



AGRICULTURAL SEED SUPPLY CHAIN IN NIGERIA: AN EMPIRICAL REVIEW

Ajuka Mercy Funmilayo 

School of Finance Science and Economics, Jiangsu University, Jiangsu, 212013, China
ajukamercyfunmilayo@gmail.com

Xu Xiaoyang

School of Finance Science and Economics, Jiangsu University, Jiangsu, 212013, China

James Onuche Ayegba

School of Management Science and Engineering, Jiangsu University, Jiangsu, 212013, China

Abstract

This study examined the empirical review of the agricultural seed supply chain. In Nigeria, statistics revealed that the food self-sufficiency ratio fell from 98 percent in the early 1960s to 18.75 percent in 2019 with increasing poverty levels among farmers. Poor adoption rates of high yielding seed varieties are evident in the productivity gap of most staple crops in Nigeria and other countries that have a high rate of adoption of improved seeds. The significance of this study lies in the fact that although supplier development has been researched across a range of industries like manufacturing and service industries, there is little or no evidence of supplier development in the agricultural input sector. Moreover, while supplier development research is widely conducted in high-income countries like Europe and northern America, little is known about supplier development in low-income countries in Africa, particularly in Nigeria. Therefore, this study has contributed by revealing the need for theoretical development of agricultural input supplier development, especially in Nigeria.

Keywords: Seed; Seed supply; Supply chain; Nigeria



INTRODUCTION

Every country needs a robust seed system that can guarantee access to quality improved seeds to its farmers. The world's major food crops (wheat, corn, sorghum, rice, and soybeans) are considered the staple crops in Nigeria, and industrial crops like cotton are all produced by seed (Donnelly, Adams, and Dekker, 2007). Therefore, the use of high yielding seed variety is very imperative in Nigeria to feed the growing population. Adoption of high yielding seed varieties is low in Nigeria due to the ineffective seed supply chain management that cannot deliver quality improved seeds to farmers to enable them to increase their productivity (Kormawa, Okorji, and Okechukwu, 2013). In Nigeria, the food self-sufficiency ratio fell from 98 percent in the early 1960s to 18.75 percent in 2019 (Export, 2019) with increasing poverty levels among farmers (Obansa, and Maduekwe, 2013).

Poor adoption rates of high yielding seed varieties are evident in the productivity gap of most staple crops in Nigeria and other countries that have a high rate of adoption of improved seeds. For example, corn which is considered a staple crop and cash crop in Nigeria (Daniel, Adeboye, Oduwaye and Porbeni, 2012) has an average productivity estimate of about 1.5 tonnes per hectare and average productivity of 11 tonnes per hectare in the US. The human population is growing at a geometric rate, and food production is declining every year, posing an imminent food crisis in the country (Ayeomoni and Aladejana, 2016).

Based on the roles of the supply chain management in improving the competitiveness of supply chain members and the benefits of supplier development to improving the performance and capabilities of the supply chain suppliers, the study identified the rationale for and challenges of the seed supply. The seed supply chain can be improved through supply development to produce quality seeds for the farmers. This study will provide answers to the current seed supply chain and its rationale and will reveal the challenges of the seed supply chain.

LITERATURE REVIEW

Agriculture in Nigeria

Agriculture is one of the most important sectors contributing to economic development (Adeniran and Ben, 2018); (Izuchukwu, 2011), and the main employer of labor accounting for about 70 percent of the population in Nigeria (Adesugba and Mavrotas, 2016). The role of the agricultural sector as the highest employer of labor in Nigeria makes it an important sector that can stimulate economic growth. Although the agricultural sector had suffered neglect since the discovery of oil in the 1970s when it was contributing about 60 percent of the Gross Domestic

Product (GDP) (Olaoye, 2014), the sector remains relevant contributing about 22 percent to the GDP of Nigeria (Adesugba and Mavrotas, 2016).

