

A roadmap for evidence-based insurance development for Nigeria's farmers

Working Paper No. 218

CGIAR Research Program on Climate Change,
Agriculture and Food Security (CCAFS)

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**Climate Change,
Agriculture and
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Abstract

In 2014, Nigeria's Federal Ministry of Agriculture and Rural Development (FMARD) proposed a major expansion of agricultural insurance in the context of other reforms to the agricultural sector, and as part of the implementation of its National Agricultural Resilience Framework (NARF). This report is designed to inform development of inclusive insurance for Nigeria's agriculture sector, and is offered as a contribution to the NARF. It is an outcome of a consultative process that began in September 2014 between FMARD and the CGIAR research program on Climate Change, Agriculture and Food Security (CCAFS).

By overcoming the problems of moral hazard, adverse selection, and resulting high transaction costs and processing delays that have plagued indemnity-based agricultural insurance, index-based insurance makes it feasible to insure millions of smallholder farmers. Well-designed index insurance can achieve specific risk objectives such as protecting farmers' livelihoods in the face of major climate shocks, and promoting farmers' livelihoods by overcoming barriers to adoption of improved agricultural technologies and practices, and access to market opportunities.

Reviews of index-based agricultural insurance initiatives have identified several success factors that are relevant to the situation in Nigeria. First, successful initiatives have been designed to unlock particular opportunities for farmers that were previously constrained by particular risks. Second, initiatives are most successful when they are driven by demand and responsive to farmer input. Third, successful initiatives have invested in the capacity of a range of local stakeholders. Fourth, investments in data systems, and in science-based index development, have helped address the challenges of data poverty and basis risk. Fifth, successful index insurance requires an enabling regulatory environment. Finally, successful initiatives involve multi-stakeholder partnerships, and often public-private partnerships.

A strategy for expanding insurance for Nigeria's smallholder farmers must address challenges that include: limited and asymmetric information; crowding out by post-disaster relief efforts; limited access to reinsurance markets; lack of insurance culture; and inadequate regulatory environments. The development of effective market-based agricultural insurance, requires

government support in five key areas: data systems; awareness and capacity building; facilitating international risk pooling; “smart” subsidies; and an enabling policy environment. Three immediate priorities are identified: (a) creating a regulatory environment that makes it attractive for insurance companies to enter the market; (b) developing a public-private partnership that incentivizes and supports companies to develop innovative products and services for the agriculture sector; and (c) progressively expand implementation through well-designed pilots, evaluation and learning processes. The organizations that have been involved or consulted in the process leading to this report offer relevant expertise.

Keywords

Agricultural insurance; Climate services; Nigeria; Resilience; Public-private partnership; Policy

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Contents

Introduction.....	10
Rationale for Index-Based Agricultural Insurance	10
Indemnity and index insurance.....	10
Benefits of index-based agricultural insurance	13
Lessons from successful index insurance initiatives	14
Policy context for agricultural insurance in Nigeria.....	17
Agricultural Transformation Agenda and Growth Enhancement Scheme.....	17
National Agriculture Resilience Framework (NARF)	18
Current status of agricultural insurance in Nigeria.....	19
Strategy for agricultural insurance development in Nigeria	20
Government roles in risk management.....	22
Support robust data systems	24
Developing innovative distribution channels	31
Develop a culture of insurance	33
Regulation	33
Phases of agricultural insurance development	34
Sources of Relevant Expertise	37
Conclusion	39
Annex 1. The ENACTS approach to improving climate information availability and access in Africa	41
Annex 2. Number of farmers participating in the GES	45
Annex 3. Potential for bundling insurance with drought-tolerant seed	46
References.....	48

Acronyms

ACRE	Agriculture and Climate Risk Enterprise
ADP	Agricultural Development Project
AGRHYMET	AGRiculture, HYdrology, METeorology Regional Centre
ARC	African Risk Capacity
ATA	Agricultural Transformation Agenda
CAYS	Crop Area and Yield Survey
CBN	Central Bank of Nigeria
CILSS	Permanent Interstate Committee for Drought Control in the Sahel (French acronym)
CIMMYT	International Maize and Wheat Improvement Center (Spanish acronym)
CSA	Climate Smart Agriculture
DTMA	Drought Tolerant Maize for Africa Project
ENACTS	Enhancing National Climate Services Initiative
FMARD	Nigeria Federal Ministry of Agriculture and Rural Development
GACSA	Global Alliance for Climate-Smart Agriculture
GDP	Gross Domestic Product
GPS	Global Positioning System
GES	Growth Enhancement Support Scheme
GIZ	German Corporation for International Cooperation
IFC	International Finance Corporation
IITA	International Institute of Tropical Agriculture
IRI	The International Research Institute for Climate and Society
MODIS	Moderate Resolution Imaging Spectroradiometer
MT	metric tons
MPCI	Multi-Peril Crop Insurance

NAERLS	National Agricultural Extension and Research Liaison Services
NAIC	National Agriculture Insurance Company
NAICOM	National Insurance Commission
NAIS	National Agricultural Insurance Scheme
NARF	Nigeria’s National Agricultural Resilience Framework
NGO	Non-governmental organization
NIA	Nigerian Insurers’ Association
NIHSA	Nigeria Hydrological Services Agency
NIMET	Nigerian Meteorological Agency
NMS	national meteorological services
NPCI	Named-Peril Crop Insurance
PPP	public-private partnership
SMS	Short Message Service
TAMSAT	Tropical Application of Meteorology using Satellite data and ground-based observations
TIR	thermal infrared
UNDP	United Nations Development Program
USAID	United States Agency for International Development
USD	United States Dollar
USDA	United States Department of Agriculture
WBCIS	Weather Based Crop Insurance Scheme
WMO	World Meteorological Organization

Introduction

During the UN Climate Summit, and the CGIAR Development Dialogs event at Columbia University, during Climate Week in New York in September 2014, the then Honourable Minister, Dr. Akinwumi Adesina, announced plans to expand insurance to 15 million smallholder farmers in Nigeria.

Subsequent discussions between the Federal Ministry of Agriculture and Rural Development (FMARD) and the CGIAR research program on Climate Change, Agriculture and Food Security (CCAFS) led to a request for CCAFS to organize a knowledge-sharing workshop in London from 27-28 January 2015. This was followed by a planning meeting in Zurich, 5-6 May 2015, hosted by SwissRe. Participants in the workshops included FMARD, the heads of the Nigerian and Indian Agricultural Insurance Corporations, CCAFS, SwissRe, German Corporation for International Cooperation (GIZ), Nigerian Meteorological Agency (NIMET), Nigerian Agricultural Insurance Corporation (NAIC), Nigerian Insurers' Association (NIA) and Pula Advisors.

Both events provided opportunities to share knowledge and to identify ways to strengthen Nigeria's National Agricultural Resilience Framework (NARF), with a specific focus on developing agriculture insurance. At the Zurich workshop, FMARD requested CCAFS to lead in the development of an evidence-based roadmap for developing insurance for Nigeria's farmers, in consultation with relevant organizations and experts.

This report is the outcome of that process. We offer it as a contribution to the NARF, and to inform phased expansion of insurance coverage for Nigeria's agricultural sector including its smallholder farming population.

Rationale for Index-Based Agricultural Insurance

Indemnity and index insurance

In particular contexts, agriculture insurance is a well-established and effective tool for increasing farmers' resilience in the face of various production risks. The United States Federal Crop Insurance Corporation, for example, was created in 1938 to help the agricultural

sector recover from the Great Depression and the Dust Bowl drought (USDA Risk Management Agency 2015). Agriculture insurance in the United States has, over the years, proven to be more efficient than providing post-disaster payments to farmers. Globally, insurance products have evolved to become more cost-effective, and to reach both large and small-scale farmers.

Traditional indemnity-based insurance, often referred to as Multi- or Named-Peril Crop Insurance (MPCI and NPCI), requires farm visits to verify loss claims. Although it has been effective for large-scale farms, adverse selection (i.e., the tendency for insurance to be purchased preferentially by farmers with greater risks, increasing premiums and payouts), moral hazard (i.e., the incentive for farmers to neglect good risk management in order to receive payouts), and high transaction costs and processing delays associated with verifying claims, have made this type of insurance generally unfeasible to implement at scale for smallholder farmers (Hazell 1992). Agriculture insurance, in the form of MPCI products, has been available in Nigeria since 1987. It reaches an estimated 35,000 farmers through the National Agriculture Insurance Company (NAIC).

A new form of insurance, known as index-based insurance, has been introduced to the agricultural sector since the mid-1990s. In index insurance, coverage is based not on actual crop, livestock or income losses, but on an objectively measurable ‘index’ that is correlated with losses. Index insurance seeks to provide cover against specific threats that can be captured by the selected index, generally at aggregate scales rather than at the level of individual farms (Hess & Hazell 2015). The most common indices are the amount of rain during a certain window of time (weather-based indices) or average yield losses measured over a larger region (area yield indices), although an expanding range of remote sensing and model-based data is being used or considered. Payouts are triggered when the index exceeds a pre-specified threshold.

Index insurance largely overcomes the problems of moral hazard and adverse selection that have plagued indemnity-based agricultural insurance. Basing payouts on an index eliminates the need for farm visits to verify losses, greatly reducing transaction costs and processing time, making it feasible to insure millions of smallholder farmers. Table 1 summarizes the main types of agricultural insurance.

Table 1. Overview of common product types and risks covered.

