and schools outreach are among the various extension activities of agencies of government which have been considered inadequate. These could be attributed to poor funding of research and extension in roots& tubers as shown in Table 1.

The amount of money released for root and tuber research in the country is highly deficient especially as they are expected to stimulate research into value addition technologies

ethanol and sorbitol from cassava. These are highly exportable products. The investors cannot be attracted without adequate extension education and the development of appropriate synergies.

To facilitate exports from roots and tubers in Nigeria, there is need to exploit public private partnership initiatives to stimulate industries designed and encouraged for exports to liaise with Research Institutes to produce standardized and targeted value added products approved for export. National Root Crops Research Institute (NRCRI)Umudike has developed these exportable value products but without targets (countries). All they need now is increased funding to expand the frontiers of their research and also assist

them in extending the new technologies on value chain and value added products. From every indication, funding now seems to be targeting improved fresh roots and tubers. The skills and technology to move to the next level are there but requires stimulation.

Valuable achievements have been recorded in the development of roots and tubers for export. The products have been tested to meet international standards. The only challenge now is on how to stimulate the stakeholders into partnership.

marketing of a specific traded commodity (roots and tubers) and also identify the main stakeholders involved at each stage including research and development. Efforts in both research and extension should not be duplicated but rather various participants, work together to stimulate advocacy and commercialization.

**11. Demand and Supply Dynamics**

Due to the short storage life of root and tuber crops cum perishability, they are mainly grown

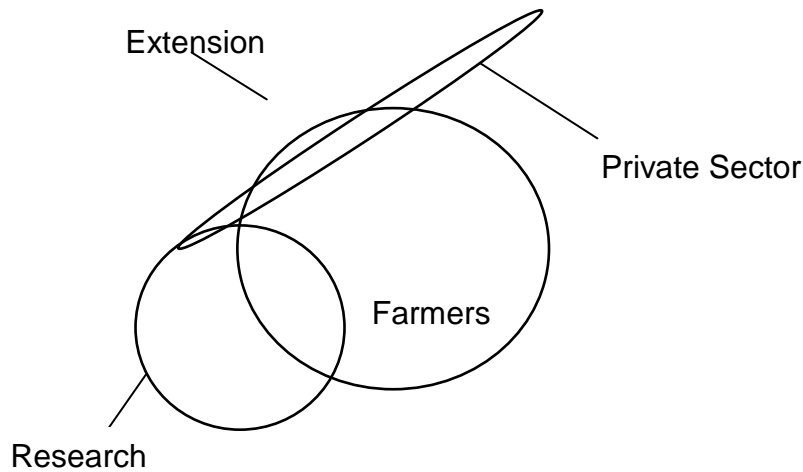


Fig 1: Proposed partnership synergy for root and tuber crops production

Nigeria for example is the world's largest producer of cassava, yam and cocoyam and yet her exports are abysmally low. The challenge we have is not on the development of value added products but being able to partner with the private sector to locate specific countries for exports.

As participants or stakeholders are trying to find their new roles in the transformation agenda, which is public sector – enabled but private sector led, the action plan for implementing commodity value chain indicates a whole lot of activities. These range from production, processing, distribution to

as subsistence crops for immediate consumption. As such, the production of substantial marketable surpluses becomes difficult with its attendant impediment to supply. Current production capacity has not met the ever increasing national demand for root and tuber consumption, let alone the huge potential existing on the unexploited international markets.

As can be seen in Fig 2, the production value of most root and tuber crops has been increasing over time with yams appreciating in highest in value.