The crop sector accounts for about 80 percent of the agricultural sector's contribution to the GDP (Izuchukwu, 2011). The agriculture sector also provides raw materials to the agro-allied industry in the country (Ogunniyi, Fanifosi, Ajao, and Dlamini, 2018). According to the United Nations Development Program's (UNDP) report of 2012, the agricultural sector is one of the sectors that is contributing to the world economic growth and poverty reduction, especially in low-income countries. This means that increasing the agricultural productivity of farmers in Nigeria will help in increasing the income of farmers, provide food to the population, provide raw materials to the allied agro-industries, and increase the share of the agricultural export.

About 70 percent of farmers in Nigeria live in rural areas, and they are poor and food insecure (Ogunniyi *et al.*, 2018; Oyakhilomen and Zibah, 2014). The income of about 70 percent of the Nigerian population who are smallholder farmers is around US\$0.7 day (Akamere, 2018).

Agricultural comparative advantage

Nigeria has a comparative advantage in crop production that can improve the living condition of the farmers. The country is blessed with a tropical climate and adequate and fair distribution of rainfall that favors crop production (Adeniran and Ben, 2018); (Ugwu and Kanu, 2012). The annual rainfall in Nigeria varies from over 3,500 mm in the coastal areas of the south less than 300 mm in the Sahel area in the north (Oyakhilomen and Zibah, 2014). This made about 90 percent of crop production to be characterized by rainfed production (Nwajiuba, 2012). The vegetation cover comprises about 84 million hectares of arable land, which can produce a wide variety of crops (Onuka, 2017). Despite this arable landmass with favorable weather conditions for agricultural production, Nigeria has not been able to attain sufficient food production that can feed its growing population (Nwajiuba, 2012).

Benefits of increasing agricultural productivity

Increasing agricultural productivity is one of the means of attaining food security and fight against hunger and poverty in the world (Osinowo and Sanusi, 2018; Oyakhilomen and Zibah, 2014). The use of quality improved seed is the most important input in crop production that contributes significantly to the increase of crop productivity (Obansa and Maduekwe, 2013), and food production (Ibeawuchi, 2007). According to Kormawa, Okorji, and Okechukwu (2002), the use of improved seed varieties has contributed to the successes in reducing rural poverty and provided abundant food production to the populace at a profitable price to farmers. The use of improved quality seed can contribute to about 50 percent of the increase of the

grain production, and thereby giving the most effective returns on investment of the farmers (Kormawa, Okorji, and Okechukwu, 2002).

Seed Quality

High-quality seed or improved seed varieties can be broadly defined as "seed of an adapted variety with the high genetic varietal, species, and physical purity; high germination and vigor; free from seed-borne pests (fungi, bacteria, viruses, insects, nematodes, parasitic weeds); and properly cleaned, treated, tested and labeled" (Bishaw, Niane, and Gan, 2007). The high-quality improved seed varieties have the potential to establish a good plant population under good agricultural practices to deliver its benefits.

Seed quality cannot be defined in general terms, but it is rather considered as the requirements of the farmers (Matthews, Noli, Demir, Khajeh-Hosseini, and Wagner, 2012). Baalbaki, Elias, Marcos-Filho, and McDonald (2009) defined seed quality as the level of satisfaction that the supplier can provide to the farmer. These satisfactions of farmers include the timely delivery, adequate supply as required, and accurate packaging. The seed supplier must know the seed requirements of the farmers in terms of specific traits and quantity and aligned his production to the that the farmer's expectation. Availability of, access to, and use of quality seed of adapted and farmer-preferred crop varieties are determinants of the efficiency and productivity of other technologies in increasing crop production (Dell'Aquila, 2007).

The quality seed has to be made available, accessible, and affordable to farmers before they can make use of them to increase their productivity. Quality seed is the major determinant of productivity increase than any other farm inputs like labor, irrigation, and cultivation practices (Dell'Aquila, 2007). The use of quality improved seed was identified as an instrument that can increase the productivity of farmers, especially where low productivity is caused by poor seed quality (Dell'Aquila, 2007). Like in Nigeria, governments, NGOs, and farmers recognized that to increase crop productivity, the quality of seeds in the market must be improved.