Product	Basis for Loss Assessment	Type of Farmer	Risks Covered	Commodities Covered
Multi-peril, indemnity based crop insurance	Farm visits 3 times per season	Large scale commercial farmers	All named risks	All crops
Weather index insurance	Weather stations or satellite data	Small and large scale farmers	Drought	Primarily rain-fed crops
Area yield index insurance	Crop cutting experiments or farmer survey	Small and large scale farmers	All risks that effect yields at an area level	All crops
Index-based livestock insurance	Weather stations or satellite vegetation data	Pastoralists or sedentary herders	Herd mortality due to weather extremes or forage loss	Primarily ruminant livestock

A challenge with index insurance is basis risk, which refers to the inherent risk that the index will not adequately represent farmers' losses, and that farmers may therefore not be compensated for experienced losses. Basis risk creates a need to communicate clearly with farmers what risks are and are not covered. Because basis risk tends to be greater at the scale of individual farms than at an aggregate scale, it may be less of a problem when an index is being used to insure an organization, such as a relief agency, a microfinance institution or agricultural input supplier, that operates at a regional or national scale and that aggregates farm-scale variations (Hess & Hazell 2015).

Although agricultural insurance has a long heritage with significant on-going investment, it has only started to become more widely adopted across the developing world in recent years, largely in response to innovations in index-based insurance (Table 2).

Table 2. Scale of index based agricultural insurance in 2014. Source: Hess & Hazell 2016.

Region	Scale (No. of policyholders)	No. Of Schemes
Africa	443,075	17
India	33,222,000	4
China	140,000,000	
Rest of Asia	963,460	11
Latin America	3,315,626	8
Developing countries	177,944,161	40

Benefits of index-based agricultural insurance

Index insurance is not a complete solution for all agricultural risks, but can be used to achieve several specific risk management objectives (Barrett et al. 2007; Barnette et al. 2008; Hellmuth et al. 2009).

First, index insurance can protect farmers' livelihoods. An uninsured shock, such as a drought or flood, can have detrimental long-term livelihood consequences through direct damage to crop and livestock productivity, infrastructure, and sometimes health. Furthermore, farmers employ a range of coping strategies that protect against the possibility of catastrophic loss in the event of an extreme event, but these actions can undermine long-term livelihood opportunity and can trap households in chronic poverty (Carter & Barrett 2006; Dercon 1996; Elabed & Carter 2014; Maccini & Yang 2009; Morduch 1994; Kebede 1992). These coping strategies include: liquidating productive assets, defaulting on loans, migration, withdrawing children from school to work on farm or tend livestock, severely reducing nutrient intake, and over-exploiting natural resources. Index-based livestock insurance generally has the protection of productive assets as its main objective.

There have been a few opportunities to evaluate how index insurance payouts reduce loss of productive assets and speed recovery from major climate-related shocks. In Mongolia, payouts from index-based livestock insurance had a significant positive effect on herd recovery for two years following a one-in-50-year winter weather disaster in 2009-2010, and a positive but weaker effect three and four years later (Bertram-Huemmer & Kraehnert 2015). The insurance payouts reportedly helped herders avoid selling and slaughtering animals; and reduced credit constraints, thereby enabling households to purchase new livestock after the disaster. In northern Kenya, index-based livestock insurance payouts following a severe 2011 drought protected the asset base of relatively well-off households by reducing the likelihood of selling livestock; while for poorer households the payouts avoided the need to reduce food intake, thereby protecting the human capital of the next generation (Janzen & Carter 2013).

Second, index insurance can improve farmers' livelihoods by enhancing the adoption of improved technologies and practices, and facilitating farmers' access to market opportunities. For smallholder farmers, the risk of an infrequent but severe shock is a significant disincentive to investing in productive assets (Fafchamps 2003) such as fertilizer (Dercon & Christiaensen 2011; Simtowe 2006; Morris et al. 2007), and agricultural technologies (Barrett

et al. 2004; Kebede 1992; Marra et al. 2003). Risk also has a negative impact on the development of rural financial services and supply chains, and particularly the availability of credit to smallholder farmers, in ways that further constrain opportunities and reinforce poverty traps at the farm level (Barrett & Swallow 2006; Kelly et al. 2003; Poulton et al. 2006). Farmers' willingness to invest in technology is enhanced by their knowing that the insurance will pay out in the event of a climate shock, while insurance increases the confidence of credit providers to lend to smallholder farmers. Increasing uptake of credit, production inputs and improved livelihood opportunities are objectives of several agricultural insurance initiatives.

Evaluations of successful index insurance programs demonstrate that they do have a positive effect on adoption of more profitable production technologies. An evaluation of the R4 Rural Resilience Initiative in Ethiopia showed that insurance allowed farmers to increase their savings, increase the number of drought animals, access more credit, and invest more in inputs such as fertilizers and improved seeds (Madajewicz et al. 2013). A separate study, using data from the pilot phase of R4 (then known as HARITA), showed that insurance had a significant positive impact on fertilizer use (Oxfam America, 2014). The ACRE (Agriculture and Risk Enterprise Ltd.) initiative reported that insured farmers had 16% more earnings and invested 19% more compared to their uninsured neighbours (ACRE 2014). This generalization is supported by randomized control trials and experimental "games" with farmers in India, Ghana, Mali and Ethiopia (Cole et al. 2013; Karlan et al. 2014; Elabed & Carter 2014; Hill & Viceisza 2012; Mobarak & Rosenzweig 2013).

Lessons from successful index insurance initiatives

The scale of agricultural index insurance coverage is however still quite low globally. Uptake rates have been disappointing in many initiatives, leading some to conclude that limited demand among smallholder farmers limits the potential for insurance to contribute to the resilience of smallholder farmers at a significant scale. On the other hand, evidence that farmer demand is influenced by design-related factors, including the degree of basis risk (Elabed and Carter 2015) and farmers' understanding and trust in the products (Hill and Viceisza 2012; Karlan et al. 2012; Cai et al. 2011), suggests that improving design and implementation could enhance uptake. Recent rapid scaling of several initiatives suggests that

uptake may be determined largely by evolving capacity to overcome the challenges and provide effective services (Greatrex et al. 2015).

Reviews of existing index-based agricultural insurance initiatives (Hellmuth et al. 2009; Hazell et al. 2010; Greatrex et al. 2015; Hess & Hazell 2015) have identified several common factors that contribute to success, which are relevant to the situation in Nigeria.

Insurance to improve farmers' livelihoods. First, in most successful agricultural insurance initiatives, insurance has been designed to unlock particular opportunities for farmers that were previously constrained by particular risks. For example, it can increase farmers' access to credit, improved production technologies and new market opportunities. Such value addition is best achieved where the insurance is integrated with input supply chains and credit, and with the broader strategy for improving the productivity, profitability and resilience of agriculture. In some instances, insurance has been bundled with credit for agricultural inputs, or bundled into the sales price of inputs such as seed or fertilizer. This type of formal bundling has the potential to improve uptake of both insurance and improved production technologies, particularly in environments where farmers lack collateral to secure loans (Carter et al. 2014). If premiums accurately reflect the cost of risk, insurance must increase farmers' incomes considerably more than the added cost if it is to be economically viable.

Giving farmers a voice. Second, like other agricultural development interventions that target smallholder farmers, index insurance initiatives are most successful when they are driven by demand. This is accomplished in several ways. At a minimum, successful initiatives generally start with assessments of the needs and risks that are relevant from the farmers' perspective, but also build mechanisms to continuously monitor and respond to farmers' evolving needs. Several initiatives have reported substantial benefits from participatory processes that involve farmers in the design of insurance products, at least initially (Patt et al. 2009). In India, which historically took a more top-down approach to achieve scale, the improvement to the National Agricultural Insurance Scheme (NAIS) that farmers requested most was greater participation in the design process (Zevenbergen 2014). The same study reported increased uptake of insurance in a community-designed pilot project that opened avenues for farmer feedback.

Developing local capacity. Third, successful initiatives have engaged and invested in the capacity of a range of local stakeholders. Those that have been scaling have worked through trusted and capable local organizations that already have established relationships with the

targeted farming communities. Examples include: agricultural input dealers, agricultural extension systems, agricultural credit institutions, farmers' associations, agricultural development programs, and development NGOs. Scaling up depends on the knowledgeable participation of all groups. Understanding what index-based insurance does and does not cover, and the implications of basis risk, are particularly crucial both for farmer clients and for local service providers. Research shows that demand for index-based insurance increases as farmers gain awareness, understanding and trust in an insurance program (Hill & Visceisza 2012; Karlan et al. 2014; Cai et al. 2011; Eling et al. 2014). Therefore the more successful initiatives have made substantial investments in the capacity of farmers to understand the index insurance products, the capacity of the various relevant local stakeholder organizations to supply insurance products and associated services, and in some cases the capacity of all stakeholders to participate in the design of insurance.

Investment in data and science-based index development. Fourth, investments in data collection systems, and in science-based index development, have helped successful initiatives address the challenges of data poverty and basis risk. Contracts must be based on reliable, quality-controlled near-real-time data; while estimating the frequency of payouts and appropriately pricing contracts requires decades of historical data. Yet the regions where agricultural insurance is most needed are often characterized by weak observing infrastructure, major gaps in historical data in space and time, and weak quality control. In response, index insurance initiatives increasingly use multiple data sources, such as combinations of meteorological and hydrological observations, agronomic data, and remote sensing. In some cases, insurance has spurred investment in weather station infrastructure; although this does not directly address the need for historical data to accurately estimate risk and price insurance. Building on scientific knowledge and working closely with relevant research organizations has enabled successful initiatives to validate indexes, quantify and effectively communicate basis risk, find solutions to data poverty, and improve farmer satisfaction with products.

Enabling regulatory environment. Fifth, successful index insurance requires an enabling regulatory environment. Insurance regulators should ensure that products are designed and managed in ways that are fair to both clients and providers. Reliable contract enforcement is a prerequisite to trust by all stakeholders. Insurance regulation should explicitly address index-

based products, and the need for transparency and resolution of disputes that results from basis risk. Laws and regulations that conform to international standards improve the prospects for accessing the international reinsurance market.

