FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

FINDING THE BEST FIT

Naatal Mbay

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NAATAL MBAY
GLOSSARY

CN	Consolidated Network of the firms, non-governmental organizations, farmer associations or federations who represent and serve farmers
CNCAS	Caisse Nationale de Credit Agricole du Senegal
FEPROMAS	Fédération des Producteurs de Maïs du Saloum
FPA	Fédération des Périmètres Autogérés
GPS	Global Positioning System, is a radio navigation system that allows land, sea, and airborne users to determine their exact location, velocity, and time 24 hours a day, in all weather conditions, anywhere in the world
MNO	Mobile Network Operators
M&E	Monitoring and Evaluation
OTC	Over -the-counter or third-party money transfers services
PCE	Project Croissance Economique (Economic Growth Project)
IRG	International Resource Group
SFZ	South Forest Zone
SRV	Senegal River Valley
UFP	Union des Femmes Productrices de Ross Bethio
UGPCL	Union des Groupes d'Interet Economique des Producteurs de Céréale Local
3G	a mobile communications standard that allows mobile phones, computers, and other portable electronic devices to access the Internet wirelessly
4G	a mobile communications standard intended to replace 3G, allowing wireless Internet access at a much higher speed

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Digital Development for Feed the Future is a collaboration between USAID's Global Development Lab and Bureau for Food Security and is focused on integrating a suite of coordinated digital tools and technologies into Feed the Future activities to accelerate agriculture-led economic growth and improved nutrition. Feed the Future is America's initiative to combat global hunger and poverty

NAATAL MBAY
COUNTRIES OF OPERATION

This case study is part of a series highlighting the integration of digital technologies into agricultural programs. Over the past ten years, and particularly over the past five, the use of mobile phones and Internet-based, digital tools in farming activities has sky-rocketed. This is largely due to the widespread adoption of mobile phones in developing and emerging markets, coupled with the increased spread of 3G and 4G connectivity. What has emerged is a broad set of digitally-based applications that have driven greater financial inclusion, more precision agriculture, better data collection and analytics, and more effective information dissemination. Agricultural organizations and programs are increasingly embracing these tools to advance their goals. Each case study in this series looks at different approaches to adoption and how the tools are impacting organizational culture, operations, and programming.

OVERVIEW

Naatal Mbay is a four-year (2015 – 2019), $24 million Feed the Future Senegal project with the primary objective of scaling up and expanding successful value chain approaches.[1] The project builds on several earlier USAID/Senegal investments, most notably the Economic Growth Project (Projet Croissance Economique, PCE) active between 2009 and 2015. Naatal Mbay, which in Wolof means "making agriculture prosperous," aims to expand the number of small-scale cereal farmers benefitting from the project, with the goal of reaching 150,600 households, an estimated 45 percent of households in the Feed the Future zone of influence. It will achieve this by strengthening the production, processing, and marketing aspects of four (4) value chains in two (2) main geographic areas: the Senegal River Valley (SRV), including the Delta and the Middle Valley, and the South Forest Zone (SFZ), composed of the central peanut basin and Casamance. The targeted value chains are: irrigated and rain-fed rice, maize, and millet.

A unique feature of the Naatal Mbay project is the way it is using digital tools to support locally-owned and sustainable data collection and analysis. The approach to digital integration in the project is marked by its simplicity. A basic set of digital technologies, mainly laptops loaded with Microsoft Office, enable value chain actors to leverage the power of data to better serve farmers, monitor activities, increase transparency along the chain, and attract investment. The approach earned a Data to Action Recognition Award by the U.S. Global Development Lab within USAID in 2014, acknowledging the project's[2] modest yet effective way of incorporating data innovations to increase impact (USAID 2015a).

This case study tells the story of how Naatal Mbay is using digital tools to empower farmer-serving organizations and firms active in the rice, maize, and millet value chains and strengthening the relationships and links between these organizations and other stakeholders. It draws heavily from information about PCE which introduced many of the digital innovations

1 Scaling up refers to a process of reaching larger numbers of a targeted audience. Value chain approaches refer to programs that focus on improving the production, processing, and marketing of products and the links between the firms that bring products to market.

2 This case study draws from information about the USAID/Projet Croissance Economique (2009-2015) as well as the current Feed the Future Senegal Naatal Mbay project (2015-2019). Although two different projects, the implementation partner, IRG, remains the same as well as the intervention domains, the zones of influence and most of the staff. PCE laid the foundation for many of the digital innovations upon which Naatal Mbay continues to build.

BOX 1.
DESCRIPTION OF NAATAL MBAY

Naatal Mbay is implemented by the International Resources Group (IRG) a subsidiary of RTI International. The project's components include:

Improve the productivity of staple cereals (rainfed rice, irrigated rice, maize and millet); Strengthen agricultural markets; and Promote a strong agricultural policy environment.

