

Exploring models of private sector collaboration to fund free digital extension for smallholder farmers

Swiss Re Foundation Report
September 2022



PxD
PRECISION
DEVELOPMENT



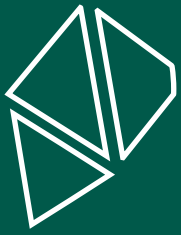
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Acronyms

- FPO – Farmer-Producer Organization
- FPC – Farmer Producer Company
- IVR – Interactive Voice Response
- NGO – Non-Governmental Organization
- SRF – Swiss Re Foundation
- VLE – Village-Level Entrepreneur



1. Executive Summary

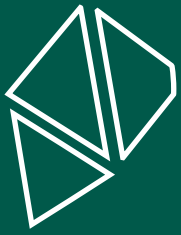


Precision Development (PxD) provides evidence-based customized advice to smallholder farmers via their mobile phones. This information helps farmers make more informed decisions to improve productivity, yields, and incomes, and advance more resilient livelihoods. By rapidly scaling our digital services, our platforms demonstrate low user acquisition costs and rapidly declining marginal costs per user per year. Whenever possible, we deliver our products and services free of charge to end-users. The overwhelming majority of our users pay nothing to receive valuable digital information. However, this model relies on funding from donors and governments to cover the costs of the service, and sustainable service delivery is often reliant on transferring the service to government management. Motivated to explore alternative funding arrangements with the capacity to benefit farmers, PxD piloted a new model for financial sustainability: connecting farmers to agricultural services offered by private sector companies in exchange for a fee paid by those private sector partners to offset the cost of delivering information to farmers.



With support from the Swiss Re Foundation, PxD initiated a series of pilots with private sector partners to (i) identify models with the potential to generate revenues at scale and (ii) generate and share knowledge on the effectiveness of these services and revenue-generation models. This support enabled PxD to grow Krishi Tarang, our existing wholly-owned digital advisory service in Gujarat, India, to service over 100,000 farmers. To operationalize the pilots, in addition to Krishi Tarang's core digital extension service, PxD layered on additional services in collaboration with private sector partners. Value-added services included multi-brand input delivery platforms, output market linkages, and soil testing.

By the end of the grant period, PxD successfully established models for service delivery with private sector partners and the rapid iteration of services during the implementation period enabled rich learning opportunities. While the fee-paying model for service delivery was successful in generating revenue for some services, the scale of these revenue streams was insufficiently lucrative to offset the cost of service provision. We were unable to identify scalable revenue-generating models for a variety of reasons, including partner-specific dependencies, a desire on the part of private sector partners to see examples of tie-in services functioning at scale before committing, and slower than anticipated service iteration with some partners which in turn slowed conversion rates and constrained economies of aggregation. More investment and experimentation will be required to identify more viable pathways for revenue generation and more productive partnerships. New partnership models could include demand aggregation through farmer-producer organizations (FPOs) or agri-entrepreneurs who deliver services to a village or group of villages. Notwithstanding these limitations, PxD generated a rich evidence base of farmer insights on the demand for, and feedback on, services provided by private sector partners, and gained a deeper understanding of partnering with the private sector to benefit poor rural smallholder farmers in Gujarat. This knowledge will contribute to PxD's service design and will be shared to inform the work of other firms and organizations active in the sector.



2. Project Charter



2.1 Project description

PxD uses mobile telephony to empower smallholder farmers with relevant and customized information, delivered at a low cost, to improve on-farm practices, input utilization, pest and disease management, weather and climate resilience, and access to markets. As of Q2 2022, digital systems implemented by PxD actively service more than 7.8 million users in nine countries. PxD relies on donor and government financing to make its services available free of charge to poor farmers. We do not charge farmers for our services for multiple reasons: (i) pay-for-use models often exclude the poorest farmers; (ii) evidence shows that farmers are typically unwilling to pay for advisory services alone¹; and (iii) the cost of collecting money from individual farmers is prohibitive². With the support of the Swiss Re Foundation, PxD explored an alternate revenue generation strategy: collecting income from private sector partners that could offer valuable services and products to our customer base while potentially offsetting the cost to PxD of information provided to farmers.

1. For example, Fafchamps and Minten (2012) evaluated the impact of a one-year free subscription to Reuters Market Light, an SMS-based service that delivers market price information, weather updates, and crop advisory information, on farmer behavior and prices received for output. While the service was free during the evaluation, the authors note that some farmers chose not to take it up because they were worried about being charged later. This pattern is also evident in the health sector, where purchase rates for preventive products drop quickly as prices increase, so much so that charging fees can actually make interventions less cost-effective due to reductions in uptake (see J-PAL 2018).

2. In a majority of instances the cost of collecting fees was greater than the marginal cost of delivering the service.



Support from the Swiss Re Foundation was extended over two years to assist PxD in meeting three objectives:

- Expanding its Krishi Tarang service in Gujarat to 100,000 farmers, who would in turn be eligible to receive value-added services offered by private sector partners. These services were offered in addition to the core digital extension service accessible via Krishi Tarang.
- Generate insights across the agricultural value chain on private sector services available to smallholder farmers.
- Identify service delivery models that incorporate partnerships with private sector partners capable of generating revenue at scale.

At the end of the grant period, PxD had successfully expanded its user base to 101,995 farmers in Gujarat, marginally above the target of 100,000. Section 3.3 details which scaling models were effective and describes the core advisory service farmers received, as well as their feedback. Throughout the project, PxD engaged a cross-section of private sector actors focused on multi-brand agri-input supply, output market linkages, financial services, and farm-tech and allied services. Section 3.3 also details various income-generating business models we developed in collaboration with partners and reports on progress.