Effective public-private partnership. All successful agricultural insurance initiatives involve multi-stakeholder partnerships, and most include public-private partnerships. Insurance is most effective when it is integrated into agricultural value chains, and engages a range of actors such as input suppliers, agricultural advisory services, farmer organizations, agricultural commodity markets, and agro-processors. Because agricultural insurance markets often suffer from market inefficiencies due to information asymmetries, lack of data, and limited access of insurers to reinsurance, the private sector alone cannot develop insurance for smallholder farmers, and public-private partnerships are needed.

Policy context for agricultural insurance in Nigeria

Agricultural Transformation Agenda and Growth Enhancement Scheme

Plans to expand agricultural insurance in Nigeria are linked to several initiatives under the Agricultural Transformation Agenda (ATA). The ATA, launched by the Federal Ministry of Agriculture and Rural Development (FMARD) in 2011, seeks to re-orient Nigeria's agriculture from development challenge to a business-oriented sector of the economy. It succeeded in its goal of adding 20 million metric tons (MT) of food to the domestic food supply and creating 3.5 million jobs by 2015.

The Growth Enhancement Support Scheme (GES), launched in 2012, sought to improve production by providing subsidized production inputs to small-scale farmers. The GES enabled farmers to receive a 50% subsidy on a maximum of two bags of fertilizer. The program was launched in 2012 to revamp the Federal and state fertilizer and seed subsidy, and introduced a new innovation to providing input subsidies to farmers by channelling the subsidy through mobile payments. These mobile payments were enabled by a mobile platform, the "e-Wallet" (Fig. 1). The system allowed fertilizer subsidies to be channelled directly to eligible farmers. Farmers who qualified for the subsidy would register with the local government authority and receive an SMS with a registration number and unique control

number that would signal that the fertilizer value was deposited in their e-Wallet. The registration process created a database of 14.5 million farmers across Nigeria in 2014, providing information about location, crops grown, age, education level and financial inclusion. At planting, the farmer would pick up the fertilizer and seeds at designated distribution centres upon showing the SMS and upon paying the farmers contribution towards the price of the inputs. In 2014, the GES allowed 14.5 million farmers to access seeds and fertilizers worth 300 million USD, in a transparent and efficient way. These qualities made this platform particularly suited to collecting premiums from farmers and transferring insurance payouts to farmers.

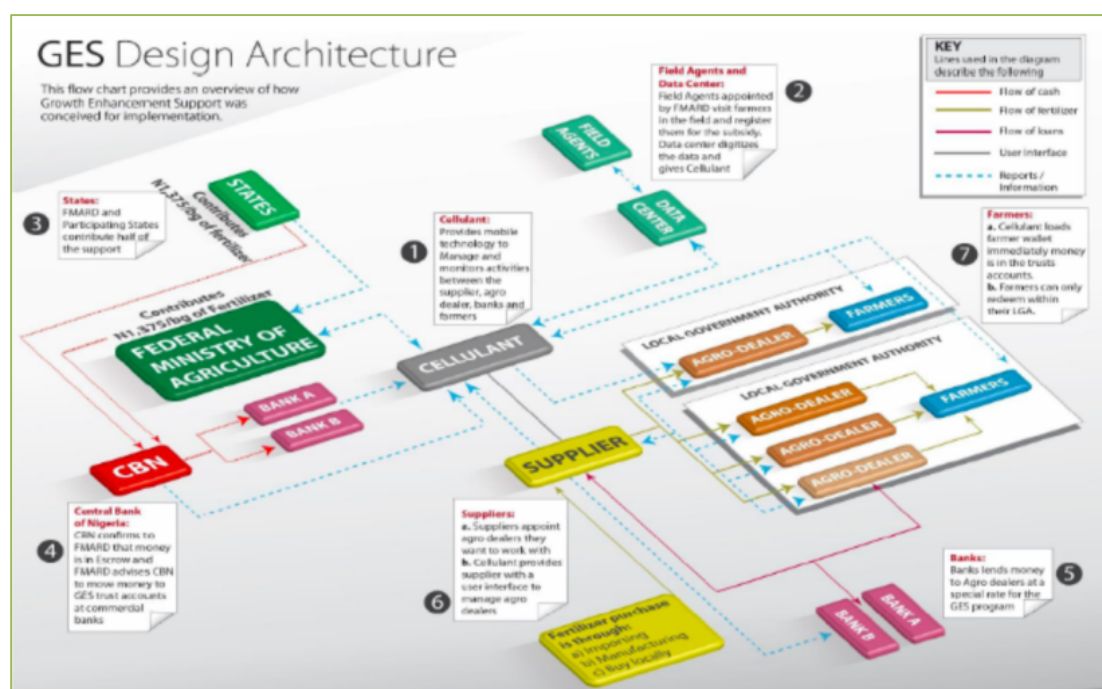


Figure 1: The Growth Enhancement Support System and e-Wallet. Source: Cellulant, 2015.

The GES effectively targeted young farmers, with 49% of the participating farmers under the age of 35, and is influencing a new generation of Nigerian farmers. The GES also targeted the relatively poor and marginalized farming population, with half of GES participants having no more than primary education (GES Factbook, 2015).

National Agriculture Resilience Framework (NARF)

With more than 70% of the country’s workforce engaged in agriculture-related activities, climate change and variability pose significant risks to agricultural development, food security, poverty reduction and political stability in Nigeria. Flooding in 2012, which resulted

in 363 deaths, massive economic loss, and the displacement of more than 3.8 million people (Federal Government of Nigeria 2013), put the issue of the resilience of the agricultural transformation process in the face of climate risk on the national agenda. This prompted a consultative process that led to the National Agricultural Resilience Framework (NARF), launched by FMARD in 2014 (Adegoke et al. 2014).

NARF is a policy framework designed to ensure that Nigeria's agricultural sector is able to cope with the shocks and stresses of a changing climate, through appropriate climate change adaptation and mitigation measures. In its bid to promote agricultural resilience, Nigeria joined the Global Alliance for Climate Smart Agriculture (GACSA), to contribute to the goal of ensuring that 500 million smallholder farmers worldwide can adopt Climate Smart Agriculture (CSA) technologies and practices through agricultural insurance as well as other options. The commitment to expand insurance to Nigeria's roughly 15 million smallholder farmers is one of the pillars of NARF.

Current status of agricultural insurance in Nigeria

Insurance composes only 0.72% of Nigeria's GDP, compared to an African average of 3% and a developed market average of 8.5 % (Swiss Re 2011). A recent overview study of the market conducted by GIZ summarised that, despite the opportunity, the market is focussed on corporate and compulsory contracts. It offers very little to retail customers beyond compulsory insurance (Dias et al. 2013). As of 2012, there were 59 insurance companies and two reinsurers in Nigeria, which is a large number for a market that generated 1.2 billion USD in gross premium in 2010 (Dias et al. 2013).

Agricultural insurance was introduced to Nigeria in 1987 through the Nigerian Agricultural Insurance Scheme (NAIS). Objectives of NAIS are to: (a) provide financial remediation to farmers after natural hazards, (b) stimulate financial institutions to offer rural credit, (c) promote agricultural production by encouraging investments, and (d) minimize the need for the government to provide assistance after a disaster (World Bank, 2011). The Nigerian Agricultural Insurance Corporation (NAIC) was established in 1993 as a public-sector corporation to administer NAIS and its associated subsidies, foster agricultural credit, and generally promote increased agricultural production to reduce the need for ad-hoc agricultural disaster assistance from the government (Epetimehin 2011).

With government support, the NAIC can offer insurance with up to 50% of premiums subsidized by the state and federal government for many types of agriculture insurance including crop, livestock, poultry and aquaculture (World Bank 2011). Farmers seeking loans for agricultural activities are mandated to purchase this agricultural insurance to protect the loans. Currently, the NAIC is the sole insurance company in Nigeria under the NAIS to receive government support, and in the event of catastrophic losses incurred by NAIC, the government will financially remediate damages greater than 200% of the premium cost (World Bank 2011).

The NAIC has presence throughout the country and has offices in 36 states of the Federation. Despite its wide presence, in 2011, according to IFC, NAIC covered 35,000 farmers as of 2010, representing 1% of the total farm population, and underwrote USD 5.6 million of premiums, half of which came from agriculture, the other half coming from other types of insurance products.

Up to 2013, NAIC held a regulatory monopoly on providing agriculture insurance. This regulation was lifted in 2013, and since then six other insurance companies have applied for, and received a license to provide agriculture insurance. The focus of these companies has, however, been on medium- and large-scale farms, as their capacity and exposure in the area of index insurance is limited.

Strategy for agricultural insurance development in Nigeria

The low penetration of agricultural insurance in Nigeria is typical of a nascent market. Like many early markets, Nigerian markets struggle with a variety of issues that include: limited and asymmetric information, crowding out by post-disaster relief efforts, limited access to reinsurance markets, lack of insurance culture, and inadequate regulatory environments (Mahul & Stutley 2010). The strategy for developing agricultural insurance for Nigeria's smallholder farmers must address these challenges, as each of them constrains the sector in a particular way.

First, limited information and information asymmetries cause insurers to shy away from developing products for farmers. Addressing this requires long-term effort by governments to build robust data collection systems that insurers can use, and to strengthen extension systems that can increase farmers' knowledge of insurance, and of good farming practice more generally.

Second, post-disaster relief can be a disincentive for farmers to pay premiums before major losses occur. At the same time, these post-disaster payments are much more expensive to the government. Therefore it is critical to work with governments to develop disaster risk management strategies that provide farmers with incentives to manage their risks through insurance or improved management practices.