In addition, the project addresses cross-cutting issues in all its activities in the following areas: Local capacity development; Gender equality and women's empowerment; Climate change; and, Environmental compliance.

Source: USAID 2016c and USAIDb

that Naatal Mbay is taking to scale. The case study begins with an overview of the digital landscape in Senegal. Then it describes the project's overall approach to digital integration and specifically its experience introducing various digital tools and approaches into the targeted value chains. It reviews the impact of digital tools on Naatal Mbay's partners and targeted value chains, and offers lessons learned about its digital integration experience drawn from the reflections of various stakeholders.

THE DIGITAL LANDSCAPE

A country with a growing digital economy, Senegal has 14.6 million mobile connections, equivalent to a 95 percent SIM penetration rate.[3] According to a 2016 nationally representative survey of 2,845 adults over the age of 15, an estimated 90 percent of the population have access to a phone, with mobile phone ownership at a slightly lower rate of 72 percent (InterMedia 2016). More women than men borrow phones: 23 percent versus 13 percent respectively, and more men than women own phones: 80 percent versus 65 percent respectively (InterMedia 2016). Three mobile network operators (MNO) are active in the country: Expresso, Tigo, and Orange (GSMA Intelligence). Mobile broadband connections are growing rapidly, with 3G and 4G coverage expanding at an annual growth rate of 62.76 percent (GSMA Intelligence). Currently, 14 percent of the country has 3G and 4G network coverage.

Although Senegal's digital financial service network is crowded with four providers, uptake of mobile money services is low. While mobile network operators Orange and Tigo offer mobile money and wallet services, two providers, Wari and Joni Joni, offer over-the-counter (OTC) or third-party money transfers services which remain far more popular: 52 percent of surveyed adults use OTC (InterMedia 2016). Awareness of mobile money services are high but adoption remains low: 71.8 percent of surveyed know of at least one mobile money provider but have not used mobile money or wallet services (InterMedia 2016). Only 11 percent of those surveyed have a digital

3 To understand how to measure mobile penetration please consult, https://www.gsmaintelligence.com/research/2014/05/measuring-mobile-penetration/430/.

Database managers of partner networks in the Central and Northern regions are trained on ComAgri.

financial service account in their name (InterMedia 2016).

Low literacy is among the barriers to uptake of mobile money services. A little more than half the population above the age of 15 years (55 percent) is literate. Fewer women (44 percent) are literate compared to men (68 percent) (World Bank 2015). According to InterMedia (2016), uptake of mobile money services is low because users perceive that current OTC services meet their needs and that mobile money fees are higher. Customers are also used to making assisted transfers with agents they know and trust, and worry about errors they would make without an agent.

While there is promise for future growth, this landscape does not offer popular digital opportunities, like mobile money, to easily plug into. This scenario is likely to change quickly. The Government of Senegal is making significant investments in ICT infrastructure and capacity (ADB 2015; ROS 2012), which as the rest of this case study will illustrate, Naatal Mbay is supporting by focuses on building skills and knowledge of basic information and communication technologies.

This will serve as a foundation for moving into more advanced digital innovations, as the digital economy of Senegal continues to mature.

APPROACH TO DIGITAL INTEGRATION

Farmers are aware of the power of information. When they apply for loans, they know they must provide details about their farms. However, few have accurate data about their farming activities or the tools to make decisions using the data they have. At the same time, development projects collect an abundance of data. Often used for reporting to donors or for making management decisions, large monitoring and evaluation (M&E) teams collect, clean, and analyze data about beneficiaries, yields, adoption of practices, and sales – the same information that farmers are required to report when seeking a loan. Yet, this information is collected for and owned by the project.

Naatal Mbay is challenging this paradigm and shifting the responsibility and ownership of data collection and analysis to the stakeholders who stand to gain the most from it: the firms, non-governmental organizations, and farmer associations or federations who represent

and serve farmers. These groups are referred to as Consolidation Networks (CNs) for their role in coordinating input procurement for the production of rice, maize, and millet; tracking productivity and loan repayment; and monitoring rainfall for 60,000 farmers (USAID 2016c). While some of this data feeds into Naatal Mbay's own project level indicators, the data is meant to help CNs manage core business processes that enable them to operate independently and autonomously in a market-based system. A fundamental component of this data management effort is the introduction of digital tools that facilitate evidence-based decision-making and devolve responsibility for information management to network partners.

The predecessor project, PCE, introduced many of the farmer- and firm-facing digital tools described in this case study to achieve its goals of promoting food security by linking small cereal farmers to commercial grain value chains. These tools laid the groundwork for network partners to manage their own data systems, increase transparency, and improve their relationship with other actors. Naatal Mbay is building upon these efforts by introducing mobile solutions that would allow these same partners to expand the reach of their operations. The project is establishing behaviors, practices, and systems that are locally owned and managed with a strong emphasis on sustainability. This case study describes digital tools that are being introduced to the 123 CNs with which the project works, and a set of digital tools being used by rice value chain actors in the Senegal River Valley (SRV).