Seed sector liberalization

Over the years, governments of Nigeria have designed and implemented several seed policies and programs to make quality seeds available, accessible and affordable to farmers. These policies were changed or restructured to obtain a suitable seed policy that will encourage the use of the quality improved seed. The recent seed policy program is the seed sector liberalization in 2011. Seed sector liberalization introduces a total withdrawal of the government from producing any class of seed and making a seed production a private sector driven business (NASC Annual Report 2011). The seed sector liberalization provided an opportunity

for NASC to concentrate on improving the capabilities and performance of the seed suppliers to ensure delivery of quality improved seeds to farmers. The responsibility of NASC has shifted from producing seeds to seed supply chain management.

Seed policies in Nigeria have led to a significant increase in the number of registered private seed companies from 5 in 2000 to 314 in 2018. These seed companies are engaging in the production of different classes of seeds (NASC 2018). Despite the increase in the number of registered private seed companies, only a few of these companies are involved in the production of breeder seeds. The National Research Institutions and the Non-Governmental Organisations (NGOs) are responsible for the production of most of the breeders before they are further multiplied by the same seed breeders or seed companies. Therefore, seed production requires multiple supply chain members to the production of seeds in Nigeria.

Seed Supply Chain

A seed is a vital input that plays an important role in the production of crop plants (Kormawa, Okorji, and Okechukwu, 2002). The seed supply chain is the most complex subset of an agricultural supply chain (ASC) that is characterized by long lead times, fragmented supply chain members, complex biological restrictions, and a high level of certainty (Ibeawuchi, 2007). The informal seeds are farmers saved seeds that do not require any form of government regulation or coordination, while the formal seed supply chain is the coordinated form of seed production (Osinowo and Sanusi, 2018).

Formal seed supply chain covered by production and supply rules and are backed by national and international standardization. Seed production is like any other agricultural product supply chain that requires several value chain activities like seed demand forecasts, production planning, inputs supply, production, quality control measures, harvesting, processing, packaging, sales, distribution, and collection of the unsold supply (Osinowo and Sanusi, 2018; Oyakhilomen and Zibah, 2014). The seed sector supply chain requires distinct activities for every stage of seed production as stipulated by the seed policies (Matthews *et al.*, 2012); (Baalbaki, Elias, Marcos-Filho, and McDonald, 2009). A seed supply chain is a subset of an ASC that has its distinct supply chain activities.

Agricultural supply chain management

The agricultural supply chain has some unique characteristics that differentiate it from other supply chains. ASC activities include sourcing the inputs, production, processing, and moving the product through multiple networks with value addition in all stages (Donnelly, Adams, and Dekker, 2007).

The features of ASC include long lead times, geographic spread of producers, and regulations in different countries (Comhaire and Papier, 2015), seasonality, supply spikes, and perishability (Behzadi, O'Sullivan, Olsen, and Zhang, 2018). These unique features make agricultural supply chains different from the manufacturing supply chains (Behzadi *et al.*, 2018). The uniqueness has led to the agricultural industry supply chain to have the most segmented supply chain that is mostly characterized by missing or poorly connected supply chain members (Ahmed and Hendry, 2012).

Challenges militating against seed supply chain

Negi and Anand (2015) pointed out that every supply chain has its challenges, and seed systems are not left out of challenges. For example, seeds cannot be produced instantly and distributed to farmers because seed suppliers must produce seed in a season before distributing to farmers and thereby leading to high inventory keeping (Behzadi *et al.*, 2018). It takes about 12 to 18 months to produce seeds before they are distributed to farmers (Ahmed and Hendry, 2012).

Behzadi *et al.* (2018) pointed out that any seed that is supplied in the market must have been produced in the previous growing season and supplied as inventory to farmers. Seed suppliers must keep seed inventories before it is distributed to farmers when in demand. Production of good quality seed costs a lot and thereby leading to the high cost of seeds in the markets (Comhaire and Papier, 2015).

There are uncertainties about the seed requirements due to environmental and political reasons which makes it difficult for seed producers to predict the seed requirements. Other challenges of the seed industry are the fragmented structure of the seed supply chain, long production period, and biological restrictions of multiplying the seeds (Singh, Sikka, and Singh, 2009).