Third, for agricultural insurance to be viable, insurance companies need reinsurance arrangements to protect them from major spatially-correlated climate shocks, such as drought. However, early agriculture insurance markets like Nigeria struggle to reach premium volumes that attract international reinsurers, limiting the growth of the market. Developing distribution channels linked to the GES can help accelerate the development of such volumes.

Fourth, the low level of insurance penetration in Nigeria reflects a limited culture of formal insurance and risk mitigation strategies. Informal methods such as mutual societies and community groupings partially fulfil this function in these markets. Since these groups have limited capacity to price the risks they face, they tend to underestimate the severity of the risks they are essentially self-insuring. This causes resistance once formal insurance is introduced, as it is perceived as expensive.

Finally, as in most of these markets, agriculture insurance is widely understood as traditional crop insurance, based on farm visits through MPCCI style products. Products that do not use farm visits, do not fit the regulatory environment, and are in the best case not understood by the regulator, and can in the worst case be prohibited.

The remainder of this section outlines a strategy by which the Nigerian Government, in partnership with the private sector, can address these challenges and work towards developing a mature agriculture insurance market.

Government roles in risk management

The current low penetration of insurance is not unique to Nigeria or Africa, but simply a reflection of the state of the market. Achieving the goal of developing sustainable, inclusive agricultural insurance will require a strong partnership between the private insurance sector and the government. The government can play a vital role in supporting the development of effective market-based agricultural insurance in five key areas: data systems, awareness and capacity building, facilitating international risk pooling, smart subsidies, and creating an enabling policy environment (World Bank 2015). During the early stages of development, without government investment private companies would have an incentive to wait for others to make these initial investments before entering the agricultural index insurance market.

Index-based insurance is particularly dependent on the availability of reliable, high-quality meteorological, hydrological, agronomic and economic data. Given their multiple uses, these data will make the greatest contribution to society if the government treats them as public goods, and supports their collection and free availability. Although the index insurance market might provide incentive for private sector investment in data collection, particularly automatic weather stations, socially optimum investment and use of data requires public investment. Like data systems, the private sector is unlikely to invest in farmers' awareness and understanding of insurance at socially optimum levels; initial investment by the government is needed in order to reach the intended scale. Before the private insurance sector can provide relevant products and services to the agricultural sector, the government should work with the private sector to ensure a conducive regulatory and policy environment, and building a critical level of capacity to design and implement viable agricultural index insurance products. Data systems, awareness and capacity building, and an enabling policy environment for index-based agricultural insurance are discussed further below.

Subsidies play a significant role in agricultural insurance worldwide. From a 2008 survey, the World Bank estimated that 68% of the global premium volumes are paid by the public sector, and that in over one third (37%) of all the countries that have agriculture insurance programs, agriculture insurance is offered as part of public partnership. These partnerships take different shapes but are dominated by premium subsidies (Fig. 2). However, if not implemented carefully, premium subsidies carry significant risks, including discouraging other means of

managing risk, creating dependence on future subsidized assistance, and distorting incentives for insurers and banks.

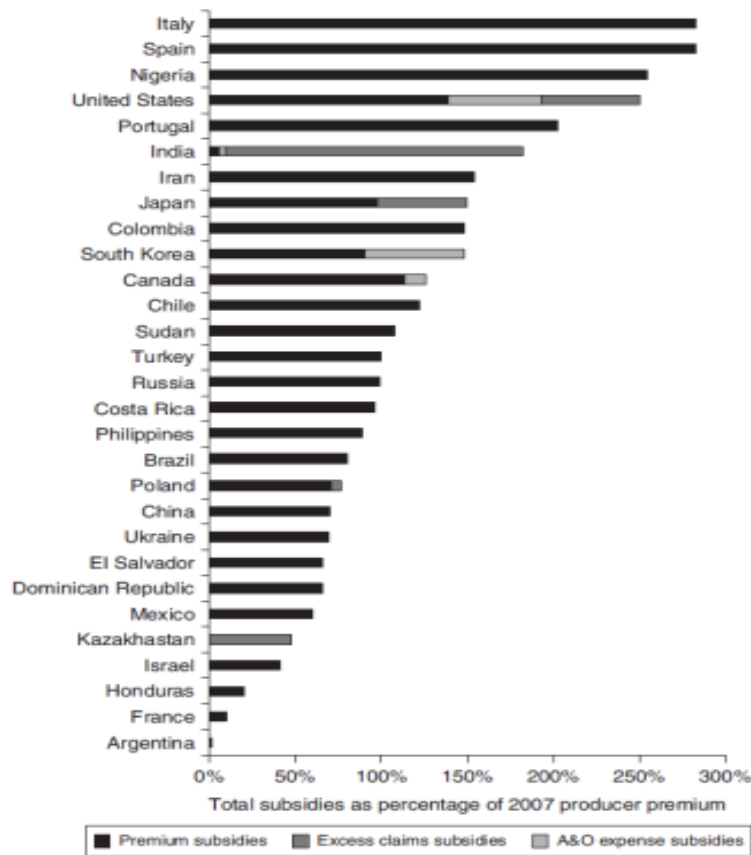


Figure 2. Government subsidies as a percentage of premiums paid by producers in select countries. (Note: The producer premium is the share of total premium paid by the farmer after deduction of premium subsidies. Excess claims subsidies in Kazakhstan are based on a 3-year average for 2004-2007. The figure for the United States excludes crop hail insurance. Source: World Bank Survey 2008.)

“Smart” subsidies are designed and implemented in ways that provide social benefits while minimizing distortions in the market and mis-targeting of clients (Morduch 2005; Clarke 2010; Hill et al. 2014; Hess & Hazell 2015). A smart insurance subsidy should: (a) serve a well-defined policy objective, (b) target a well-defined set of beneficiaries, (c) be informed by monitoring and evaluation, and (d) have either a clear exit strategy or a viable long-term financing strategy. Subsidies directed at costs of developing and administering insurance may be more cost-effective and less distorting than direct subsidies to premiums. If premiums are subsidized, recommendations in the literature include: providing subsidies on a per farmer rather than proportional basis, to equitably support relatively poor smallholder farmers; and

ensuring that farmers' portion of the premiums is not less than the long-term average expected payout, to avoid disincentives to managing risk through other available means.

While formal risk mitigation structures like insurance are still nascent in Nigeria, there are several other solutions in place to address risks, most notably disaster risk and emergency response funds, which are provided to the rural sector by both government and international non-governmental organizations. While these mechanisms are necessary, they can crowd out the need for formal risk transfer solutions like insurance and discourage farmers to pay for premiums, by reducing the consequence of not buying insurance. Furthermore, the cost of disaster response is known to be far higher than that of insurance-based risk transfer. Importantly, without the need for fundraising, the response time of ex ante solutions such as insurance is much faster. While the need for disaster relief may never be eliminated completely, insuring governments through the African Risk Capacity (ARC) provides an attractive, insurance-based mechanism to implement disaster relief financing.

In designing effective public-private partnerships, key Nigerian actors—particularly those from the FMARD, Central Bank of Nigeria (CBN), and NIA—could exchange knowledge and learn lessons through exchange visits to key developing and developed markets (particularly learning from the USA, Mexico and Indian markets) to understand government role and activities in those countries. The experience in India can be particularly illuminating. India, similar to Nigeria, has a state-owned agriculture insurance company, but there are also several other private sector insurers active in the market. Since government started offering premium subsidies to the market as a whole this sector has expanded rapidly, growing from a 2 million USD premium volume in 2007 to 20 million USD in 2013. Nigeria may consider implementing some of the steps India has taken in this field – not all of which require substantial financial resources – for example by requiring farmers to be insured in order to access credit, or requiring that all farmers that purchase inputs with government support also insure those inputs.

Support robust data systems

Lack of data to develop and price index-based products is often identified as a key constraint to developing effective schemes for agriculture. Data are key to producing viable insurance indexes, and determine the premium price of index insurance products that are relevant to small-scale farmers. Historical data series facilitate the assessment of the variability of

weather and yields, hence allowing for an estimation of a premium price based on objective assessment of the risks. Without historical data, setting premium rates is likely to lead to losses for the insurers and can lead insurers to withdraw from the market prematurely.

Weather data

Designing viable weather index insurance products generally requires a long time series of (typically rainfall) data, with a minimum of 15 years and ideally 30 or more years of data. Rainfall indices are used primarily to insure for drought risks as the correlation between reduced rainfall and drought-related crop losses are high.

Because the relationship between crop yields and weather observations weakens, and therefore basis risk increases, with increasing distance, early index insurance pilots only offered index insurance to farmers within a given distance from a long-term weather station. Sparse and generally declining weather observation networks have been identified as a major challenge to scaling up weather index insurance in Nigeria (World Bank 2011). The Nigerian Meteorological Agency (NIMET) maintains a network of roughly 60 climate plus synoptic observing stations (National Bureau of Statistics undated; Akeh et al. 2000). Although the country has many more agromet and rainfall stations (roughly 500), most of these are currently under the control of state governments rather than NIMET. Providing FMARD with access to all available, quality-controlled historical and monitored meteorological data is a priority for developing weather index insurance.

Weather insurance schemes elsewhere (e.g. ACRE in Kenya, Weather Based Crop Insurance Scheme (WBCIS) in India) are prompting investment in new automatic weather stations to fill gaps in real-time observations. Expanded weather station networks play an important role in improving the accuracy and reduce basis risk of indexes, but it will take decades for new networks to provide enough historic data to quantify risk sufficiently to inform the design of robust contracts.