Farmer-facing Digital Tools

The farmer-facing suite of digital tools supported by Naatal Mbay are simple, yet practical (Table 1). The suite consists of laptops, Microsoft Office, Dropbox, Garmin Global Positioning System (GPS) devices, MapSource, and Quantum GIS. The main purpose of these tools is to enable CNs to track and monitor the productivity and performance of their farmer networks. The suite therefore includes tools, like Microsoft Excel, to aggregate and analyze data, and Dropbox, to store and share files. The CNs also learn to use complementary tools to measure the size and capture GPS coordinates of farmer plots that improve the accuracy of production calculations.

In addition to the tools, each CN forms a team of Lead Farmers, Field Agents (FAs),[4] and a Database Manager (DM) to manage the data collection and analysis efforts. Field Agents are responsible for collecting data and delivering extension and training with support from Lead Farmers. The number of Field Agents and Lead Farmers depends on the size of the CN. There is roughly one Field Agent for every 200 producers and 1 Lead Farmer for approximately 35 farmers. The Database Manager centralizes and consolidates the data, which is then shared with the decision-making bodies of the CN and Naatal Mbay. By October 2016, the CN extension system consisted of 136 DMs, 580 FAs, and 4,199 Lead Farmers. Women occupy a only small percentage of these positions, a challenge that the project is seeking to address (Box 2). With staff and these tools, each CN has the basic building blocks of data collection and analysis.

4 In some publications, field agents are also referred to as facilitators.

TABLE 1.
SOFTWARE AND APPLICATIONS USED BY NETWORK PARTNERS

SOFTWARE/ APPLICATION	FEATURES	DESCRIPTION OF USE
Microsoft Excel	Part of Microsoft Office suite of applications	Track data and develop simple pivot tables for analysis and monitoring
Dropbox	File hosting service offering cloud-based storage and file synchronization with 2GB free storage	Store spreadsheets and reports for each network partner Share data and reports with Naatal Mbay
MapSource	Software used to transfer GPS data to a computer	Transfer, illustrate, and label the size and location of farmers' plots
QuantumGIS	Free, open-source geographic information system	Analyze geospatial data and view geographic spread of network partners' activities, members, and demonstration sites
CommCare	Open-sourced and cloud-based mobile application and platform for data collection	Collect data on farmers, production, inventory, and sales Replace paper-based notebooks used for data collection
AreaMapper	Free area calculation tool for Android phones and designed to integrate with CommCare app	Measure the size of and map the GPS coordinates of farmer plots

In 2012, PCE began to experiment with more advanced mobile solutions. Working with Dimagi, a for-profit software social enterprise, the project introduced the widely-used technology platform CommCare[5] to replace the paper-based data collection system. Two organizations, the Union des Groupes d'Interet Economique des Producteurs de Céréale Local (UGPCL) and the Fédération des Producteurs de Maïs du Saloum (FEPROMAS) were the first to use CommCare. In 2016, the number of CNs using CommCare expanded to 14 organizations in maize and millet value chains, serving a total of 5,842 farmers from 521 villages, and five rice mills (Voisard 2017). CommCare's mobile and web-based platform is suitable for agile deployment, meaning that Naatal Mbay could expand slowly and over the course of

5 CommCare is an open source mobile application originally designed to support frontline health workers. The software, which can be used on smartphones, tablets, and Java-enabled phones, is used to collect data. See https://www.commcarehq.org/home/ for more information.

the pilots, adjustments could be made based on what Dimagi was learning from users. During this time, the GPS technology and software were also upgraded. Instead of using Garmin devices and MapSource, some Field Agents began to measure the size and capture the GPS coordinates of farmers' plots with smartphones using AreaMapper, another Dimagi application that automatically integrates plot data into CommCare.

Shifting the responsibility for M&E means that Naatal Mbay can operate with a lean 5-person team focused on aggregating data and analysis for reporting to Feed the Future. Resources that would have been spent in a large M&E team can be used instead to support local organizations and for organizational strengthening. Furthermore, the ability to share data using applications like Dropbox has meant that the M&E team does not travel to the field to collect data themselves or from partners. Dropbox allows the CNs to upload farmer data, on training attendance, adoption of technologies, or yields, that is remotely accessible to the M&E team at the project's main offices.