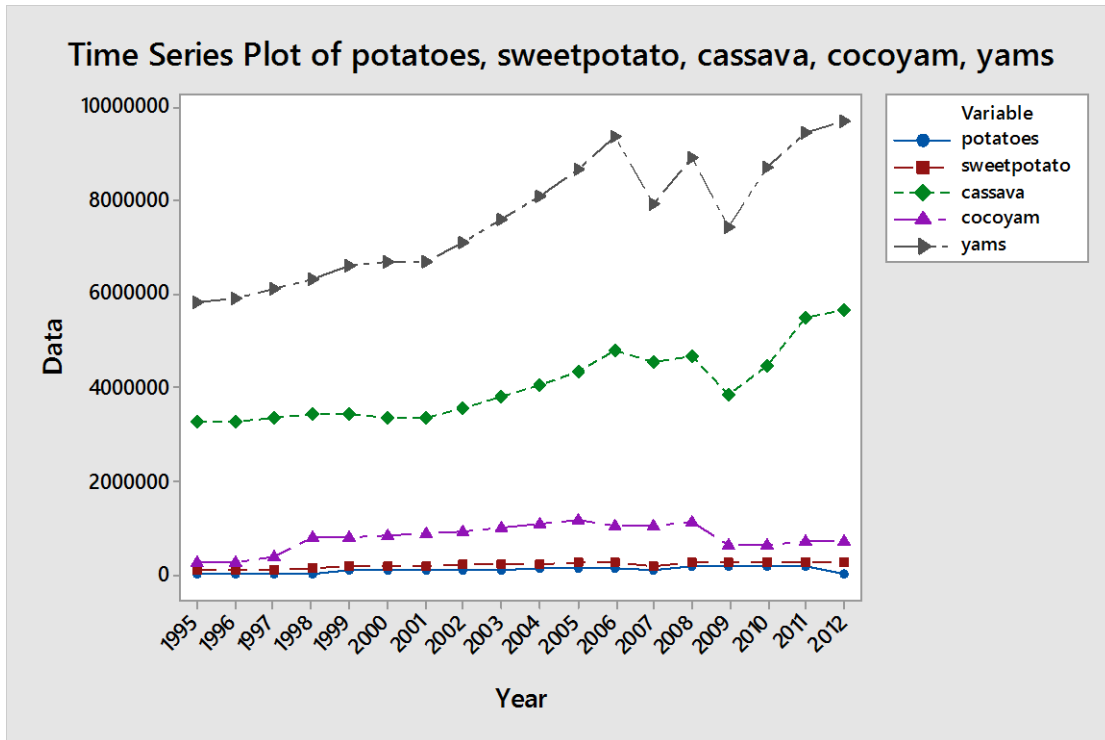


Fig 2: Trend of Gross production value (\$'000) for root and tuber crops in Nigeria (1995 – 2012)

Contemporary thinking in view of our current national dilemma is that food production including root and tuber crops should be considered a top priority in our national development plans as a means of diversifying the economy. However, mere plans and project proposals do not themselves constitute solutions to the existing gaps between food supply and demand. The following measures are necessary to bring about improvement. They include:

- (i) Reinforcement of research to improve root and tuber crops;
- (ii) Intensification of agricultural extension services;
- (iii) Technological application;
- (iv) Value addition;
- (v) Changing market orientation of farmers.

#### IV. Economic Potentials of Root and Tuber Crops Production in Nigeria

Roots and tuber crops are storage plant materials characterized by energy rich underground organs which are used for food by man or as feeds for animals. The major roots and tuber crops in Nigeria are cassava (*manihotesculenta*), yams (*Dioscoreaspp*), sweet potato (*Ipomeabatatas*), cocoyams (*xanthosoma* and *Colocasiaspp*), potato (*solanumtuberosum*) and ginger (*zingiberofficinale*). Carrot, botanically a root crop is mostly recorded as vegetable in Nigeria. The major roots and tubers provide more than 50% of the total calorie requirements of Nigerians (Ukpabi, 2009; Plumbley, 1982).

Roots and tubers form the major staple food crops in Nigeria, excluding being the major source of cheap carbohydrate for most Nigerians and other diverse uses in pharmaceutical, confectionery, livestock and chemical industries (Asawalam, 2014). Nigeria, though a major producer of roots and tuber crops, imports virtually all the value products obtainable from roots and tubers namely

starch, flour, sweeteners, adhesives and ethanol.