Satellite rainfall estimates, which go back to about 1982, offer an alternative to sparse station observations, and provide complete coverage in time and space. However, most satellite products are constrained by some combination of coarse spatial and temporal resolution, short period of record, inhomogeneity when sensors or methods were changed, and poor or unknown accuracy due to lack of calibration with ground observations. Merging satellite

estimates with quality-controlled station data greatly increases their accuracy. An initiative known as ENACTS (Enhancing National Climate Services), led by the International Research Institute for Climate and Society (IRI), works with African national meteorological services to develop high-resolution, high-quality blended station-satellite data, and a range of online climate data and information products, in a form and at a spatial resolution that is suitable for local decision-making (Annex 1). Because the accuracy of merged products depends primarily on the number and spatial distribution of station observations, the quality of merged data sets produced by a national meteorological service, using all of their available station data, is expected to be substantially better than any merged products that use only the very small set of globally available station data. The satellite rainfall products have performed well across several African countries, even in complex terrain, but accuracy tends to diminish in coastal areas.

There are options for introducing weather index insurance for more than drought. While excess rainfall is sometimes used as an index for flood-related losses, local rainfall is not likely to be a good proxy for flooding and its impact on crops. This is because flooding can be due to a range of factors unrelated to local rainfall. River flooding, which is the greatest flood-related threat to agriculture in Nigeria, is often a delayed response to rainfall elsewhere in a watershed. Flash flooding and waterlogging are due to excess local rainfall interacting with topography, land use and soil water content. Coastal flooding is associated with storm surge driven by offshore windstorms.

Remote sensing and hydrological modelling – alone or in combination – might offer promising alternatives for developing index-based agricultural insurance that addresses flood risk, particularly for river flooding. Well-qualified expertise and a long-term investment in developing such products, in partnership with international expertise, should be featured in any plans to develop insurance based on remote sensing or hydrological modelling. Relevant experience is however available both internationally and locally. Within the CCAFS network, the International Water Management Institute (IWMI) is working with FMARD on a three-year project to develop flood risk mapping, flood forecasting tools, and analysis of flood

impacts along the Niger and Benue rivers¹. IWMI also leads a four-year (2015-2019) CCAFS project to use remote sensing and hydrological modelling to develop index-based, meso-scale flood insurance for agriculture in South Asia². The Nigeria Hydrological Services Agency (NIHSA) began in 2014 to use two hydrological models for their annual flood outlook (NIHSA, 2014). Nkeki et al. (2013; Univ. of Benin and Delta State Univ.) used satellite remote sensing to map flood risk in the Niger-Benue basin, map the extent of the 2012 flood, and analyse vulnerability to flooding.

Yield data

Farmers globally face a variety of risks beyond drought. A World Bank (2011) pre-feasibility study of crop weather index insurance in Nigeria, requested by NAIC, concluded that weather indexes could not capture the most important insurable crop production risks (disease > flood > fire > drought). Within index insurance, another way of insuring for other non-drought related risks is using area yield index insurance. Area yield index insurances are products where the yield of an area (or large group of farmers) is used as the proxy for individual farmer's experience. Rather than visiting all farmers, a selected sample of farmers is visited and harvests measured by further sampling. By measuring the harvests, losses due to various events such as flooding, pests and disease can be accounted for.

Annual crop production and cropped area is measured by state Agricultural Development Projects (ADPs), through a Crop Area and Yield Survey (CAYS) process. Annual production statistics for many crops are available at the state level, since 1995, through the National Bureau of Statistics; annual performance survey reports by the National Agricultural Extension and Research Liaison Services (NAERLS), under FMARD; and CountryStat³. Gaps in the records up to 2005, in several states, had to be estimated based in part on data from adjacent states (National Bureau of Statistics 2007). The usefulness of these data for

¹ <http://frdsan.iwmi.org/home>

² <http://ibfi.iwmi.org/>

³ <http://countrystat.org/home.aspx?c=NGA&tr=21>

agricultural insurance are limited by their coarse spatial scale, substantial delays in processing the data, and questions about their reliability.

Yield data at a finer resolution do exist in Nigeria, but they are scattered across various sources such as research institutes, agriculture development programs, agribusiness and government agencies. Some of these institutions have collected excellent data already, using rigorous crop cutting methods. For example FMARD, in partnership with IITA, has collected maize yield data using GPS to measure farmers' fields.

It is feasible to collect and combine such data sets from various sources for the different crops grown in Nigeria. These data sets could be used to build a publicly available database in cooperation with the insurance sector. Its use would depend on the willingness of the insurer or reinsurer to accept historic crop yield datasets compiled from multiple sources. Such an exercise should be done alongside an investment in yield data collection systems employing rigorous crop cutting procedures that involve harvesting and weighing standardized areas that are randomly selected in farmers' fields. This should preferably be implemented by private sector partners with the capacity to execute the measurements in a timely and cost-effective manner, and who could be audited. Such efforts in other countries have encouraged the private sector to enter the agricultural insurance market.

Connecting insurance with credit, technology and inputs

Insurance initiatives targeting smallholder farmers have been most successful when they have either unlocked opportunities for increasing income (for example by improving access to credit or improved production technologies), or protected productive assets (for example, livestock herds). These initiatives have generally treated insurance as one component of a comprehensive approach to managing risk, and have intentionally connected insurance with, e.g., credit, production inputs, market opportunities, management advisories, or social protection programs.

Many things that farmers can do to increase productivity require taking risks. For example, a farmer might be able to increase yields by using high quality seeds, but farmers who lack savings would need a loan to buy those seeds. Farmers may worry about making that investment, because if those high yielding seeds are more costly and more sensitive to rainfall, their losses may be even higher in a bad year than if they had used the regular seeds.

Furthermore, if banks think that farmers are at high risk, they may not be willing to make those loans in the first place. A study based on a 2013 survey found that a majority of farmers across Nigeria that applied for credit were either denied credit or loaned less than what was requested, and identified the perceived risk of lending to smallholder farmers as a major constraint despite a range of programs and policies that seek to promote lending to farmers (Olomola, & Gyimah-Brempong 2014). Very high default rates on agricultural loans observed in a recent study in two states (Obasi 2015) suggest that lenders' concern about risk may be warranted.

Insurance can address climate risks and thereby increase banks' willingness to make loans while simultaneously encouraging farmer to make investments in farm productivity via the use of new agricultural technologies and practices. Farmers can, hence, take advantage of productive opportunities that bring them higher income in most years. Insurance, thus, can both build resilience by providing a payout in bad years to help farmers survive and protect their assets, and also unlock opportunities to increase productivity in the better years.

The National Agricultural Resilience Framework (Adegoke et al. 2014) notes the work of Micro-Ensure in Malawi, in 2005-2006, as a potential model. The project in Malawi initially targeted groundnut producers who had limited access to improving their inputs since drought-resistant varieties of groundnuts were expensive. Rainfall index insurance was bundled with loans for a package of groundnut, and subsequently maize and tobacco, production inputs. Nearly all eligible farmers purchased insurance as part of a bundle, at an actuarially fair price (Hellmuth et al, 2009).

We suggest that bundling be seriously considered in the case of piloting and scaling index insurance in Nigeria. In Annex 2, details are provided of drought tolerant maize varieties that have been developed for Nigeria and that are strong candidates for inclusion in index insurance schemes in Nigeria.

Building farmer's understanding and capacity

The effectiveness of communication with farmers is a key factor that influences trust and farmer uptake of all technologies and practices, including insurance. This is especially the case when it comes to index insurance. Nigeria's ambitious plans to rapidly scale up agricultural insurance will require efficient, scalable mechanisms to engage farming

communities, and build their capacity to understand and hence effectively demand appropriate insurance products. Whether the focus is conventional indemnity insurance or index insurance, farmers need to trust that the people they are paying to take on their risk will be around to provide payouts, and need to understand and trust the structure of the contract. Partnering with organizations that already interact with farming communities, and that have already built trust, has proven to be effective in several successful agricultural index insurance initiatives (Greatrex et al. 2015).

Building the capacity of farmers requires building the capacity of local institutions to effectively engage farmers, building on the plethora of literature and experience on how effectively to work with farmers in a participatory way (e.g., Pretty et al. 1995). There are well-documented participatory approaches and guidance materials to streamline the processes of building awareness of farmers and obtaining their input into the design of (index) insurance. For example, the International Research Institute for Climate and Society (IRI) has developed guidance and training materials to streamline the process of engaging groups of farmers in participatory in educational games and interactive exercises, based on their experience in the early development of several successful index insurance projects.

The interaction with farmers need not all be face-to-face. For example, ACRE markets its insurance products to farmers over the radio, since this is how most farmers already get information. The announcements discuss the benefits of ACRE's work, and advise which input suppliers to visit to acquire the product. Building on the considerable experience of Farm Radio International, a forthcoming CCAFS report (Woodley et al. forthcoming) provides guidance for developing interactive models of rural radio programming to efficiently build farmers' awareness of index-based insurance, and obtain their input into product design.

Building this level of financial education to farmers, even through mass communication channels, is costly, suggesting that investments in farmer's knowledge could be viewed as a public rather than a private good. Recognizing the risk of this form of market failure, we recommend that the Nigerian government consider supporting farmer outreach and education related to insurance, leveraging existing publicly supported advisory services and communication platforms. Because the benefits of insurance depend in part on farmers' understanding and willingness to adopt good production practices, there is a need for agricultural insurance initiative to include extension and education on improved practices.

The last decades have however seen a reduction in investment in public extension services. Private extension services that have partially filled the void have tended to cater to better-off farmers. But there are exceptions in Nigeria (Ozor et al 2007; Horna et al 2007; Ajieh et al. 2008).