More importantly, the system is decentralized to strengthen the position of the CNs in the value chain. Information is empowering. It is the foundation for a

BOX 2.
WOMEN'S PARTICIPATION IN THE CN EXTENSION SYSTEM

Naatal Mbay was designed to address a range of gender-based constraints affecting women's participation in the rice, maize, and millet value chains. Detailed in the project's Women's Economic Empowerment strategy, interventions are accounting for differences in women's status and participation in agriculture by region, addressing women's time burden, and the lack of women in producer association or as leaders of those groups. It is also aiming to engage women as community-led service providers, database managers and field agents for networks. The challenges here are significant. Women are less literate than men: 44 percent compared to 68 percent. They are disproportionately responsible for household chores, and in many communities, provide the labor to their spouse's plot before tending to their own. Together, these challenges make it difficult to recruit women into DM or FA positions: in 2016, women made up 13 percent of database managers, 23 percent of field agents, and 22 percent of lead farmers.

Individuals selected to become DM and FA receive a salary, acquire analytical skills, and learn to use digital tools. Their status in their communities likely increases. Some mentioned having been approached by other projects because of newly acquired skills. With few women in these roles, the project risks deepening a divide in men's and women's digital knowledge and skills. To mitigate this, the project is establishing quotas for each CN to increase women's participation in these roles. These will be agreed upon and written into the contracts between Naatal Mbay and the CN.

Source: USAID 2016d and communication with Naatal Mbay Gender Specialist

professional and capable organization. With accurate and timely information about the productive capacity of their farmers, CNs determine financing for inputs and negotiate prices with buyers. The CNs share data with the farmers in their networks, troubleshoot production challenges, and increase the transparency and accountability of their activities. Stakeholders commented repeatedly that the responsibility for managing data is a way of professionalizing their CN.

Firm-facing Digital Tools

Twice a year, rice farmers in the SRV apply for loans from the Caisse Nationale de Credit Agricole du Senegal (CNCAS) to finance inputs. Using a warehouse receipt system, these loans are repaid in-kind with paddy rice delivered and stored at warehouses throughout the valley. Local rice processors then buy up the paddy from these warehouses for their activities. Since this system was put in place, financing of the irrigated-rice value chain in the SRV increased sharply: Between 2012 and 2016, financing jumped from $3.2 million to $13.5 million (USAID 2016c). To secure and sustain this financing, the Fédération des Périmètres Autogérés (FPA), the leading farmer federation in the SRV, needed a system to track and monitor the yields and quality of rice produced by its farmers. At the same time, CNCAS needed a system to track repayment of loans and ensure that the information about the rice stocks at warehouses was accurate. To achieve this, two monitoring and tracking systems were developed under Naatal Mbay.

The first, a digital database system to monitor the in-kind repayments delivered to 18 warehouses in the SRV, was developed by SisTech, a software development firm based in St. Louis. SisTech was selected through a competitive process that attracted bids from eight (8) local technology firms. The platform was custom built by SisTech because there are no off-the-shelf applications that met the characteristics required for the platform. The database needed to be simple and yet accommodate the information needs of diverse actors using it. Additionally, to meet privacy and security specifications for CNCAS, the database needed to be a closed system.

The online platform is populated by warehouse managers who enter and upload information about the volume and quality of paddy deliveries from farmers on tablets or smartphones. This enables the FPA to track the value of its members' in-kind rice payments against the balance of their loans. These entries can also be accessed online by bank loan officers to track farmer repayments, allowing them to better organize their loan repayment efforts. Furthermore, rice processing plants can check the levels and quality of stock stored in area warehouses from which they source their supply of paddy.

When loans are repaid in cash to a bank, the money is received, tracked, and secured by the bank itself. It manages its own financial record keeping. In this case however, loan repayment is made in paddy and stored at a warehouse until the time it is sold, out of reach and control of the bank. In parallel to the warehouse database, CNCAS and Naatal Mbay worked with a local accounting firm, KAMEX, to set up an independent online control system that tracks the deposits and stocks of paddy at the warehouses. This separate system strengthens the bank's quality control over the repayment process and ensures the accuracy of the data and loan repayment, enabling it to continue to investment in the rice value chain.

Although the systems are brand new, CNCAS has already expressed interest in financing SisTech's online platform and is exploring opportunities to expect the

platform. One idea is to move the loan application process online which would take advantage of the borrower's digital loan history to evaluate credit decisions. Elements of this pilot are also likely to influence the World Bank Sponsored Warehouse Receipt System (USAID 2016c).

Commitment to Learning

A core pillar of Naatal Mbay's approach to digital integration is learning and experimentation. This commitment is clear in the project's choice to begin with simple tools and incrementally add more advanced digital elements. It requires a significant investment of time and resources to train the CN's database managers and field agents. The investment in capacity building however is not just about mastering the tools, but also building ownership and appropriation over the system and increasing the chances of its continued use beyond the life of the project.