In addition to data on revenue generation, PxD surveyed farmers to more effectively meet their informational needs and to collect feedback on their assessment of services (highlighted in Section 4). This information has the potential to reduce the costs of impact-focused research (e.g., by generating administrative data on farmers’ input decisions and output sales), enabling PxD and other consumers of our research to test and scale new approaches to improving the lives of smallholder farmers.

Knowledge and insights generated by activities associated with this grant have helped us to improve our understanding of the viability of different types of revenue-generation and partnership models; the viability of free-to-farmer digital extension platforms focused on meeting the needs of poor farmers and funded by partnerships with the private sector; and the value of private sector partnerships for delivering value to poor farmers. Insights generated from this project will inform PxD’s internal strategy and will be made available to inform the activities of peer organizations and private firms active in the sector.

2.2 Progress against milestones

Deliverables for the project were organized into three milestones: the distribution of customized advisory to 100,000 farmers, generating and disseminating insights from the project, and forming revenue-generating partnerships with for-profit entities. PxD completed the deliverables after a six-month no-cost extension necessitated by the COVID-19 pandemic which affected the roll-out of project activities, slowed support from partners, and impacted the availability of resource and personnel.

Objective	Progress
Scaling up the service to 100,000 farmers; identifying effective models to scale; providing customized agricultural advice to farmers	Complete, successful
Generating insights about private sector firms active in the agricultural value chain	Complete, successful
Identifying revenue-generation strategies for PxD that allow us to offset the cost of disseminating advisory	Complete, limited success – we developed and tested multiple strategies, but none allow us to offset the majority of the costs associated with service delivery



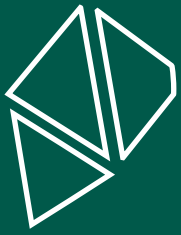
PxD currently provides customized agronomic advisory to 101,995 farmers across the state of Gujarat. 39,401 farmers were profiled and registered directly by PxD, including a small number whose contacts were sourced from three farmer-producer organizations (FPOs) associated with a consortium of FPOs and Farmer Producer Companies (FPCs) in Gujarat. The profile data of the remaining 62,594 registered farmers was sourced from not-for-profit partner organizations (see section 3.2 for details). Initial efforts to use a model for farmer self-profiling did not yield substantive results. Consequently, we contacted FPOs (direct outreach at scale through FPOs was not successful) and non-governmental organizations (NGOs), reaching our target of extending services to 100,000 farmers.

Generating insights about private sector firms operating in the agricultural value chain: To be viable, revenue-generating partnerships capable of offsetting the costs of free-to-farmer digital extension services would need to be beneficial to farmers, profitable for private entities, and revenue-generating for PxD. To facilitate the creation of such an ecosystem, we engaged over 50 private sector entities - including market linkage organizations, input suppliers, and ag-tech and allied service providers, and sought input from farmers and partner organizations regarding their needs and demand for complementary services. These scoping activities informed valuable insights into the viability of farmer demand for services, the potential service offerings, and an assessment of the relative advantages of potential private sector partners.

Identifying revenue-generation strategies to offset the cost of disseminating advisory: PxD explored several partnerships with organizations and firms, including input suppliers, firms active in developing improved market linkages, and other agri-related service providers. While we believe that the partnerships we entered into created value for farmers, identifying scalable revenue generation strategies met with limited success. In this report, we document internal and external factors that may have limited our success, including leverage with partners, competitive advantage in geographies, quality of service, and partner-specific challenges. While success was limited, this program led us to experiment with different revenue-generating streams, assess the opportunity costs of providing complementary services to farmers, and systematically evaluate relationships with partners, with the added benefit of identifying new opportunities and insights to inform PxD's services beyond the duration of this grant.

2.3 Key indicators

Farmer users registered on the service	101,922 (target 100,000)
Number of new farmers added to PxD services	62,486
Number of advisory messages sent	2,824,635
MoUs signed	7
Inquiries from farmers	6,325
The conversion rate of inquiries to orders	7%



3. Krishi Tarang:

Building and Scaling a Customized Advisory Service to Farmers



3.1 PxD's existing digital extension system

Information technology has made it possible to provide services to large numbers of people at little or no cost. These services can provide useful advice; spread up-to-date information such as weather conditions, market prices, and disease outbreaks; enable coordination; connect people; change attitudes, and increase accountability. Today, infrastructure for mass information dissemination is expanding rapidly, with access to mobile phones now outpacing access to clean drinking water. Most people, including people living in extreme poverty, use mobile phones and can access information at their fingertips. However, valuable services are often not provided for the poorest people, because it is unprofitable for the private sector to invest and governments do not have the resources or skills needed to fill the gap. As a result, a range of services that could be provided at very low cost, at scale, and with high value to many of the poorest people in the world never get designed or delivered.

PxD leverages the ubiquity of mobile phones and draws on the innovations of the technology sector to deliver low-cost relevant and customized services directly to smallholder farmers, students, teachers, and other users, to enable them to sustainably improve their well-being.