Even though most of the seeds are produced by NARIs and NGOs in Nigeria, seed distribution channels remain a challenge to the seed industry in Nigeria. The seed distribution channels are mostly concentrated with people who have no knowledge about seed varieties characteristics, incredible, and lack good seed storage facilities (Daniel *et al.*, 2012). Seed adulteration by incompetent and unscrupulous seed companies and their agents has a greater effect on the seed industry. The activities of this seed supply chain members have a greater tendency of discouraging farmers from buying certified seeds and thereby putting the entire seed industry into disrepute.

The seed policy in Nigeria is one of the causes of the low adoption of improved seed varieties (Murthy, Gajanana, Sudha, and Dakshinamoorthy, 2009). Seed policy in Nigeria does

not empower the seed companies to recoup their investment and make more profits due to the lack of intellectual property rights of the plant breeders. This has led to a lack of investment and commitment from seed companies that are willing to make profits from their investments. The poor performance of the seed industry in Nigeria and some other African countries was reported to be related to the government policies that favor the government agencies and donor agencies to provide free or subsidized seeds to farmers.

The seed subsidy program of the government and Non-governmental organizations is characterized by a distribution of adulterated seeds, delay in the delivery of seeds, and faking of the bags and tags of the certified seeds (Ahmed and Hendry, 2012). Farmers do not welcome the idea of adopting the improved seed varieties due to the inappropriate distribution of seed varieties during the seed subsidy program (Ahmed and Hendry, 2012).

This has led to the withdrawal of about 85 percent of farmers from adopting the improved seeds variety to rely on the informal seed supply which has a negative implication for the development of the seed industry (Behzadi et al., 2018). Despite these seed distribution challenges, farmers are willing to pay for high-quality improved seeds at a high cost if seed companies can make the seeds available at the beginning of the planting season (Murthy *et al.*, 2009).

Seed quality challenges continue to affect farmers in Nigeria, leading to poor adoption of certified seeds (Murthy *et al.*, 2009). These challenges include the poor quality of seeds (genetic, physical, health, and physiological), poor distribution, inadequate seed breeders, and poor knowledge of seed business. The poor seed quality is a challenge that has led to low productivity, increase poverty, and lack of interest in agriculture (Ahmed and Hendry, 2012).

Available data indicated that low crop productivity in Nigeria is related to poor seed quality, and most of the seeds that are accessible to farmers are expensive and adulterated. The peculiar challenges of the seed supply chain always raise a question on how a seed supply chain can deliver quality seeds to farmers that will be available, accessible, and affordable to most of the farmers in low-income countries.

Supplier Development

Routroy and Pradhan (2014) pointed out that supplier management is the key instrument that can overcome supply chain challenges. Through supplier management, buyers can integrate their suppliers' activities into their activities to develop a competitive supply chain. They also defined supplier development as "a long-term cooperative effort between a buying firm and its suppliers to upgrade the suppliers' technical, quality, delivery, and cost capabilities and to foster ongoing improvements".

Records have indicated the benefits of supplier development to include improving the suppliers' performance and capabilities which are aimed at meeting the buying firms' demands (Humphreys, Li, and Chan, 2004; Wagner, 2011). To achieve some specific benefits in the supply chain, buying firms initiate supplier development programs to achieve some certain value addition in their product deliveries. In crop production, no crop production is of value if the seed is not delivered to them at the right place, right time, and at an adequate quantity (Adejobi and Kassali, 2013). Also, the efforts of the buying firm to improve the capabilities and performance of the suppliers is the primary tool that can be used to align the supplier's quality with the buying firm's quality (Adejobi and Kassali, 2013). Seed quality requirements of farmers are one of the determining factors of adopting the use of improved seeds.

GAP FROM EMPIRICAL REVIEW

Previous researches on the efforts to increase crop productivity were centered on the genetic potentials of crops and the adoption of improved seed varieties to improve crop productivity. The seed industry in Nigeria has enormous potential for improvement if the seed supply chain is studied to identify the potentials of coordinating the seed supply chain members and improving their performance and capabilities to deliver quality seeds to farmers effectively.