Reversing this trend, calls for stimulating collaboration among the stakeholders in the industry. It is worthy of note that root and tuber crops value chain encompassing production, processing and marketing is responsible for the employment of over 40% of Nigerian population and by stimulating research and extension could be capable of substituting oil as a source of foreign exchange (Okonkwo, 2015).

large expanse of land available for root and tuber crops production, with collaborative research and extension among the stakeholders, Nigerian farmers would be able to produce enough roots and tubers. This will assist in meeting the ever increasing local demand and exploit the untapped potentials of the international markets. It is on record that previous efforts of research and extension of the National Root Crops Research Institute, Umudike have resulted in Nigeria currently being the world's largest producer of cassava,

**Table 2: Yield potentials per hectare of major root and tuber crops in Nigeria**

S/N	Crop	Actual yield tons/ha	Potential yield tons/ha	Current Res. Ext. Gap
1	Cassava	14.02	48	33.98
2	Yam	13.90	19	5.1
3	Cocoyam	6.90	17.5	10.6
4	Potato	4.54	22.5	17.96
5	Sweet potato	3.04	27.5	24.46

Source: Derived from FAO Database (2015)

Recent statistics have shown that oil is gradually giving way as the main player in the Nigerian economy. Oil prices are fluctuating at an abysmal level that requires urgent intervention. The oil price is currently put at 28 Dollar per barrel thereby throwing the country into economic hardship. Most state governments are calling for bailout. The federal government has intervened in some states. Workers are being owed several months of salaries in some cases, some workers have lost count of the number of months they are being owed.

Nigeria has adequate land area of about 91 million hectares; more than 80% are suitable for arable crops while over 70% of the arable land is suitable for roots and tubers. It is pertinent therefore to note that following the

yam and cocoyam with average annual production of 52.4 million, 38 million and 4 million metric tonnes respectively (Okonkwo, 2015). This is depicted in Table 2.

Table 2 shows that a lot of research and extension are required to close the gap. The actual yield per hectare for cassava is 14.02 tons/ha while we have potential for 48 tons/ha, indicating a gap of 33.98 tons, yet Nigeria is still the world's largest producer. The gap recorded for cassava is highest. This was followed by sweet potato 24.4 tons/ha, potato 17.96 tons/ha and yam with 5.1 tons/ha respectively.

Effective research and extension collaborations with stakeholders in root and tuber crops production would collapse the gap.

Moreso, the current statistics have shown that the potential yields have been attained at the research fields but the challenge now is with extension and the farmers' field.

As can be seen in Table 3, there is much work to do in order to close the gap between actual yield and potential. The potential yield is about 48tons/ha while the highest produced now is 14.02tons/ha. Funding should be made to

**Table 3: Recent Improved Cassava Varieties**

S/N	Variety	Specific Features	Yield t/ha
1	NICASS 30	Very suitable for food and industry	> 40
2	NICASS 8	Contains beta carotene high yielding, suitable for food and industry	> 40
3	Umucass 32	Early maturing, tolerance to drought suitable for food and industry	> 40
4	Umucass 33	Very suitable for intercropping, early maturing, food and industry	> 40
5	Umucass 34	Early maturing, smother weeds, suitable for food and industry	> 40
6	Umucass 35	Smoothing weeds, early maturing	> 40

Source: NRCRI Umudike, 2015.

**Table 4: Improved Yam varieties**

S/N	Variety	Specific Features	Yield t/ha
1	Danidansi	High yielding, resistant to yam pests & diseases grown rainforest area	33
2	Dr.cv.200/4/2	High yielding	30t/ha
3	TDr 89/02461	High yielding	30t/ha
4	Dr.cv.150/2/001	High yielding	29t/ha
5	TDr.89/02461	High yielding and dry matter	29t/ha
6	TDr 89/01213	High yielding & dry matter	29t/ha
7	TDr 89/01924	High yielding & dry matter	29t/ha

Source: NRCRI Umudike, 2015

**V. Recent Released Improved Root and Tuber Crops Varieties**

The release shown in Tables 3 and 4 indicates the names, features and potential yields of new varieties of cassava and yam respectively by National Root Crops Research Institute, Umudike.

stimulate production, research and extension.

**Improved Cocoyam Variety**

The two prominent varieties are colocasia and xanthosoma. The total yield is 16.17ton/ha while 6.17tons/ha for xanthosoma. Nigeria is the largest producer of cocoyam in the world



with an estimated production figure of 5.49 metric tons. It has been proved that with GockenRapid Multiplication technology, the two improved varieties could be enhanced (Onwubikoet al, 2013).