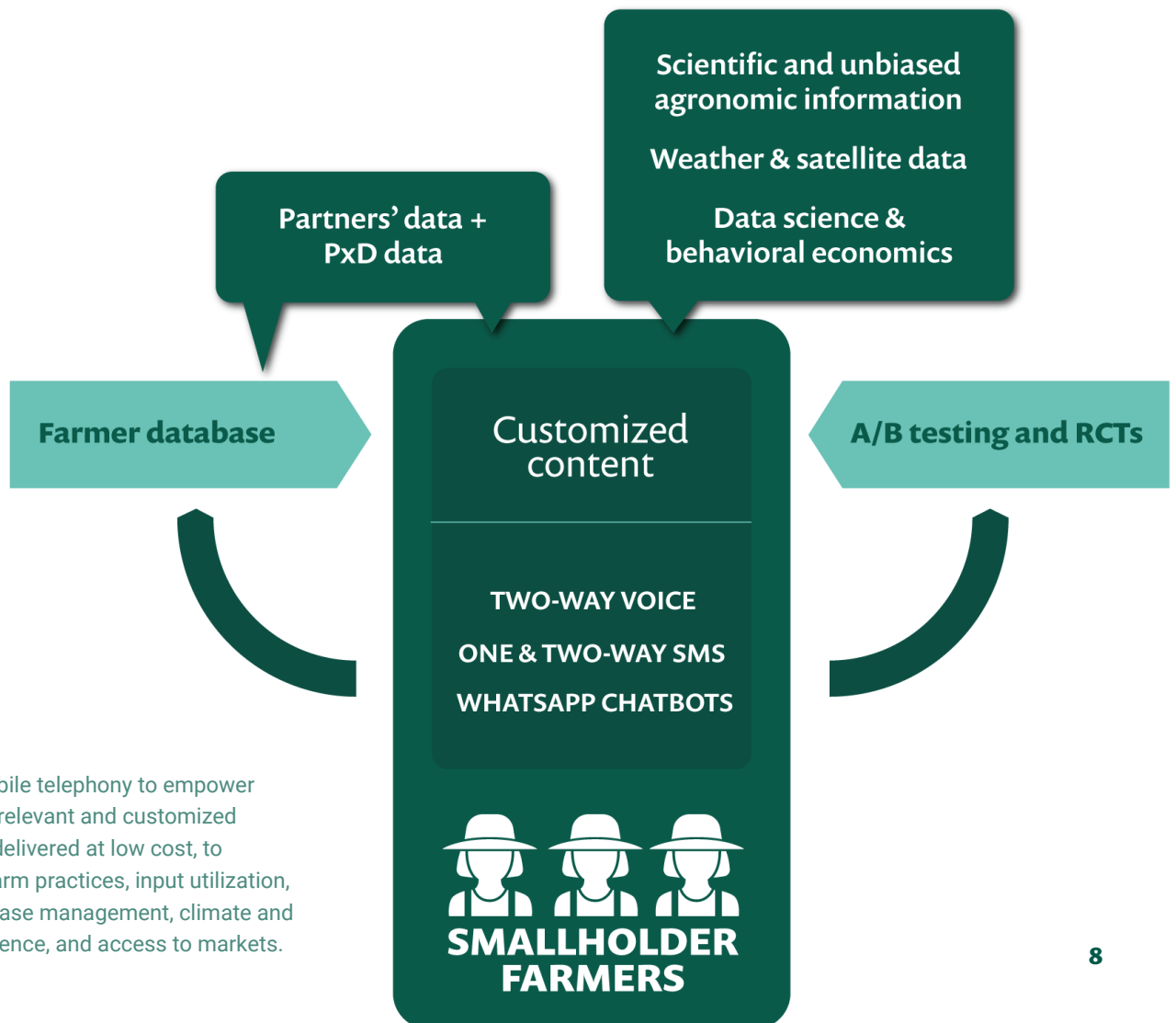
PxD mainly provides customized digital advice to smallholder farmers, but we are expanding into new informational fields, including environmental sustainability education, financial services, and nutrition. We collaborate with partners to achieve scale, and continuously experiment, iterate, and gather evidence to improve our services and demonstrate value.



PxD’s Krishi Tarang platform in Gujarat is a two-way communication platform that provides farmers with customized, low-cost, and scalable advisory services. Krishi Tarang’s core service consists of weekly voice messages pushed to farmers that provide advice and recommendations based on crop and weather cycles (“weekly advisory service”). Farmers can also access a toll-free helpline to ask questions (answered by expert agronomists within two days), pull previous weekly advisory messages, and access their history of questions (“IVR hotline”).

This model differs from others because it does not depend on internet access but uses channels that are accessible to users of basic mobile phones and farmers with low levels of literacy. While the user experience is designed to be simple, the backend is considerably more sophisticated: PxD’s IVR service disseminates customized information, making large-scale services cost-effective, leveraging behavioral economics and data science to target messages to farmers and monitor progress. Mobile phones also allow for the collection of information from users, which we use for rapid experimentation and analysis to iteratively improve user experience and user-centered design.

Before the receipt of the grant, Krishi Tarang’s services reached 39,436 farmers, with new users added primarily through word of mouth.



PxD uses mobile telephony to empower farmers with relevant and customized information, delivered at low cost, to improve on-farm practices, input utilization, pest and disease management, climate and weather resilience, and access to markets.



3.2 Scaling up Krishi Tarang

With support from the Swiss Re Foundation (SRF), the PxD team focused on scaling up its services to 100,000 farmers. We used various strategies, including allowing farmers to self-register through a web form, partnering with a consortium of FPOs, and facilitating outreach to farmers with various grassroots organizations. The challenges and successes of these strategies are described below:

(i) Self-profiling via a web form: We developed a web form for farmers to enroll themselves in our service by sharing their name, location, and crop information. We received no responses, despite sharing the web form with 800 farmers via SMS and then following up via phone to encourage them to register. This is likely due to low levels of literacy, poor digital literacy, limited internet access, and a lack of trust in SMS links relative to voice messages.