The agricultural advisory service landscape is changing, and new innovations should be considered. For example, the international design firm IDEO worked on a project in Kenya to assess the best ways to deliver technical information at scale, and concluded that information needed to be delivered that first inspires farmer to try something new and then supports them as they adopt these new technologies⁴. They tested delivering these inspiring messages at scale through videos that were delivered by local farmers' spokespeople, and followed up through helplines that farmers could call for individual support. In India, farmer helplines were initiated by the private sector, but were scaled up when government subcontracted these services as a more cost efficient channel for its extension services. While this example may not be directly at insurance, experiences with developing insurance for smallholders in Kenya showed that helpline services contributed to uptake of insurance. Offering the products to aggregators like millers, processors, input providers, seed companies, might offer an alternative to scaling up agricultural insurance, since they are better educated and at a better position to stand against contractual non-performance on part of the insurers.

Developing innovative distribution channels

In developed markets, agriculture insurance takes advantage of high financial literacy, high overall insurance penetration and a larger farm size that can bear the higher operational costs related to individual distribution and sales. In Nigeria and other African markets where the agriculture sector is dominated by small-scale distribution, and hence micro premium volumes, distribution becomes key to reaching commercial viability.

General insurance in these markets has grown exponentially in the last 2-3 years leveraging on loyalty based schemes with mobile network operators, where insurance is offered as a

⁴ <https://challenges.openideo.com/challenge/youth-employment-pathways/ideas/the-facebook-farm-extension/comments>

‘bonus’ for staying and topping up credit with a particular mobile network operator. Based on this initial insurance experience, people have then converted ‘voluntarily’ to purchase insurance cover through their mobile. MicroEnsure and Bima have each reached millions of micro-insurance customers through such models (Prashad et al. 2013).

Across the world various distribution mechanisms to sell agricultural micro-insurance have been tried. In Kenya, index insurance has been sold voluntarily through agro dealers using mobile technology to transfer premiums, as well as in partnership with seed and fertilizer companies which bundled the insurance together with seeds and fertilizers. In Kenya, however, this relied on an established private sector seed and fertilizer distribution system with tens of thousands of rural agro-dealerships and an established market demand for seed and fertilizers.

In comparison, the Nigerian agro inputs market is much less developed, despite its vast potential. One of the leading rice seed companies advised that 100% of its certified seed production was channelled through government programs such as the GES. A leading fertilizer company mentioned that 80% of the fertilizer was sold through the GES. While there are some private agro dealerships, the volume sold through these shops is still nascent and they are unlikely to stimulate large-scale uptake of insurance at an early stage. That said, given the sheer size of the farmer population in the Northern states, in a couple of years from now, when the agribusinesses that sell fertilizers and seeds are more established, these businesses could offer a viable channel to distribute insurance.

Given the above, the main conduit for scaling agricultural insurance in Nigeria in the short term is the GES. The main strength of the program is its scale in combination with its use of mobile technology allowing for subsidies to be channelled directly to farmers. It is these qualities that make this platform particularly suitable to collect premiums from farmers and to distribute any claims. The number of rice and maize farmers in the GES totalled 8 million in 2014. If these farmers were insured, it would immediately make it one of the largest crop insurance schemes in the world, in both farmers and premium volume. Annex 2 provides an overview of the total number of farmers that participated in the GES for the last 3 years.

Like with mobile linked general micro insurance, using the GES as a platform would allow farmers to try out insurance at a relatively low cost as it would only cover for the first two bags of fertilizer and the first bag of seed. This could build trust in insurance products with

this previously uninsured rural population, while providing private insurance companies the volume that is required to interest future investments. From there, farmers could be targeted with voluntary products that offer an expanded cover, insuring all inputs or even the harvest.

Develop a culture of insurance

As mentioned several times in this document, building an insurance culture is extremely important. Building an insurance culture is however not only the result of effective training and communication to the end customers. It is the result of the insurance companies offering relevant products and reasonable premium rates and paying claims at high speed. An insurance culture is not the result of a marketing campaign. It's the result of well thought out products backed up by solid operational processes. The results of this are reflected in customer experiences and finally in 'an insurance culture'. These characteristics are the hallmark of developed insurance markets that thrive and develop through competition.

Regulation

Development of a competitive market requires a conducive regulatory environment. There are specific challenges in the Nigerian context when it comes to fostering a conducive regulatory environment. Regulation has shaped the agriculture insurance sector in Nigeria, affecting the role the private insurers and reinsurers take, and shaping the products offered in the market through premium subsidies.

Up to 2013, NAIC held a regulatory monopoly on providing agriculture insurance. This regulation was lifted in 2013, and since then several insurance companies have applied for, and received a license to provide agriculture insurance. While these private companies are able to offer agriculture insurance, some areas of uncertainty persist in their licensing, access to premium subsidies and area of operation. These issues need to be clarified as they are currently limiting insurance companies entering and growing in the market.

Regulation in Nigeria also regulates the involvement of the international reinsurers. The insurance law act of 2003, section XII point 72.4 stipulates that only under exceptional circumstances may any reinsurance or insurance be placed outside of Nigeria with international insurers and or reinsurers, and that such an exception needs to be approved by the National Insurance Commission. Since much of the technical and financial capacity in agriculture insurance is generally with reinsurers rather than domestic primary insurers, this

regulation is likely to limit the willingness of international reinsurers to participate in any product in terms of technical capacity as once the product has been established they are likely to be pushed out of the market by this regulation. While reinsurers may find alternative structures to overcome this issue, it should be noted, as it may be used by the incumbent local re-insurers to prevent the international reinsurers from entering the market.

Phases of agricultural insurance development

Developing inclusive agriculture insurance in Nigeria will take years and will require stakeholders across the public and private sector to work effectively together. The activities we suggest that FMARD consider undertaking or supporting are not meant to be prescriptive. The suggested measures fall into three streams. First, we would advise to work towards creating a regulatory and partnership environment that makes it attractive for insurance companies to enter into the market. Secondly, we would advise to supporting the growth of the sector through more direct incentives such as through development of a public-private partnership as well as encouraging supporting companies to innovate and develop products for the sector through targeted assistance programs. Finally, we suggest a phased approach to implementation that progressively builds capacity, overcomes challenges, and develops a knowledge and evidence base to support effective and inclusive agricultural insurance at scale.

Activity stream 1: Public sector capacity and regulatory environment

We recommend forming a task force of public sector champions that will become a centre of expertise in agriculture insurance in Nigeria and that will spearhead efforts from the public sector. This task force should represent institutions such as FMARD, NAICOM, CBN, NIRSAL, NAIC and other relevant government agencies. This task force would lead in several activities that would foster the development of inclusive agricultural insurance, for example:

- Engage appropriate expertise to review the current regulatory environment – including how disaster relief measures relate to agricultural insurance – and propose and follow up on the implementation of any needed changes.
- Assess the role of the government in risk financing, for example through the African Risk Capacity (ARC).

- Assess the role of the government in subsidies, bearing in mind the principles of “smart subsidies” outlined earlier.
- Engage appropriate expertise to guide bundling insurance with credit or inputs; and engage the banking and agricultural input supply sectors as appropriate.
- Establish a sustainable Public Private Partnership (PPP) that could support the development of data systems, product development, and any subsidies, that can be rolled out over the following years.
- Participate in knowledge exchange visits to learn from experiences in other countries, in particularly countries that have vibrant index insurance and agriculture insurance programs with PPPs such as India and the USA.

For reasons discussed earlier, the public sector must play a role in addressing the need for reliable quality data. Several steps are likely to be needed:

- Formalize the relationship between FMARD and NIMET to ensure full access to historic and near-real-time meteorological observations, including those from agromet and rainfall stations.
- Work with relevant research organizations to produce and evaluate spatially and temporally complete records by merging available, quality-controlled station rainfall observations with satellite data.
- Build a long-term database of yields for target crops, in collaboration with relevant research institutions and with the private sector.
- If flood index insurance is considered strategic, work with relevant research organizations to select and assess appropriate tools and data.
- Develop a training program for insurance companies on remote sensing data sources and their use for product development in agriculture insurance.
- Set up an ongoing yield data collection framework, using private data collection agents that execute crop cutting experiments to build a timely and cost efficient data collection process.

Activity stream 2: Building private sector capacity

Similar to public sector, private sector companies may also consider joining forces and forming a working group that can act as a representative body in the process of developing the sector toward the public sector. And similar to the public sector, the private sector could

benefit from understanding experiences from other countries in developing agriculture insurance.

The private sector will require support at the early stages of development, as initial set up costs will often be prohibitive for insurance companies to take on, particularly if they are testing out new distribution channels or products. The Nigerian Government should therefore consider a fund for those companies willing to implement innovative products, as this will de-risk insurance companies from entering the sector and committing their human and insurance capital. Such a fund could support technical assistance for product development, pilot testing, feasibility studies, development of financial education, or testing of innovative marketing and distribution channels. Such funds have been done in other countries – although generally by development agencies such as the private sector arm of the World Bank, IFC – and have resulted in innovative schemes that subsequently scaled up. Lessons from the beneficiary companies should be shared, so that the sector as a whole can benefit from these experiences, returning a public benefit of these initiatives developed by the private sector.

Activity stream 3: Pilot implementation and scaling

A phased process for developing agricultural insurance should start with pilot implementation that is designed to progressively build the capacity of all relevant stakeholders, develop practical solutions for the challenges that have been identified to developing insurance for smallholder farmers, and strengthen the knowledge and evidence base for scaling up.

We recommend starting with pilot implementation in one or two crop value chains that are widely important and vulnerable to climate-related risks, in at least two states. The choice of location and value chain should be informed by analysis of the risks that are most important to farmers, by agricultural value chain and by agro-ecological zone. Implementing pilot weather-based and area-yield based index insurance in parallel would provide opportunity to quickly develop the data systems for both, and provide early evidence of their feasibility and acceptability.