The project's capacity building efforts aim to teach the Database Managers and Field Agents to use the digital tools while making the case for why and how information systems are useful to their activities. At the start, the project began with very simple and non-digital data collection processes to teach M&E principles. FAs and Lead Farmers used paper-based facilitator notebooks and farmer notebooks to collect data on basic demographics of the farmers in CN; attendance at training; plot identification information; seasonal agronomic details; and loan repayment status (USAID 2015). The data was then entered into Excel by the DM and used for determining credit, planning, and contacting input suppliers.

Jean Michel Voisard, the Chief of Party for Naatal Mbay, insists that this incremental introduction of digital tools is necessary. Database Managers, Field Agents, and farmers need to understand how data is constructed and analyzed. Although programs exist to automatically analyze and integrate data, farmers need to experience the challenges of data collection and analysis because this is a fundamental part of learning. As Voisard explains, "Apps have a way of protecting farmers from this experience." This is one reason the project is moving slowly to introduce CommCare to network

BOX 3.
SYSTEMIC CHANGE INDICATORS

While no clear definition exists for systemic change, emphasis is often made on changes in the policies, behaviors, policies, and perceptions, such that "the factors supporting a new evolutionary path overcome the factors supporting the status quo." In Systemic change is often described as a disruption, in similar ways to digital tools. Buy-in indicators are used to understand systemic change. These measure "the degree to which market actors have taken ownership over the new business models, technologies, practices and behavior changes that were introduced – for example adaptation or innovation to the original model; continued, independent investment after program sponsorship ends; repeat behavior; satisfaction with the new business model."

Source: USAID 2016a

partners. Automated integration and reporting hides the analysis that Database Managers and Field Agents are learning first with Excel. In keeping with the commitment to learning, the project has chosen not to block the use of applications like Facebook or WhatsApp on smartphones where those are being introduced. Instead, using these apps and exploring others is considered part of the user's experimentation process.

In devolving the M&E for the project to the CNs, Naatal Mbay was taking a risk. The project had to make sure that CNs were collecting data accurately. At first, the M&E team spent a lot of time conducting additional surveys and checking of the accuracy of the data coming from the CNs. Over time however, the M&E team found themselves spending less time on checking and verifying the accuracy of the data, and more on continued capacity building and analysis. The speed at which this happened surprised some of the M&E staff who admit that they thought it was going to be more difficult: "We underestimated the capacities of the producers. We said, we should move slowly, slowly but we learned we could have moved faster. This was a nice surprise. We underestimated their capacity."

UNDERSTANDING THE IMPACT OF DIGITAL TOOLS

Digital tools and technologies are expected to accelerate the achievement and deepen the impact of development objectives. Digital tools are understood as leading to greater productivity or more inclusive financial outcomes. In this way, they add value to the reach, efficiency, and costs of development programs. Understanding their impact would require calculating this value added: How much more productivity was achieved? How many more people were included? Yet because few projects, including Naatal Mbay, calculate the added value of their digital tools, the impact of digital tools must be assessed using other measurements. In this case study, the impact of digital tools within Naatal Mbay draws from recent publications about systemic change from the USAID Leveraging Economic Opportunities project (Box 3). Impact is examined by considering the extent to which CNs are buying into the digital tools. Buying-in refers to "the degree to which market actors have taken ownership over the new business models, technologies, practices, and behavior changes that were introduced – for example adaptation or innovation to the original model; continued, independent investment after program sponsorship ends; repeat behavior; satisfaction with the new business model" (USAID 2016a). Where possible, the case study also includes data about quantitative changes in the targeted value chains that correspond to the timeframe following the introduction of the digital tools.

Farmers, leaders of the CNs, Database Managers, and Field Agents consistently highlighted ways that the digital tools have improved the operations and reach of their organizations. Many staff of CNs explained that the ability to store their data in a more accessible and safe manner was a benefit of increased digitization. They no longer worry about losing data because notebooks were misplaced, torn, or waterlogged. Furthermore, the digital tools allowed them to work with the data in new ways. The Union des Femmes Productrices de Ross Bethio (UFP), for example, described how previously they collected information about their members and inserted it into tables in a Microsoft Word document. Using Word however, the Database Manager explained that they really didn't have a good sense of the size and scope of their activities and it was impossible to analyze the data.

Similarly, the Database Manager for the FPA explained that the organization used a database before beginning work with Naatal Mbay in 2016, but it was not as comprehensive nor were they able to analyze the data in detail. The unions that make up FPA had databases as well, but there was no way of consolidating the information at the federation level. They are now all operating with the same system and have stopped using earlier databases.