(ii) Outreach to FPOs: Our team conducted outreach with seven FPOs to encourage them to onboard our services to receive advisory and additional value-added services. Of these seven, only three responded with access to their farmer database. Due to the lack of active responses, poor data quality (e.g. several numbers were duplicates or inactive), and limited leadership bandwidth, this strategy was unsuccessful. Of the 7,700 contacts we received, only 1,852 were successfully onboarded to the service.

(iii) Collaboration with grassroots partners: PxD partnered with three NGOs with field teams reaching out to tens of thousands of farmers across Gujarat. Unlike PxD, these organizations rely on field workers to collect information from and disseminate advisory to farmers. The proposition of (i) providing timely and customized agronomic advice available


to farmers in local languages and at no cost to farmers and (ii) access to a wider selection of goods and services, facilitated by PxD's private sector partners (output market linkages, loans, insurance, carbon credits, etc.), that could service a broader set of farmer needs, was very attractive to these NGOs. Through the NGOs' field teams, we rapidly onboarded 62,594 farmers to receive PxD's free agricultural extension services. Scaling through NGO partners can be particularly effective, as there is a strong on-ground presence to support awareness about the services, which also reduces the farmer acquisition costs and helps build trust in the system.





PxD's two-way advisory service in Gujarat is known as 'Krishi Tarang'

 **Outbound service:** The outbound service includes weekly push calls delivered to farmers on the basis of crop and season.

 **Inbound service:** The inbound service includes a hotline that farmers can dial into to access several features, including: recording a question that will be answered by an agronomist within 48 hours; listening to previous push calls; listening to frequently asked questions; and listening to a personal inbox of the farmer's own previously asked questions.



Accessing the power of e-commerce for smallholder farmers



ON OUR BLOG





3.3 Feedback about the Krishi Tarang service

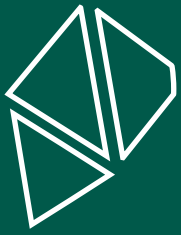
PxD collected feedback from a representative sample of cotton farmers on the Krishi Tarang advisory service³ on the adoption of five important recommendations⁴, and their experience using the service. Overall, the survey indicated that farmers were satisfied with, and have trust in, the Krishi Tarang advisory service. When asked to rate whether they would recommend the service to other farmers, the average response was 3.75 (with 1 indicating they would not recommend the service and 5 indicating they would recommend it). Among the 72% of respondents who remembered listening to the Krishi Tarang messages in the Kharif season (171 farmers), 39% (66 farmers) reported that they had changed their agricultural practices as a result of advice received from Krishi Tarang in the current season. Adoption for the priority messages ranged from 11% to 83% across the various messages. This variance may be because some practices are mandatory and are performed by the farmers irrespective of suggestions from an external source, while other practices are less commonly practiced.

PxD made use of Krishi Tarang, its existing digital extension system in Gujarat, to advance business model innovations, and test the effectiveness and scalability of different revenue-generation strategies among a diverse set of partners. The specific objective of this project was to test different pathways to revenue generation through partnerships with agribusinesses (B2B) capable of offsetting the costs associated with providing digital advisory services to farmers.

In collaboration with private sector partners, PxD expanded the functionality of its advisory platform to connect farmers to various products and services along the agricultural value chain. We targeted services we believed could reduce farmer costs or help improve their yields and profits. These services included marketplaces for agricultural inputs, machinery, farm outputs, and ag-tech services such as soil testing, carbon sequestration, and financial services that could extend their services to small and marginal farmers. We contacted over 50 private sector entities – including market linkage organizations, input suppliers, and several ag-tech and allied service providers – and sought feedback from farmers and partner organizations. We ultimately established partnerships with three input supply companies, three market linkage organizations, one soil testing organization, and one carbon sequestration organization. While exploring revenue-generating models with these partners, we continued to operate with an impact-first focus (improving farmer outcomes, including knowledge, yields, access to markets, and resilience).

3. A random sample of 808 farmers was drawn to conduct the survey. The sample was stratified based on gender, district, and listening rate (farmers were classified into two categories: listening rate higher or equal to 60% were in the high listening rate category and lower than 60% were in the low listening rate category).

4. The priority recommendations identified by PxD's agronomy team were intercropping, micronutrient applications, macronutrient application, sucking pest management, and pink bollworm management.



4. PxD's Approach to Developing Revenue-Generating Models



4.1 Revenue-generating activities

Overview of partnerships: Below we describe the different kinds of partnerships we entered into with private entities for the supply of inputs, market linkages, and other ag-tech-related services. In each of these models, PxD plays two key roles: (i) aggregating demand from farmers and connecting them to private sector services and (ii) collecting feedback about these services and passing them on to our private sector partners to help improve service quality.

4.1.1 Input supply

Small and marginal farmers in India primarily rely on local agro-dealers for agricultural inputs and advice related to crop management. The incentive to provide appropriate advice premised on the optimal use of inputs can be skewed by an agro-dealer's motivation to maximize sales. Some agro-dealers may recommend too many inputs (higher costs and potential harm to farmers), indulge in product adulteration, sell counterfeit products, and implement arbitrary or predatory pricing strategies. Other local agro-dealers extend credit to farmers to purchase agricultural inputs, trapping farmers into debt cycles and limiting their interaction with other suppliers. Several early-stage start-ups have attempted to revolutionize the last-mile delivery of agricultural products by developing digital platforms on which farmers can purchase agricultural inputs, including branded quality products from seeds to agricultural implements. However, these services are often limited to smartphone owners and exclude poor farmers who can benefit from them the most.