To provide useful evidence, we recommend that each pilot initially target on the order of 10,000 farmers. Expanding implementation to more farmers, to new value chains and to new locations should be informed by strong ongoing monitoring and evaluation. The monitoring and evaluation process should answer questions and strengthen evidence about issues such as:

the degree to which indexes and contracts cover the important risks, degree of basis risk, effectiveness of farmer outreach, cost-effectiveness, impact on access to credit and improved production inputs, and impact on production and incomes.

Pilot implementation provides an opportunity to test and adapt several innovations that have proven useful in other parts of the world, including:

- Innovative ways to build farmers' understanding of the complexities of index insurance, e.g., through interactive radio programming;
- Involvement of farmers and other key stakeholders in the design of insurance products and services;
- Development and use of merged satellite-station rainfall and temperature data sets as an alternative to sparse ground-based observations (Appendix 1);
- Further development of expertise in using either hydrological models or remote sensing for flood-related agricultural insurance applications; and
- Identification of suitable climate smart agricultural technologies (e.g. drought tolerant seed bred for different agro-ecological zones in Nigeria; Appendix 3) that lend themselves to bundling with crop insurance initiatives.

Initial pilot implementation is likely to need strong financial support for reasons outlined earlier. As insurance is developed at scale, increasing attention should be given to cost-effectiveness and to developing viable business models.

Sources of Relevant Expertise

Plans for scaling out insurance; announced by the former Minister of Agriculture and Rural Development, Dr. Akinwumi Adesina, at Climate Week in New York, September 2014; led FMARD to request CCAFS to organize a workshop to bring together several national stakeholders and key international experts to identify solutions to the challenges and begin to formulate an implementation strategy – resulting in the development of this roadmap document. The workshop, held in London, January 2015, included the heads of the Nigerian and Indian Agricultural Insurance Corporations, CCAFS, Swiss Re, German Corporation for International Cooperation (GIZ), Nigerian Meteorological Agency (NIMET), Nigerian Agricultural Insurance Corporation (NAIC), Nigerian Insurers Association (NIA) and Pula

Advisors (a consultancy company). The organizations that have been involved or consulted in the process offer a range of relevant expertise:

- The CGIAR research program on Climate Change, Agriculture and Food Security (CCAFS) is a research program of all 15 Centres of the CGIAR that aims to ensure a food-secure future in the face of a changing climate. CCAFS and its partners (including CIMMYT, IITA, AfricaRice, IWMI, CIAT, ICRISAT, IRI) provide access to a wide range of expertise including: synergies between insurance, improved seed, production technologies and value chains; understanding of agricultural risks; communication with smallholder farming communities; expertise on climate and remote sensing information and their application; capacity-development for index insurance design and communications; flood risk analysis and mapping; and evaluation of adoption and impacts. CCAFS contributed to the initial formulation of Nigeria's National Agricultural Resilience Framework (NARF).
- The German Corporation for International Cooperation (GIZ), in response to requests from national governments, offers technical advice and services on a range of issues related to insurance development, including regulation, development of public-private partnerships, and design of index insurance schemes.
- Pula Advisors is a consulting company that provides technical advice and services on index insurance issues such as product design and pricing, pilot design and implementation, and guidance on scaling. Its staff were intricately involved in the design and implementation of the successful index insurance initiative, Agriculture and Climate Risk Enterprise (ACRE) (formerly known as Kilimo Salama), which has reached 200,000 farmers in Kenya and Rwanda by bundling insurance with agricultural credit and farm inputs.
- Swiss Re is a global reinsurance company that is active in index-based agricultural insurance in the developing world. It offers advice and services with regards to data, pricing, structuring and reinsurance.
- Nigerian Insurers' Association (NIA) (and its member companies, including NAIC) coordinates and provides a range of services to Nigeria's insurance industry.
- Cellulant Corporation is a digital technology business that developed the IT support services and platform for integration through the GES e-Wallet.

Conclusion

While agricultural insurance has been a feature in Nigeria for nearly three decades, in 2014 FMARD announced plans to expand agricultural insurance as part of its Agricultural Transformation Agenda (ATA), with priority given to farmers benefiting from fertilizer subsidies under the Growth Enhancement Support Scheme (GES), and to the development of weather index insurance in parts of the country susceptible droughts and floods.

Experiences from index insurance initiatives in India, Kenya, Rwanda, Ethiopia and Senegal suggest that there is demand for index insurance; that bundling insurance with production inputs and finance can make insurance more attractive to farmers; and that several challenges must be and can be overcome in order to develop inclusive agricultural insurance at scale. In Nigeria, key challenges include: limited and asymmetric information, crowding out by post-disaster relief efforts, limited access to reinsurance markets, lack of insurance culture, and inadequate regulatory environments. The government can play a vital role in supporting the development of effective market-based agricultural insurance in six key areas: data systems, awareness and capacity building, facilitating international risk pooling, smart subsidies, and creating an enabling policy environment. This report provides guidance for developing each of these areas.

To initiate the process of developing more inclusive insurance for Nigeria's farmers, we recommend prioritizing three near-term actions. First, in order to create a regulatory environment that makes it attractive for insurance companies to enter the market, it is important to form a task force of public sector champions who will become a centre of expertise in agriculture insurance in Nigeria and spearhead efforts, discussed in this report, from the public sector. Second, to build capacity for agricultural insurance within the private sector, there is a need to develop a public-private partnership that incentivizes and supports companies to develop innovative products and services for agriculture. The private sector will require support at the early stages of development, as initial set up costs for innovative new products and distribution channels will often be prohibitive for insurance companies. Third, a phased process for developing agricultural insurance should start with pilot implementation of both weather index and area-yield index insurance, designed in a manner that progressively builds the capacity of all relevant stakeholders, develops practical solutions for the challenges

that have been identified to developing insurance for smallholder farmers, and strengthens the knowledge and evidence base for scaling up. It is important to use the piloting process to adapt and test methods for building farmers' understanding and trust, developing effective data systems, researching options for important risks (e.g., flooding) that are not widely addressed by index insurance, and exploring appropriate insurance-technology bundles.

Annex 1. The ENACTS approach to improving climate information availability and access in Africa

Tufa Dinku and James Hansen

There are critical gaps in availability climate data in most of Africa. The state of the current station network is seriously inadequate with the number and quality of weather stations in many parts of the continent in decline. The available stations are unevenly distributed with most of the stations located along the main roads. This seriously limits availability data and services to rural Africa. This has been one of the major challenges to providing weather index insurance to smallholder farmers in Africa. Where station records do exist, data quality and access is often lacking and records suffer from gaps in space and time. These challenges need to be addressed if index insurance is to reach those who need it most.

Satellite-based estimates of rainfall and other weather data offer a potential alternative to sparse ground-based observations. Satellite rainfall estimates, which now go back more than years, offer complete coverage in time and space. However, most satellite products are constrained by some combination of coarse spatial and temporal resolution, short period of record, inhomogeneity when sensors or methods were changed, and poor or unknown accuracy due to lack of calibration with ground observations.

An effort by the IRI and partners (including CCAFS, USAID, DfID, WMO, Univ. Reading, UNDP), known as ENACTS (Enhancing National Climate Services), works with African national meteorological services (NMS) to produce reliable climate data and information products in a form and at a spatial resolution that is suitable for local decision-making. Combining data from the national observation network, with satellite (or reanalysis in the case of temperature) data, produces spatially and temporally complete historic time series at a high spatial and temporal resolution. The high-resolution, gridded historic data sets provide a foundation for producing a range of climate information products and tools, which are made publically available on the NMS websites in the form of online “maprooms,” built on a highly customizable, freely available software platform.

The first step in reconstructing historic time series data is quality control of station data, including verifying station location, checking and addressing outliers and discontinuities, and

spatial and temporal checks for consistency. Suspect data are flagged and excluded in the subsequent merging process.

In the next step the quality-controlled station data are combined with spatially complete, regularly updated, freely available satellite or reanalysis gridded data sets. METEOSAT thermal infrared (TIR) images used for rainfall estimation across Africa are available from 1981, while reanalysis products start even earlier. When ENACTS was first implemented in Ethiopia, only TIR data from the METEOSAT satellite were used in order to ensure temporal consistency of the satellite rainfall estimate. Raw METEOSAT data going back to 1981 were obtained and processed by TAMSAT (Tropical Application of Meteorology using Satellite and other Data) program at the University of Reading, for all of Africa.

Station observations are used to correct the errors in the satellite products while satellite products are used to fill gaps in station observations. This approach uses Regression Kriging, and (for temperature) ancillary digital elevation and averaged MODIS Land Surface Temperature) data, to merge quality-controlled station observations with satellite and/or reanalysis estimates. The final products are moderately high-resolution gridded datasets with >30 years of historic rainfall and temperature, covering every 4 km grid cell across a country, on either a dekadal (10-day) or daily time step. Monitoring applications, including weather index insurance, require updating the data set in near real time on a sustained basis.

Figure A1 illustrates how the resulting merged rainfall data in Ethiopia (d) compare with (a) the station observations, (b) raw satellite data, and (c) gridded data based on interpolating station data; for a single dekad in mid-April 1996. Major gaps in observations are apparent in some parts of the country. The satellite product conveys the general spatial structure of the rainfall reasonably well, but underestimates rainfall amounts over most of the country. The gridded gauge field depicts the overall spatial structure of rainfall as shown by the gauge data, but with unrealistic smoothing, and unreasonable values over lowland areas. The combined product overcomes, to some degree, the lack of stations over the lowlands, the problems with gridded data, and the underestimation by the satellite product.

ENACTS has so far been implemented nationally in Ethiopia (Dinku et al., 2011, Dinku et al. 2013; Dinku et al. 2014a), Tanzania (Dinku et al 2014b), Madagascar, Rwanda, The Gambia, Mali, Ghana and Zambia; and regionally for the CILSS countries through AGRHYMET. ENACTS is under development in Kenya, Uganda and Malawi.