DISCUSSION

The seed industry has received less attention in research compared to other sectors in the agriculture industry. The seed industry has enormous potential for improvement but due to an inadequate seed supply chain framework that can address the challenges is quality seed distribution, the sector remains underdeveloped.

This study focused on investigating the existing seed supply chain in Nigeria to unveil the challenges affecting the delivery of quality seeds and seed supplier development program that is aimed at improving the capacity and capabilities of seed suppliers. Studies have been conducted on promoting the distribution of quality improved crop varieties through plant breeding and seed policy reforms which are also considered another means of promoting the production of quality seeds.

The existing study did not consider the seed supply chain issues, which are more important to making quality seeds accessible, affordable, and available to farmers. There is a need to explore the seed supply chain and develop a survey instrument that will confirm the early findings. The opportunity to increase farmers' productivity in Nigeria lies in an effective seed supply chain which is still at a low level at the moment. Adoption of quality improved seeds by farmers in Nigeria is low because seeds are not available at the planting time. The

competitive advantage of farmers can be maximized when all seed supply chain members work together to serve the farmer with quality improved seeds.

CONCLUSION

The essence of this study lies in the fact that although supplier development has been researched across a range of industries like manufacturing and service industries, there is little or no evidence of supplier development in the agricultural input sector. Moreover, while supplier development research is widely conducted in high-income countries like Europe and northern America, little is known about supplier development in low-income countries in Africa. Therefore, This study will contribute to the theoretical development of agricultural input supplier development, especially in low-income countries.

Besides the contribution of this study to the literature, it x-rays the contributions of supplier development to seed companies and farmers. This study provides answers to the current seed supply chain and its rationale, and the challenges of the seed supply chain, and how the supplier development activities contributed to the capabilities and performance of the seed suppliers.

REFERENCES

- Adejobi, A. O., and Kassali, R. (2013). Markets and rural services as determinants of improved seeds usage by crop farmers in Osun State, Nigeria. *African Crop Science Journal*, 21(2)
- Adeniran, A. O., and Ben, S. O. (2018). Economic Recession and the Way-Out: Nigeria as a Case Study. *Global Journal of Human and Social Science: E Economics* 18 (1), 1-7.
- Adesugba, M. A., and Mavrotas, G. (2016). Youth employment, agricultural transformation, and rural labor dynamics in Nigeria," IFPRI discussion papers 1579, International Food Policy Research Institute (IFPRI).
- Ahmed, M., and Hendry, L. (2012). Supplier Development Literature Review and Key Future Research Areas. *International Journal of Engineering and Technology Innovation*, 2, 293-303.
- Akamere, F. A. (2018). Nigeria and the challenges of food security. 4.4 (2018).
- Ayeomoni, O. I., and Aladejana, S. A. (2016). Agricultural Credit and Economic Growth Nexus. Evidence from Nigeria. *International Journal of Academic Research in Accounting, Finance and Management Sciences*, 6(2), 146 – 158
- Baalbaki, R.; Elias, S.; Marcos-Filho, J. and McDonald, M.B. (Eds) (2009) *Seed vigor testing handbook*. Ithaca, New York, Association of Official Seed Analysts.
- Behzadi, G., O'Sullivan, M. J., Olsen, T. L., and Zhang, A. (2018). Agribusiness supply chain risk management: A review of quantitative decision models. *Omega, Elsevier*, 79(C), 21-42.
- Bishaw, Z., Niane, A. A., and Gan, Y. (2007). Quality seed production. In: Springer, Dordrecht, Lentil, Pp. 349-383.
- Comhaire, P., and Papier, F. (2015). Syngenta Uses a Cover Optimizer to Determine Production Volumes for Its European Seed Supply Chain. <http://dx.doi.org/10.2139/ssrn.2533852>
- Daniel, I. O., Adeboye, K. A., Oduwaye, O. O., and Porbeni, J. (2012). Digital seed morphometric characterization of tropical maize inbred lines for cultivar discrimination. *International Journal of Plant Breeding and Genetics*, 6(4), 245–251.
- Dell'Aquila, A. (2007) Towards new computer imaging techniques applied to seed quality testing and sorting. *Seed Science and Technology* 35, 529–539.