As a revenue-generating activity, PxD piloted an order-booking service to connect farmers interested in purchasing agricultural and allied products with private sector partners. We partnered with platform-based input suppliers to provide inputs such as seeds, crop nutrition (fertilizers), crop protection (insecticides, pesticides), and farm implements (pumps, harvesters, etc.). PxD’s revenue-generation policy does not allow us to promote specific inputs or encourage input overuse. As a consequence, our role was limited to aggregating demand, raising awareness about the service, and offering alternatives to existing markets. We collected data from farmers regarding the inputs and quantity they required and forwarded this to the private sector partner, who then took responsibility for managing the order delivery.

Feedback from the pilot was promising, with farmers expressing interest in the service (see Section 4.3.1), but revenues generated were not sufficient to offset the cost of advisory.

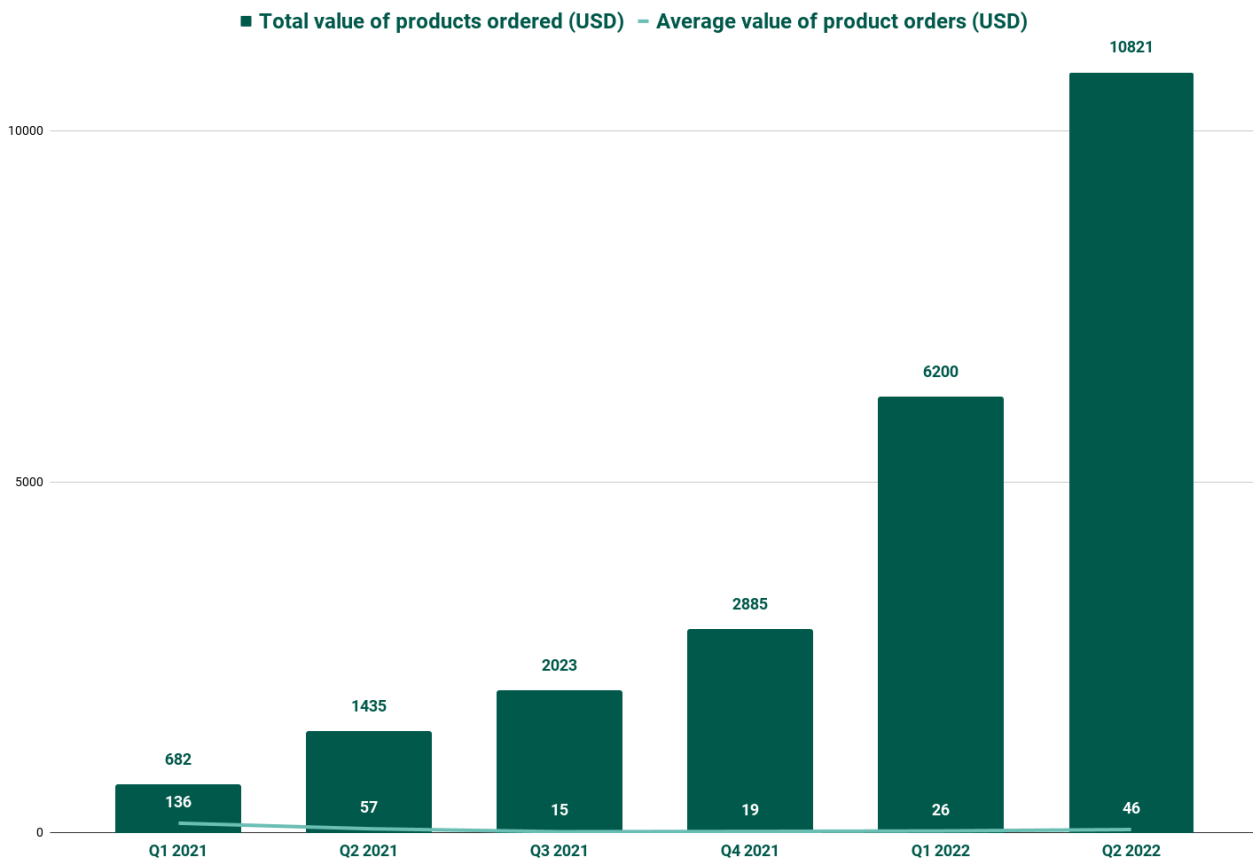


Chart 1. Value of products ordered by farmers, by quarter



As can be seen in the figure, the value of orders grew by a factor of 7.5 between Q2 2021 and Q2 2022. More than 90% of the farmers who placed orders and who were surveyed indicated that they would use the service again to buy services and would recommend PxD's order-booking service to others. Farmers considered the doorstep delivery of the products to be useful and were satisfied with the quality of the products they received. It is thus not surprising that 61.2% of the orders placed to date are from repeat customers

Significant investment to refine the operating model and achieve scale is needed to reach a break-even point. The revenue generated by PxD remained small relative to the cost of running the order-booking service. For the service to achieve breakeven, significant improvements in certain areas are required, such as scaling up farmer inquiries while reducing costs, higher inquiry-to-order conversion rates, and lower order rejection rates. While PxD could potentially develop unilateral solutions for some of these challenges, others depend on the ability and willingness of partners to adjust their offerings. Ultimately, this requires further time and iteration to get right.