Although several organizations are developing high-resolution data sets that combine satellite and station data, a key strength of the ENACTS approach is that it works with national meteorological agencies to develop products that they fully own, using all available station data – most of which are not available outside the country. Because the accuracy of merged products depends primarily on the number and spatial distribution of station observations, the quality of the resulting data sets is far greater than any merged products that use only the very small set of globally available station data. The satellite rainfall products have performed well across several African countries, even in complex terrain, but performance degrades in coastal areas.

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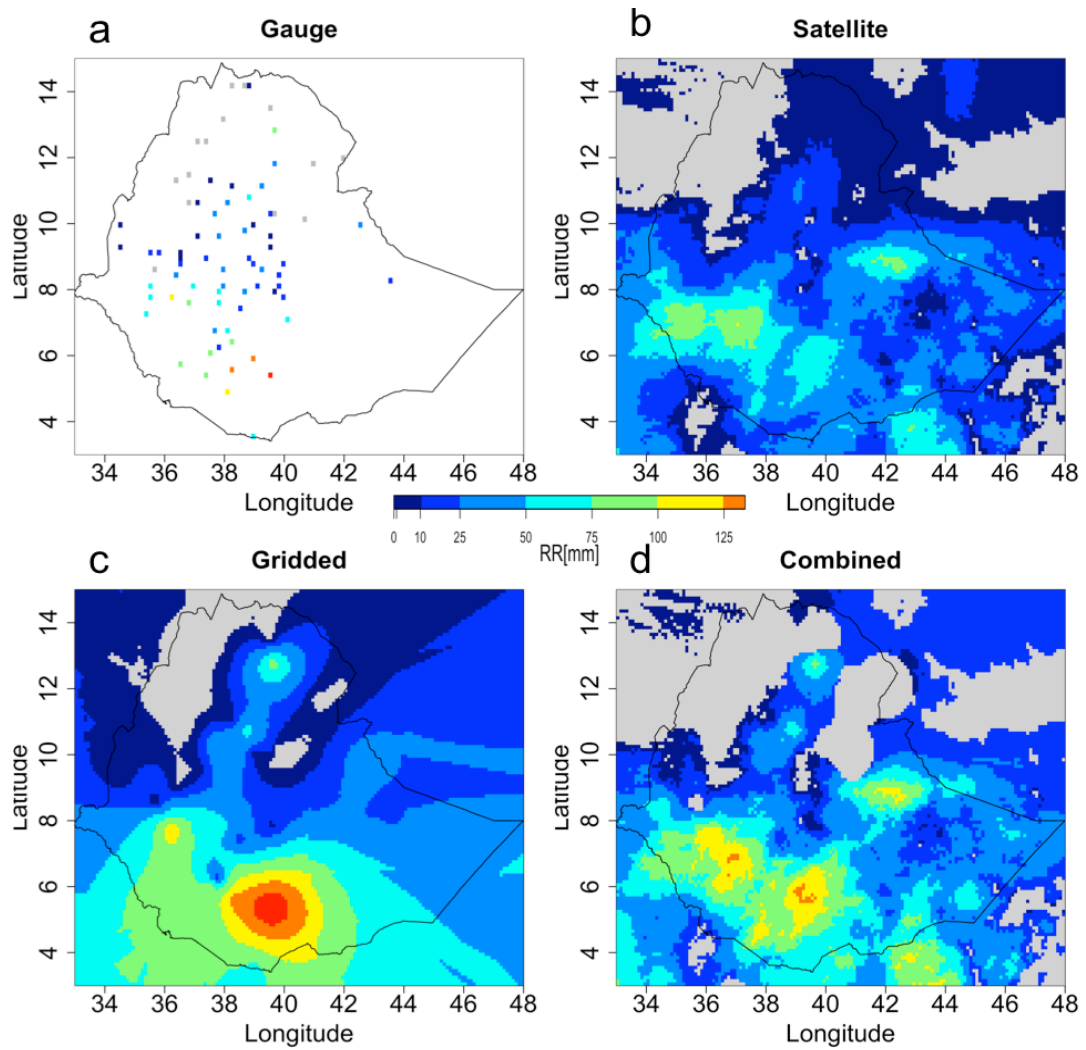


Figure A1. Comparison of (a) station observations, (b) raw satellite data, (c) gridded data based on interpolating station data, and (d) merged rainfall data, Ethiopia, for a single dekad in mid-April 1996.

Annex 2. Number of farmers participating in the GES

State	2012	2013	2014
ABIA	121,435	134,877	265,214
ADAMAWA	97,882	182,277	218,012
AKWA IBOM	153,674	125,825	366,290
ANAMBRA	84,646	94,158	232,205
BAUCHI	341,366	511,651	700,126
BAYELSA	160,951	50,715	144,355
BENUE	184,175	217,282	297,260
BORNO	37,254	226,892	331,403
CROSS RIVER	149,471	49,039	220,538
DELTA	125,483	98,351	204,219
EBONYI	193,750	88,077	173,076
EDO	63,397	64,367	174,724
EKITI	145,242	69,382	198,143
ENUGU	110,661	72,860	145,026
FCT	135,438	91,902	156,432
GOMBE	363,678	152,881	401,900
IMO	78,484	29,781	136,990
JIGAWA	281,796	184,799	511,479
KADUNA	174,863	261,357	546,037
KANO	277,611	426,583	511,868
KATSINA	210,464	103,350	234,077
KEBBI	532,412	203,260	343,010
KOGI	210,789	151,626	210,914
KWARA	115,997	142,217	280,343
LAGOS	12,841	16,303	85,598
NASSARAWA	233,693	27,292	215,789
NIGER	283,837	186,727	257,420
OGUN	108,842	40,666	196,401
ONDO	69,274	132,955	243,413
OSUN	107,559	117,937	194,630
OYO	176,183	147,081	249,450
PLATEAU	300,490	211,745	394,804
RIVERS	51,181	28,522	113,566
SOKOTO	198,403	138,715	413,157
TARABA	167,174	246,402	418,810
YOBE	167,740	102,697	196,749
ZAMFARA	177,758	387,259	551,306
Total	6,405,894	5,517,810	10,534,734

Source: Cellulant

Annex 3. Potential for bundling insurance with drought-tolerant seed

Jonathan Hellin

We highlight the potential of crop insurance to enhance farmers' access and use of drought tolerant maize varieties. With more than 5.56 million ha of land planted to maize in 2013 (or about 16% of all of Africa's maize area combined), Nigeria has the right to claim the position of the giant of maize production in Africa. Only Tanzania claims a distant second position, with about 4.1million ha. However, productivity of maize has not kept pace with the rate of growth in area. For example, the national average yield increased gradually from 1.2 MT/ha in the 1980s to 1.9 MT/ha in 2013. Constraint to higher productivity include drought. Nigeria was one of the target countries of The Drought Tolerant Maize for Africa (DTMA) project which was funded by the Bill & Melinda Gates Foundation.

The synergy between DTMA and the objectives of the Nigerian government is obvious. Great scope now exists for minimizing deficit in Nigeria's maize production and demand, estimated at about 6 million tons in 2013. The key factor for a maize revolution in Nigeria will be a massive increase in its fertilizer and improved seed use. The national program in Nigeria, in close collaboration with DTMA, released a total of 22 drought tolerant maize varieties between 2007 and 2013 (Table 1). Much could be learnt from India (WBCIS and NAIS), ACRE and the R4 programs as to how crop insurance can be used to further enhance Nigerian farmers' access to and use of these drought tolerant maize varieties.

Table 1. Drought tolerant maize varieties released under DTMA in Nigeria (2007 to 2013)

No.	Release name	Year of release	Hybrid or OPV	Maturity Range	Suitable agro-ecologies	Grain yield
1	Sammaz 15	2008	OPV	Medium-late	Moist savannas	High
2	Sammaz 22	2009	Hybrid	Medium-late	Moist savannas	High
3	Sammaz 23	2009	Hybrid	Medium-late	Moist savannas	High
4	Sammaz 24	2009	Hybrid	Medium-late	Moist savannas	High
5	Sammaz 25	2009	Hybrid	Medium-late	Moist savannas	High
6	Oba Super 7	2009	Hybrid	Medium-late	Moist savannas	High
7	Oba Super 9	2009	Hybrid	Medium-late	Moist savannas	High
8	Sammaz 18	2009	OPV	Early	Guinea & Sudan Savanna	High
9	Sammaz 19	2009	OPV	Medium-late	Moist savannas	High
10	Sammaz 20	2009	OPV	Early	Guinea & Sudan Savanna	High
11	Sammaz 26	2009	OPV	Medium-late	Moist savannas	High
12	Sammaz 27	2009	OPV	Early	Guinea & Sudan Savanna	High
13	Sammaz 28	2009	OPV	Extra-early	Guinea & Sudan Savanna	Medium
14	Sammaz 29	2009	OPV	Extra-early	Guinea & Sudan Savanna	Medium
15	Sammaz 32	2011	OPV	Extra-early	Guinea & Sudan Savanna	Medium
16	Sammaz 33	2011	OPV	Extra-early	Guinea & Sudan Savanna	Medium
17	Sammaz 34	2011	OPV	Early	Guinea & Sudan Savanna	High
18	Sammaz 35	2011	OPV	Early	Guinea & Sudan Savanna	High
19	Sammaz 38	2011	OPV	Extra-early	Guinea & Sudan Savanna	Medium
20	Ifehybrid 5	2013	hybrid	Extra-early	Guinea & Sudan Savanna	High
21	Ifehybrid 6	2013	hybrid	Extra-early	Guinea & Sudan Savanna	High
22	Sammaz 40	2013	OPV	Late	Southern & Northern savanna	Low

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