Many of the teams also described their organizations as now being more professional. The Database Managers and Field Agents express confidence in the accuracy of their data, which they did not feel prior to using the digital tools. There was pride and satisfaction in knowing how many farmers are in their network, knowing the size of farmers' plots, and knowing that farmers were taking loans for the correct amount of inputs. The ability to relate the history of an organization with data representing past and present yields lends credibility to the organization. As a leader from Mabo, a millet group in the Kaolack, explained:

"I used to think that the computers were something that only the people in offices used. They were not something that farmers could use. But these tools are important [for us] because they help the farmers understand the size of their plots. And with GPS, farmers know precisely how much seed and inputs to apply and they can better understand performance. Before we didn't have context for [understanding] our performance."

Several CNs attributed new business to the ability to collect and analyze digital data. The Database Manager for UFP attributes a 124 million CFA investment in a rice processing plant from Green Senegal to a presentation she made using pivot tables and the data collected about UFP members. The Database Manager for Mabo explained that after showing a local government official their database, they received a tractor. These anecdotes are important because they illustrate the value that the network partners attribute to the new digital system. They signal that Naatal Mbay is creating a strong value proposition for the system's sustainability.

Without the need to consult and compile information from paper tracking sheets, the Database Manager can quickly analyze and inform farmers and decision-makers of the CN. The database facilitates real-time monitoring and reflection by the CN and its farmers. As one Database Manager expressed, "It helps us talk to farmers." This ability to provide useful information to farmers was a recurring theme in the interviews. It is linked to how the data increased the ability of the CN to deliver quality services to their members. Capturing the precise size and location of farmers' plots with the Garmin GPS devices means that the Field Agents can provide right-sized input recommendations to farmers. Many Field Agents described their experiences with farmers who over- or underestimate the size of their plots. This means they are applying either too little fertilizer or paying for too much. With accurate measurements, some farmers will buy fewer inputs, while others may buy more, however ultimately all should see an increase in productivity. This becomes evident when the CN links plot size data to yields, and farmers come to understand and appreciate the value of the information that the CN is generating. In 2014, PCE estimated that the introduction of digital tools led to a 25 percent increase in maize yields for 25,000 farmers (USAID 2015a). This kind of impact increases the trust between the farmers and the CN.

Farmer debrief meetings are becoming more valuable now that the CN has better data. An open discussion about the setbacks and achievements of each growing season is possible. In 2016, the rains came late to the Sahel seeding doubt among farmers about when to plant. Some farmers planted in the dry earth when the rains should have started, while others waited until the rains started hoping they could still harvest in time. All farmers took a risk not knowing how the timing of their planting would affect their harvests. However, last year, farmers were equipped with manual rain gauges and a small mobile phone subsidy so that rain measurements could be tracked and sent to the DM monthly. At the end of the harvest, the rainfall and yield data was analyzed to see how farmers fared. Based on this analysis, the farmers determined that for future seasons, the minimum about of water needed to plant and be successful was 10 mm (USAID 2015a).

"The database is like a supermarket. It contains all the ingredients that you need to make different meals."

Database Manager, Paoskoto

A different kind of analysis is possible with the availability of sex-disaggregated data. As a Feed the Future project, Naatal Mbay collects sex-disaggregated data to be able to track and monitor the outcomes of the project's work on men and women farmers. This same practice is taught to the CN. This opens the opportunity to discuss how gender-differentiated access to resources contributes to differences in yields. Because of these discussions, some CNs are setting higher targets to improve women's participation in activities (USAID 2015b).

Several CNs explained that without digital tools growth would not be possible. Symbiose, an NGO operating in Kaolack, believes that since their work with rice farmers began in 2011, the tools and systems introduced by PCE allowed them to expand from working in 3 communes to 16, with more than 2,500 farmers. The data management, storage, and monitoring system facilitates the coordination of activities and allows the 13 FAs to serve more farmers. Symbiose expects that it will be able to grow further to serve up to 3,000 farmers.

At least one CN is expanding the use of the tools to other organizational activities not supported by the project, an example of repeat behavior. Symbiose is using the database to track the progress of their farmers producing horticultural crops. Several Field Agents explained that farmers are asking them to measure other plots of land that are not used for the targeted crops, evidence that they want to transfer their learning. Further, there is some spillover to non-member farmers. Several Field Agents indicated that they have been contacted by farmers who are not part of their CN to ask that the Field Agent measure their land.

While even the best information is unable to tell farmers what will happen tomorrow, with better information, value chain actors can reasonably predict what might happen. Additionally, faster and more accurate data collection allow for rapid decision-making. Altogether, the predictive capacity and real-time monitoring that access to digital data facilitates, creates stability in the chain and attracts investment. In 2016, the cloud-based monitoring tool developed for CNCAS accelerated the loan approval process for the rainy season which meant that some farmers could

plant two seasons of rice. The portfolio for rainy season loans totaled $12.1 million USD (USAID 2016c:15).