4.1.2 Market linkage partners

Market linkage organizations act to connect farmers and buyers, providing a demand-driven supply chain of produce by procuring fruits, vegetables, spices, and other crops at the farm gate from farmers and supplying the produce directly in marketplaces. When working with individual farmers, market linkage companies must set up payment, packaging, infrastructure, and quality verification systems. As a consequence, they often prefer to work with aggregated farmer groups, including FPOs. The model varies considerably depending on the type of produce. For example, fresh fruits and vegetables that are harvested more than once during the year require low volume transactions in higher frequency, quality checks are low cost and low touch, and payments are usually made within a week of dispatch. Commodities like spices require higher volume transactions with less frequency. Extensive and time-consuming quality checks are implemented. This may require the involvement of third-party firms, with the potential to delay payment.

To support the supply side of the transactions, PxD piloted a project in Gujarat that utilized its reach within farmer communities via FPOs, setting up three partnerships with market linkage companies and connecting them to farmer groups. For a fee, we also helped one of the market linkage companies conduct a survey on post-harvest marketing needs to assess demand. However, overall success was limited. For example, we attempted to help FPO farmers producing Kesar mangoes by linking them with markets in Delhi, but seasonal factors reduced the production of Kesar mangoes in Gujarat and the expected price could not be matched. We also attempted to connect market linkage companies to several NGOs that support FPOs in Gujarat and Rajasthan for spices. In Section 5, we list the various challenges to this partnership model. One of the challenges that could benefit from further product iteration is that many FPOs require an advance payment to fulfill the orders, which market linkage companies may be unable to provide. A financial provider could help farmers facilitate these transactions. PxD is keen to explore this work in future months.



4.1.3 Ag-tech services

PxD has also explored the potential in the ag-tech and allied services sectors, such as soil testing, carbon sequestration, and insurance. We have assessed the relevance of some of these ag-allied services and weighed their potential for increasing farmers' yields, productivity, and quality of life. We have had conversations with several private sector organizations in carbon measurement and trading.

Soil testing

We signed a partnership with a soil testing company and commenced a pilot late in the grant implementation period. Due to infrastructural challenges on the partner's end, however, we were unable to move forward, but we did collect useful information from farmers (listed in Section 4.3.3) that could benefit other organizations.

Carbon sequestration

We also explored the feasibility of connecting farmers to carbon markets by receiving mobile money payments for adopting climate-smart farming practices with measurable climate mitigation benefits. We were particularly focused on validating the measurement of climate mitigation outcomes and the value of the payouts to farmers. The private carbon measurement organization we partnered with used in-house soil modeling and historical data to assess the sequestration potential in 43 of our farmer plots across 43 villages in Gujarat. The future direction of this work stream depends on the outcomes of this data pilot and our continued carbon credit market learnings. Unfortunately, it is too early to assess the viability of this partnership model as a revenue generation stream for PxD.

4.1.4 Financial services

To bridge some of the existing financial gaps among smallholder farmers to access financial institutions and credit ratings, we explored partnerships with financial institutions that service the agricultural value chain and deploy models that provide credit to rural agri-businesses, buyers, market linkages, FPOs, and the like. We continue to explore agri-credit, research the requirements of short-term credit for agri-input supplies, and ways to strengthen the value chains of FPOs through financial support.

4.2 Revenue-generation model

(i) Commission-based model: The primary revenue-generation model followed by PxD in the different partnerships under this project was a commission-based model. PxD did not charge its private sector partners to generate awareness about their



products or services, but a percentage-based commission was charged when transactions took place. The commission was calculated on the total value of the transaction for input or output market linkages and varied according to product/commodity type and/or order size. Below is an illustration of PxD’s fundamental revenue-generation model:

(ii) Fixed fee per user: In some cases, a fixed fee was charged when new farmers were added to a partner’s business to grow their customer base.

(iii) Fee for market research: PxD also explored the possibility of generating specific market intelligence for agri-businesses through primary surveys conducted with its farmers.

PxD communicates information about the partner's products/services to the farmer.



Farmer expresses interest in learning more about the partner's products/services or in making a transaction



PxD communicates the farmer's interest to the partner, along with the farmer's name and phone number

Partner confirms farmer's requirement and, with the farmer's permission, executes transaction.



Farmer makes payment and receives the desired product/service directly from the partner

PxD receives a small fee from the partner for every successful transaction, which is utilized to cover PxD's operating costs and keep advisory services free for farmers



Farmer receives free agronomic advisory from PxD, has access to an inbound hotline for individual queries, and is able to learn about and benefit from other services along the value chain.



At scale, we envision the primary source of revenue being the commission-based model for two reasons: (i) there is a limitation in terms of the scale of onboarding that any consortia will be able to achieve in terms of generating fresh leads, and (ii) based on our experience, a bulk of the orders were from repeat customers rather than new orders.

4.3 Farmer feedback on services offered by private sector partners

4.3.1 Input supply

To inform our partnership development strategy, PxD conducted a qualitative survey with farmers to understand their procurement practices and credit-related activities. Farmers mostly buy their inputs from local agro-dealers (seeds and pesticides) or cooperatives (fertilizers). Motivators for local purchases are trust in the seller, access to credit, and ease of access (for example if issues arise due to poor quality, etc). Farmers primarily considered price and quality while making decisions and, in general, seemed open to other sources of input procurement, provided that the price remained attractive. In terms of online procurement, delivery time was a key concern for farmers, as immediate access to inputs was considered important, particularly for time-sensitive decision-making (pest infestations and disease).