**Improved Orange Fleshed Sweet Potato**

The roots could be utilized in different value product forms. They include buns, doughnuts, meat pie, chin-chin, bread and cake. These forms have increased the demand and consumption of orange fleshed sweet potato. It is now being used as meal by Osun and Kaduna State Governments for school projects.

especially in the 70s when its price was on the upward trend. However, following the supply and demand limitations of major producing nations which brought about fall in the price of oil by more than 80% since June 2014 when it was \$115 a barrel.(Okonkwo,2015). This has contributed to plummeting of the price to less than \$30 after five years of stability.

As a matter of urgency, there is need for the government to begin to look into diversification of various sectors of the economy so as to survive the disease of mono-grade economy which is very imminent. The hitherto increasing

**Table 5: Economic Potentials of Root and Tuber Crops in Nigeria**

Crop	Yield/ha	Potential Yield tons/ha	Starch	Flour	Chips
Cassava	14.02	48	\$350/ton~12 tons	\$40/ton~9.8 tons	\$175/ton
Yam	13.90	19	\$360/ton~4.75 tons	\$65/ton~9.7 tons	\$180
Cocoyam	6.90	17.5	\$340/ton~4.35 tons	\$100/ton~5.2	\$210
Potato	4.54	22.5	\$350/ton~4.5 ton/ha	\$120/ton~3.2	\$100
Sweet potato	3.04	27.5	\$350/ton~5.5ton/ha	\$15/ton~2.1	\$150
Ginger	3.20	NA	NA	NA	NA

Source: Derived from FAO STAT, International Trade Centre & World Bank (Several Issues)

**VI. Economic Diversification**

When the revenue of a nation comes from different streams or sources, the act or practice of investing in a variety of sources of revenue is sustained. Such economy is said to be diversified.

It is on record that petroleum (crude oil) has contributed significantly to the Nigerian revenue base since its discovery in 1956

price of crude oil per barrel led to complete neglect of other sources of revenue. Fortunately, the price of crude oil is crashing and this has prompted the obvious need for economic diversification.

Economically, Nigeria has the potential to produce 12 tons of starch from cassava, 4.75 tons from yam 4.35 tons from cocoyam,



4.5tons from sweet potato and these starches are currently at \$350 dollars per ton. As shown in Table 5, this will be of economic benefit if our farmers target the market.

With the stimulation of research and extension, Nigeria has the potential of raising her total output of roots and tubers to 184,800,000 million tons in cassava,55,700,000 million

**Table 6: Potential Output of Roots & Tubers**

S/N	Crop	Hectares (ton/ha)	Potentials/ha	Total Production/m/tons
1	Cassava	3,850,000	48	184,800,000
2	Yam	2,900,000	19	55,100,000
3	Cocoyam	500,000	17.5	875,000
4	Potato	264,000	22.5	5,940,000
5	Sweet potato	11,150.000	27.5	306,625,000
6	Ginger	48,000	3.2	153,600

Source: Derived from FAO, NRCRI(2015)

**Table 7: Value added products from roots and tubers in Nigeria**

Cassava	Yam	Sweet potato	Cocoyam	Ginger
cassava starch	Yam flour	Salad cream	Chips	Ginger powder
cassava flour	Chips	Starch	Fufu	Ginger oil
cassava chips	Fufu	Flour	Flour	Spice drinks
cassava pellets		Chips	Soup thickener	Garri
Ethanol		Garified sweet potato		
cassava based adhesives		Fufu		
glucose syrup				
Gari				

Source: National Root Crops Research Institute, NRCRI (2015)

tonnes in yam and 8,750,000 million tons in cocoyam (Table 6). Okonkwo (2015) noted that root and tuber crops are currently responsible for the employment of over 40% of the Nigeria population. Examining the potentials with adequate incentives, they would be capable of replacing oil, which cannot boast of employing upto 6% of the population. This makes a case for greater attention on root and tuber crops value chain and will increase the value added products for exports.

Currently, the NRCRI has developed the following value added products using approved international standard. They could go for the current prices at the world markets (See Table 7).