LESSONS LEARNED

This section outlines lessons learned from the experience of Naatal Mbay and the CNs with the digital tools highlighted earlier in this case study. It is organized around the Principles for Digital Development, a set of principles developed by donors and the development community to guide and inform technology-enabled development programs.[6] This frames the lessons learned drawn from conversations with representatives of the CNs and Naatal Mbay staff in a larger discussion of digital development. The discussion below includes the most significant reflections and therefore not all of the Principles are represented.

PRINCIPLE ONE: DESIGN WITH THE USER

Identifying context-appropriate and suitable digital tools for users is a cornerstone of Naatal Mbay's digital integration experience. Naatal Mbay carefully selected each of the digital tools it introduced to partners. Tools had to be well-suited to the users and have the potential to lead to sustainability. This meant identifying low cost applications that were not dependent on the adoption or use of highly specialized skills. Naatal Mbay relies therefore on off-the-shelf, open source software that is either free or at low-cost, accessible, and easy to use. Some suggestions were rejected based on a lack of suitability for the rural Senegalese context. One such example was the suggestion to use Microsoft Access instead of Excel to store and analyze data. The project chose not to pursue this avenue because Excel is easier to work with and there would likely be far more people familiar with the software than with Access.

Contractually devolving the responsibility to the CNs for managing the data collection and analysis also keeps the CNs at the center of choices about digital upgrades. Nothing is done without working directly with the CNs and in many cases Naatal Mbay is on the sidelines as the CNs and other stakeholders, like Dimagi, work out new iterations to workflow and reporting.

> *"This can never be about the project. It doesn't make sense to have systems or activities that relate to a project or are led by the project. That's just not going to create change."*
> *Eric, CommCare Associate*

PRINCIPLE FOUR: BUILD FOR SUSTAINABILITY

Naatal Mbay is building for sustainability. It has been planning from the beginning for a time when the project will withdraw from communities. One reason for introducing digital tools and the choice of tools, is to ensure that CNs and other stakeholders can act independently of the project. The investment in capacity building is aimed at equipping the CNs with the skills, tools, and data to be able to continue their work once Naatal Mbay closes out in 2019. Naatal Mbay's approach is also to foster independence and autonomy in the way it establishes relationships with the CN and other local firms.

Although Naatal Mbay subsidizes the purchase of the digital tools and supports the salaries for the DMs and FAs, the CNs are responsible for procuring the technology and managing the staff. This might appear

6 http://digitalprinciples.org/

a risky sustainability strategy, but Naatal Mbay is clear about the need for CNs to develop the skills and knowledge to manage their own businesses. CNs figure out where to purchase laptops, which allows them to make connections with firms that provide and may also repair equipment. They conducted their own recruitment and manage the payment of the DMs and FAs with funds received from the project. For those CNs that are now using CommCare, they too are responsible for purchasing smartphones and working with Dimagi to pay for the services and troubleshoot problems with the app. In this way, Naatal Mbay is laying the foundation for the expected behaviors and practices that CNs will need to continue once the project ends. This strategy not only affects the CNs, but also has changed the operations of other actors, most notably Dimagi (Box 4).

"These tools are now in our heads. We are not going to leave them behind when the project leaves."
Database Manager, Symbiose

Sustainability remains a key question and one that worries M&E staff who have invested a significant amount of their time teaching the CNs to use the digital tools. Naatal Mbay staff however stay on message and during the interviews for this case study continued to reiterate that the project will not endlessly subsidize the costs of the M&E system. This includes the salaries for the DMs and FAs, as well as for the procurement of new tools. Naatal Mbay staff are working with CNs to identify different business models that CNs can adopt to continue to pay for services. For example, some CNs, like FEPROMAS, already charge farmers a service fee for purchasing inputs which could be increased slightly to cover the costs of CommCare.

PRINCIPLE FIVE: BE DATA DRIVEN

Naatal Mbay's digital integration approach is entirely data driven. It is embedded with the M&E team, which shapes the scope of the approach. Digital tools are introduced within an M&E framework which emphasize the importance of data and the power of real-time monitoring. In this way, the CNs learn to collect and analyze data on agricultural outputs and outcomes that allow them to make production and marketing decisions for and with their members. This approach lays the foundation for additional digital upgrades, for example into CommCare, and can more easily be introduced precisely because users understand M&E principles.

BOX 3.
DESIGNING UNDER THE MANGO TREE

"We design under the mango tree." This is the first statement Dimagi staff will make when you begin a conversation. It conveys the company's organizational philosophy of working with the user where he or she is and with whatever tools are most appropriate for the user. Under Naatal Mbay, 19 CN are currently subscribing to CommCare, Dimagi's premier data collection platform, and working directly with Dimagi's Senegal-based team. Dimagi is used to working with more established development partners and foundations which has challenged the organization's operations. Yet, adhering to its operating principle, Dimagi's work under the Naatal Mbay made two significant operational changes to meet the user under the mango tree:

Adapting customer service practices. Dimagi staff in Senegal were used to using email as the primary mode of communication. Yet, when Dimagi staff began to interact directly with the CN, it became clear that the staff needed to rethink its outreach and customer service. Dealing directly with the DM and FA meant picking up the phone to speak with them and often traveling to rural areas of Senegal to troubleshoot and deliver training. Through various interactions with the DB and FA, Dimagi staff learned to adjust their expectations. They came to appreciate that while they could see the possibility for automated and integrating data collection and analysis, that the CN teams were not ready for these features.