Convenience and input quality appeared to drive interest in the order-booking service, and most farmers appeared satisfied with these two factors. In a survey of 51 farmers who ordered inputs from our partners, most cited doorstep delivery as a primary motivation, followed by “better quality products.” Of these farmers, 76% (39 farmers) were satisfied with the quality of the product, and 78% (40 farmers) received the product at the right time. Almost all of the respondents (96%, or 49 farmers) indicated they would buy through the service again. Respondents indicated that they were very satisfied with the Krishi Tarang input order-booking service and would recommend it to other farmers.

Among farmers who had placed an inquiry with the service (N=154) but not an order, most inquiries were about physical inputs. On being asked why they had not made a purchase, farmers responded that they had no need; these were presumably general pricing inquiries. The main reasons for buying from the local agro-dealer were trust in product quality, availability on demand, and credit availability. Of the respondents, 66% said that people in their village knew about the service, 68% considered our order booking service when buying the inputs, and 89% thought that others would also benefit from our service. These results indicate a general awareness of the service and that most of the farmers surveyed considered our service before making a purchase.

4.3.2 Market linkages

From qualitative interviews, we see that a majority of respondents reported selling their produce at the Agricultural Produce and Livestock Market Committee (APMC) markets. However, many of them were unsatisfied with the selling price and were open to selling to other buyers for a better price. Some farmers remain skeptical about changing buyers, either because of a lack of trust in a new buyer or because they receive credit from their



current buyers, which may not be available from new private sector partners. In general, there seemed to be high demand among farmers for price information and connections to new buyers.

Farmers⁵ were also keen to reduce transportation costs, and the ability to sell directly from home was appealing. On the market linkage front, farmers mentioned that they rent a vehicle (45.95%, n=156) or use their own vehicle (35.14%, n=156) to transport their yield. Other farmers mentioned that they only sell from the farm gate and do not need transportation (17.57%, n=156), while a very low proportion of farmers use shared vehicles (1.35%, n=156). If a transport facility was provided and prices were better, 89.19% of farmers (n=156) would be interested in selling in another mandi. Farmers cited selling to the same person (i.e. trust with the seller) as the main reason for not selling in another mandi/local market (n=17). Taken together, these insights suggest that a combination of infrastructural and informational support could help farmers obtain higher prices but would require significant on-ground coordination to succeed.

5. This survey was conducted with 156 farmers in two categories: farmers who had ordered from Krishi Tarang order booking service and farmers who had placed an inquiry but not ordered.

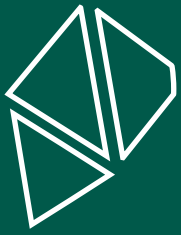


4.3.3 Soil tests

Soil tests can help farmers make better input management decisions to reduce input costs and improve soil health. In practice, soil health tests (often provided by the government) are not readily available. When they are, farmers often struggle to interpret and act upon the results, and additional verification measures to ensure the accuracy of soil tests are often required. To understand farmers' knowledge of and attitudes to soil testing we partnered with an agri-tech startup specializing in soil technology, farm data acquisition, and related cloud services.

From a campaign of calls to 274 farmers in Banaskantha district in Gujarat, 33% (90 farmers) showed interest in having their soil tested. We also measured their existing knowledge levels and awareness of soil testing. Our learnings show:

- Soil testing was familiar to 66.06% (n=274) of the farmers. On being asked what they knew about soil testing, most (87.85%, n=181) correctly said that soil testing would help them understand which fertilizers to use. Awareness of tests was relatively high.
- Farmers had heard about soil testing in discussion with other farmers and from the local agricultural extension agent or extension office.
- Soil testing had been done by 45.86% of farmers (n=181), of whom 73.49% (n=83) had done it over a year ago. Among these farmers, 37.35% (n=83) believed there was no ideal time to have soil tested and 32.53% (n=83) believed, in line with best practice, that soil should be tested every year. Soil testing for 72.29% of the farmers (n=83) was performed by a government organization.
- Among farmers who were not interested in soil testing, 60.31% (n=194) were not interested because they did not want to pay for it (as the government had provided it for free).



5. Insights



Below we list several insights (successes and challenges) that we encountered during the execution of this grant that could inform future work:

For revenue-generating models to succeed, scale and associated leverage are critical

One of our key insights was that a successful consortium of private sector partners requires scale. At our envisioned scale of 100,000 farmers, we were often unsuccessful in attracting the attention of the right partners. Similarly, partnership development (moving from the first point of contact to signing a contract) took months of investment from senior management. When conversion rates are low, scale is imperative for offsetting the costs of advisory services, as costs are distributed over a wider potential customer base of farmers. This could also give us leverage to negotiate higher compensation terms with our partners and improved service delivery quality. Identifying partnerships (ideally with strong buy-in from government or large-scale private partners) with significant opportunities to scale could also help better assess the revenue-generating potential of this model.

A multi-partner ecosystem with several partners within the same value chain can reduce partner-specific dependencies

Partner-specific idiosyncrasies often prevented partnerships from realizing their full potential. In one case, a partner's unforeseen infrastructural challenges prevented



the partnership from taking off, while in other cases, lack of inventory prevented the conversion of orders. As with leverage, this model would probably work better with multiple partners for each service, thereby reducing dependencies on individual partners and offering farmers more choice.