It is unfortunate that Nigeria is the world's largest producer of major roots and tubers namely cassava, yam and cocoyam yet we are not found in the list of exporting countries like Thailand, India, Sri-Lanka, China, Indonesia, USA, Honduras etc. It is unbelievable that Thailand that accounts for only 10% of global production of cassava accounts for about 80% of value addition. Ghana is the leading exporter of yam while Nigeria is yet to partake in its exports.

The concentration of efforts on root and tuber crops value chain is key to the planned economic diversification. If the economy is ready to go along value chain, it would offer small scale and medium scale industries opportunities to be established. The development of root and tuber value chain will open the windows for more local and international markets, which will invariably ignite the birth of many subsidiary industries, thereby providing employment for all categories of Nigerians especially the youth.

### *VII. Creation of Employment in Root and Tuber Crops*

In meeting with the objectives of the Green Alternative Agenda, a more fundamental

development challenge confronting us is the very rapid increasing unengaged labour force especially youth unemployment. There is a conscious plan to move agriculture from a development programme to agribusiness value chain management with the goal of making the country an agricultural industrialized economy in order to create wealth, jobs and markets for the stakeholders and revive the economy.

Root and tuber crops are dominantly prominent in the rural areas. Rural areas are dependent on both external investment and the development of indigenous resources for income and employment creation opportunities. Policy must address the challenge of ensuring that significant population of new industries along the value chain and value products are located in the rural areas. The root and tuber crops remain the single most important contributor to the economic and social viability of the rural areas. It employs more than 50% of the rural population even when employment is declining in relative terms.

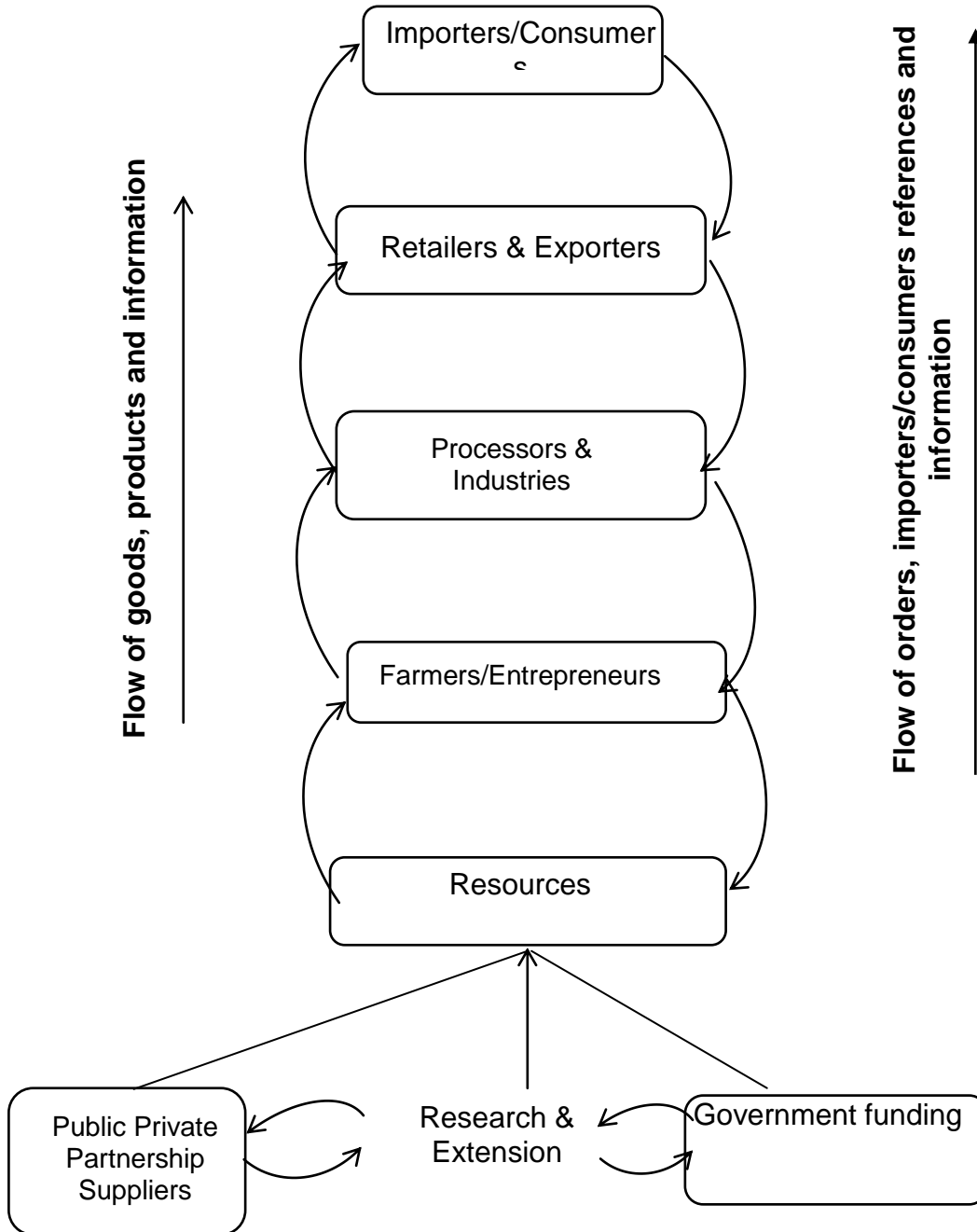
Root and tuber crops will remain in future, critical to the well being of the rural economy and in many areas, represent the main option for economic regeneration of the rural areas.