Developing appropriate financing mechanisms. When the COP of Naatal Mbay insisted that Dimagi work with each CN to collect monthly subscription fees for CommCare, the organization knew it had to rethink its payment mechanisms. Dimagi's systems were designed to receive credit card payments or transfers via mobile money but the CN did not use any of these mechanisms. Most of them had bank accounts, many with Ecobank, and were accustomed to depositing cash for payment of services via the bank. Monthly deposits would be too frequent given the distance of some CN to the nearest bank. In response, Dimagi adjusted its internal invoicing so it would invoice the CN on a quarterly basis and accept payment via deposits to its Ecobank account.

Mrs. Dianké Kandé, member of the Kissal network in Mampatim (Kolda), inserts coordinates of her geo-referenced plot into the database. Using this data, she hopes to find the area of her plot.

CONCLUSION

Naatal Mbay is built on a commitment to learning, sustainability, and strengthening the independence and autonomy of local value chain actors. These core values permeate the project and are especially visible in the project's approach to digital integration. This approach is data-driven and digitally supported to ensure that over time, local organizations have a locally-owned and operated system that can grow with them.

While collecting certain indicators is important for Naatal Mbay's reporting to Feed the Future, far more important is how these same indicators take on new meaning for network partners allowing them to make evidence-based decisions, negotiate with other actors, and build a vision for the future. Naatal Mbay focused on teaching network partners to use a simple, yet practical set of digital tools to analyze and manage data about their organization and its operations. As they master these, Naatal Mbay is introducing more efficient digital tools that streamline these processes and allow each partner to expand the reach of its services with the same level of accuracy and attention. As Naatal Mbay looks to the future, it will need to ensure that capacity building investments in Database Managers and Field Agents reach both men and women to avoid deepening any inequities between men's and women's technology skills. Reaching out to younger, educated women might be one avenue for increasing their participation in these roles.

As the examples in this case study revealed, devolving the responsibility for M&E to network partners has fundamentally changed their role in the value chains in which they operate. Digital data collection tools have strengthened these organizations and helped create new business opportunities. A foundation is being built for these partners to make independent decisions and become financially sustainable. Naatal Mbay hopes this means that network partners see the value in continuing to use these tools long after the project closes its doors.

REFERENCES

African Development Bank. 2015. Senegal Digital Technology Park: Appraisal Report. https://www.gtai.de/GTAI/Content/DE/Trade/Fachdaten/PRO/2016/01/Anlagen/PRO201601255007.pdf?v=1 Accessed August 2, 2017.

GSMA Intelligence. https://www.gsmaintelligence.com Accessed June 18, 2017.

InterMedia 2016. Consumer Behaviors in Senegal: Analysis and Findings. http://finclusion.org/uploads/file/FINAL%20SENEGAL%20-%20UNCDF%20MM4P%20Senegal%20.pdf Accessed June 18, 2017.

Republic of Senegal. 2012. National Strategy for Economic and Social Development: 2013 - 2017. http://extwprlegs1.fao.org/docs/pdf/sen163055.pdf Accessed August 2, 2017.

USAID. 2016a. Case Studies on Facilitating Systemic Change: A Synthesis of Cases from Ghana, Senegal, Zambia, and Rwanda. LEO Report No. 49. USAID: Washington, DC.

USAID. 2016b. Naatal Mbay Baseline Study: Gender and Women Empowerment Component. Deliverable N. 3. Feed the Future Senegal - Naatal Mbay. USAID: Washington, DC.

USAID. 2016c. FY2016 Annual Report. Feed the Future Senegal - Naatal Mbay. USAID: Washington, DC.

USAID. 2016d. Women's Economic Empowerment Strategy. Feed the Future Senegal – Naatal Mbay. USAID: Washington, DC.

USAID. 2015a. Turning Data into Action. U.S. Global Development Lab. USAID: Washington, DC.

USAID. 2015b. Farmer-Owned Cloud Based Environments: Improving the Use of Data in Decision-Making and Value Chain Development through Farmer-Managed Data Tracking and Evaluation. USAID: Washington, DC.

Voisard, J.M. 2017. A Mobile Platform for Supply Chain Productivity and Market Linkages in Senegal. Presentation at Cracking the Nut Bangkok, Thailand. March.