Successful service delivery requires iteration and must incorporate input from farmers

PxD added significant value by soliciting farmer feedback and improving the service delivery model, which could be a win-win for all parties. For example, we worked with our input-supply partners to tailor their inventory to the seasonal calendar and push information to farmers at the right time. Similarly, when farmers shared that delivery time was a key decision-making factor in their choice to purchase from our partners, we worked with the partner to reduce delivery times. We also worked with partners to improve the conversion rate of inquiries into orders for select services. However, we were not able to generate successful market linkages results, because identifying a price point agreeable to both the partner and the farmers proved difficult. PxD demonstrated success in generating repeat orders (> 60% of our orders were repeat orders), indicating that farmers who engaged with the service trusted and valued it. With improved scale and additional leverage, there may be opportunities for further improvement. Customization is critical to success: for all services, identifying farmers with the right crop at the right time of the season, and with the right conditions to benefit from select services, significantly improved engagement rates.

On-ground presence could be important in shifting farmers' trust

Trust is a key determinant of where farmers choose to buy and sell products. Particularly for logistically complicated services like market linkages, an on-ground presence was beneficial. For example, being able to negotiate mutually beneficial payment terms between an FPO and partner could have transformative impacts on farmers' outcomes but requires considerable time and resource investments. PxD developed an exploratory village-level entrepreneur (VLE) program, but early efforts to develop this as a light-touch initiative (organized remotely, with small commissions and limited infrastructure) met with limited success. We are keen to partner with more established VLE programs to ensure that farmers benefit from the trust and first-mover advantage these VLEs have already established within their communities. While digital services like ours can play a significant role in connecting farmers to partners, an in-person component could significantly enhance a farmer's willingness to engage with these services, particularly where financial transactions are involved.

Aggregation could help reduce the costs of operating the service

In addition to building trust, a local presence through VLEs may help aggregate demand for various value-added services, reducing the need for coordination and making the service delivery model more economical. A similar rationale could be considered when working with FPOs. For example, we saw that most of our market linkage partners work through farmer collectives. However, the success of this model is highly dependent on the quality and performance of individual FPOs which is extremely variable, introducing uncertainty in the potential for revenue generation.



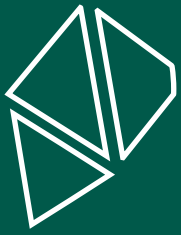
PxD would like to experiment with various aggregation structures (cooperatives, FPOs, agri-entrepreneurs) to identify cost-effective ways of setting up these revenue-generating partnerships. Aggregation brings with it the benefit of reduced operating costs for PxD, improved coordination within the community, and the ability to generate higher volume transitions with less effort while meeting the needs of a larger group.

Access to credit could be instrumental in shifting farmer decisions

A key issue inhibiting farmers' access to improved markets is their access to credit. Farmers often remain loyal to existing partners because of the line of credit available to them. Working with financial institutions could be key to connecting farmers to improved output markets. We observe that some FPOs require advance payments to fulfill large volumes of orders, but many market linkage companies provide payments in tranches or after a quality check. There is tremendous potential here for organizations like PxD to directly or indirectly fill this gap, and this is an area of study we would like to explore further. Access to credit could also unlock potential high-productivity investments for farmers, improving farmer outcomes and generating revenue for private sector partners.

Incentive alignment with partners is critical for success

PxD's revenue generation policy applies an impact-first focus to our collaborations with private sector partners. For example, we do not promote specific branded products to farmers, nor is our metric for success based on pushing higher input sales among farmers. As a non-profit, our first commitment is to provide unbiased, scientific, and easy-to-understand advice to farmers. We look for gaps in the value chain that prevent farmers from maximizing their return on their agricultural activities and help them identify and take advantage of options and innovations from the private sector. For this partnership model to work, it is important that in addition to achieving scale, we identify private sector partners who will be patient as they work with relatively small farmer populations to better understand their needs and determine the relevance, quality, and value of the service the partner can deliver to them. Given our motive is to promote farmer interests, preferably in a financially sustainable way for PxD, and not to turn a profit, it is important to recognize that this may also affect the potential for revenue generation, as we are always careful about what services we choose to scale.



6. Conclusion



This project enabled PxD to pursue new partnerships with private sector players to explore the potential for revenue generation and advanced the long-run prospect of providing advisory services on a financially sustainable basis. PxD scaled its existing advisory service in Gujarat to over 100,000 farmers, built lasting relationships with non-profit partners interested in extending private sector services, identified and developed relationships with private sector partners across various services (far beyond the original scope), and documented a range of insights from partner and farmer perspectives. Most importantly, we have identified complementary services that can help farmers improve their productivity and outcomes. The learnings from this grant will benefit other stakeholders and have several implications for PxD's operations beyond this specific context or geography.

However, we were unsuccessful in our primary goal of identifying models that would allow us to generate enough revenue to offset the cost of providing advisory services. Several reasons are described in the report, including a lack of leverage, fragmented services, the need for scale, and service refinement. More time and investment are required to finesse these systems and relationships and to identify settings and contexts in which these models are more likely to succeed by providing value to farmers and private sector partners, and generating margins to offset the cost of advisory services. We have identified a few avenues for further exploration, including bundling advisory and credit services; leveraging agri-entrepreneurs, FPOs, and other farmer collectives to optimize operating models; and identifying settings at a scale where there may be interest in exploring this model. We are also in talks with our non-profit and government partners to determine whether there is a funding model that will cover some of the costs of the advisory services to reduce reliance on donor funding going forward.



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