### *VIII. Competitiveness in Root and Tuber Production*

It is clear that to attain improved competitiveness in roots and tubers, efforts must continue to be made not only in the interest of rural communities but also in the interest of the national economy. Government should maintain a macroeconomic environment which is conducive to structural change, capital investment and production efficiency. Improved competitiveness in this area will require continued support in research and extension to secure a better age structure amongst the stakeholders. The promotion of quality products along value chains will be

essential elements in securing the development of efficient and competitive products in the world market.

In an attempt to create employment in the roots and tubers, it is essential to overcome the obstacles faced by farmers as producers and economic agents by improving rural poor



**Fig. 3: Value Chain Production Systems**

people's access to and management of basic productive resources along value chain.

Making a difference in employment creation in the root and tuber subsector will involve partnerships that mobilize the resources of government, the private sector, the rural poor and international development partners to produce along value chains. This is exemplified in Fig 3.

#### *IX. Value Chain Production of Roots and Tubers*

The value chain requires entrepreneurs/farmers link that will attend to the needs of importers (consumers), working closely with public private partnership and processors/industries to produce the specific goods required by importers/consumers.

This approach will provide through continuous innovation the feedback between different stakeholders along the chain; the farmer/entrepreneurs power and profitability are realized internationally.

The functionality of value chains is said to be more efficient in bringing products to consumers and all stakeholders including exporters and ordinary consumers to benefit from (Abani, 2012). Importers purchase value products that are produced according to their references. Research Institutes should be allowed to have a commercial unit just like NNPC has today.

#### **X. Conclusion**

Stimulating research and extension in roots and tubers for economic diversification is the most significant economic intervention needed in Nigerian economy and must be market and export driven in order to create value for the much sought dollar.

There is a need to establish national stakeholders' networks which should be strengthened and empowered fully to act as brokers between researchers, extensionists

and farmers. The network should be able to generate data on value addition which is vital for addressing competitiveness and exports. Though a lot of improvements have been achieved in the export potentials of root and tubers, most farmers, industrialists and companies are not adequately carried along. An in-depth partnership approach needs to be employed in the extension of roots and tubers for export.

The value of extension activities needs to be increasingly appreciated and rewarded by the stakeholders. This has given rise to a great gap between the desired and actual functional linkages among the stakeholders. This will enhance the need for multi-institutional interactive linkage as compared to the present research-extension-farmer linear linkage approach. In addition to the aforementioned, these courses of action can assist in bridging the gap:

- (i) Government should provide a broad policy guidance through the Ministry of Agriculture by ensuring the involvement of public and non-public stakeholders.
- (ii) Non-governmental organizations (NGOs) should be involved in the design and validation of future advocacy.
- (iii) Private sector should be allowed a free hand in the commercialization of value of various outputs of roots and tubers among others.

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