- Donnelly, J. L., Adams, D. C., and Dekker, J. (2007). Weedy adaptation in *Setaria* spp.: VI. *S. faberi* seed hull shape as soil germination signal antenna," <http://arxiv.org/abs/1403.7064>.
- Food and Agriculture Organization (2014). Food Safety and Nutrition.
- Humphreys, P. K., and Li, W. L. and Chan, L. Y. (2004). The impact of supplier development on buyer-supplier performance. *Omega, Elsevier*, 32(2), 131-143
- Ibeawuchi, I. I. (2007). Intercropping: A food productivity strategy for resource-poor farmers. *Nature and Science*, 5(1), 46–59.
- Izuchukwu, O. (2011). Analysis of the Contribution of Agricultural Sector on the Nigerian Economic Development. *World Review of Business Research*, 1(1), 191 – 200.
- Kormawa, P. Okorji, E. & Okechukwu, R. (2013). *Assessment of Seed-Sub Sector Policy in Nigeria*. International Institute of Tropical Agriculture.
- Negi, S., and Anand, N. (2015). Issues and Challenges in the Supply Chain of Fruits & Vegetables Sector in India: A Review. *International Journal of Managing Value and Supply Chains*, 6(2):47-62 DOI: 10.5121/ijmvsc.2015.6205
- Nwajiuba, C. (2012). Nigeria's agriculture and food security challenges. *Agriculture & Food Security*, 45-53
- Matthews, S., Noli, E., Demir, I., Khajeh-Hosseini, M., and Wagner, M. (2012). Evaluation of seed quality: From physiology to international standardization. *Seed Science Research*, 22(S1), S69-S73. doi:10.1017/S0960258511000365
- Murthy, D. S., Gajanana, T. M., Sudha, M., and Dakshinamoorthy, V. (2009). Marketing and Post-harvest losses in fruits: Its implications on Availability and economy. *Indian Journal of Agricultural Economics*, 64 (2), 259-275.
- Obansa, S.A.J., and Maduekwe, I.M. (2013) Agriculture Financing and Economic Growth in Nigeria. *European Scientific Journal*, 9(1), 168 – 204.
- Ogunniyi, L. T., Fanifosi, G. E., Ajao, O. A., Dlamini, D. V. (2018). Impact of Agricultural Extension Services on Crop Farmers' Productivity in Oyo State, Nigeria. *Applied Science Report*, 23(3), 97-101. DOI: 10.15192/PSCP.ASR.2018.23.3.97101
- Olaoye, A. (2014) Potentials of the Agro-Industry towards Achieving Food Security in Nigeria and Other Sub-Saharan African Countries. *Journal of Food Security*, 2, 3-41.
- Onwuka, I. O. (2017). Reversing Nigeria's Food Import Dependency - Agricultural Transformation. *Agricultural Development*, 2(1), 1-12
- Osinowo, O. H., and Sanusi, R A. (2018). Drivers of Agricultural Productivity in Agriculture-Based Economy. *Journal for the Advancement of Developing Economies*, 7(1), 78-84.
- Oyakhilomen, O., and Zibah, R. G. (2014). Agricultural Production and Economic Growth in Nigeria: Implication for Rural Poverty Alleviation. *Quarterly Journal of International Agriculture*, 53(3), 207-223
- Singh, S. P., Sikka, B. K., and Singh, A. (2009). Supply Chain Management and Indian Fresh Produce Supply Chain: Opportunities and Challenges. International Food & Agribusiness Management Association, 19th Annual World Symposium.
- Routroy, S., and Pradhan, S. K. (2014). Analyzing the performance of supplier development: a case study. *International Journal of Productivity and Performance Management*, 63(2), 209-233
- Ugwu, D.S. and I.O. Kanu, 2012. Effects of agricultural reforms on the agricultural sector in Nigeria. *Journal of African Studies and Development*, 4: 51-59.
- Wagner, M., Pywell, R. F., Knopp, T., and Matthew S Heard, M. S. (2011). The germination niches of grassland species targeted for restoration: Effects of seed pre-treatments. *Seed Science Research*, 21(02), 117-131 DOI: 10.1017/S0960258510000450