



Partnering for Innovation

The “D” in “R&D:” Understanding the Development Process

Purpose

This guide is a companion piece to the publication titled, [Success Factors for Commercializing Agricultural Research: Lessons Learned from Feed the Future Partnering for Innovation](#). One of the success factors identified in this report was “recognize that research is just one part of R&D. The development aspect also takes considerable time and resources.” This companion guide further elaborates on this idea and shows why donors developing commercialization projects for products developed in research institutions need to involve the private sector early on in the product development process. It describes common challenges faced by businesses in the product development stage; potential solutions to these challenges are currently being discussed by Partnering for Innovation and other stakeholders.

This guide assumes that the business and research institution have already reached an agreement about intellectual property, compensation, technology transfer, and other legal and administrative aspects of the process.

Feed the Future Partnering for Innovation is a United States Agency for International Development (USAID)-funded program that provides incentive-based grants to de-risk the upfront investments that are necessary to scale and market agricultural innovations for smallholder farmers. The program works toward this goal through partnerships with the private sector, which to date number 50 in total.

Understanding the Context: Commercialization Processes

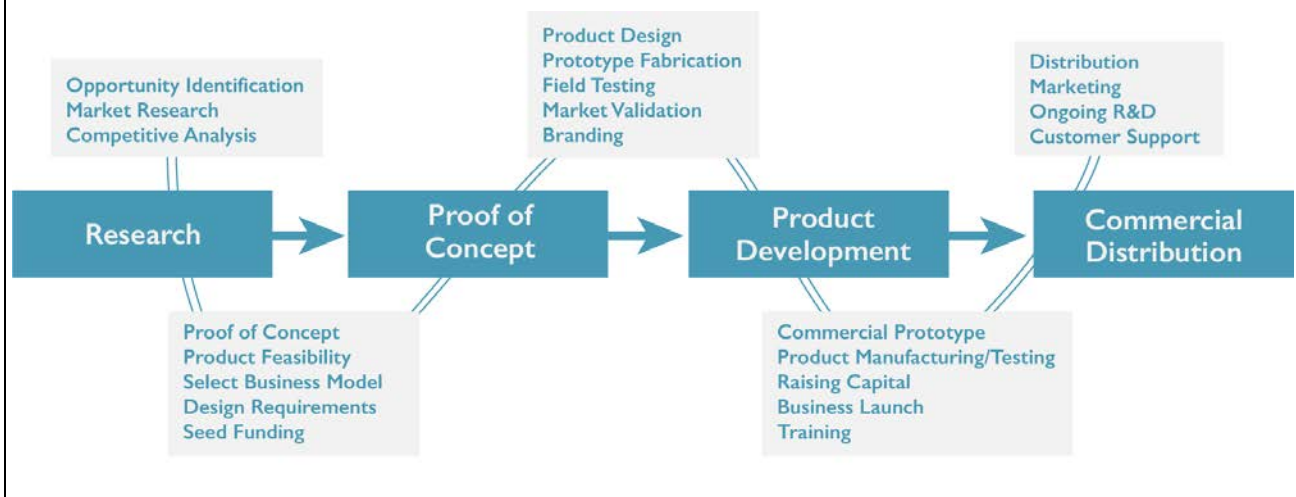
Commercialization of publicly-funded agricultural research to benefit smallholder farmers has much in common with the commercialization of any product, service or technology for the mass market. While the specific details vary based on individual circumstances, the research to commercialization process generally includes the following stages: research, development, and distribution.

During the first stage, the research institution (and its collaborators, if applicable) **conduct research**¹ that ultimately leads to an innovative product, service, or technology that the researchers believe has the potential to be commercialized. This research may or may not have been conducted with the goal of commercialization in mind, depending on the requirements of the funder, mission of the research institution, and interests of the individual researcher.

¹ For more information on the research process, see the [US Government's Global Food Security Research Strategy](#).

The next stage is the **development process**. This is normally led by the commercializing entity (usually a business), but the research institution may play a role. Development includes a wide range of activities including conducting market research (assessing demand, market potential, etc.); designing and establishing mass production processes and facilities; building a supply chain; determining distribution channels and related logistics; designing and implementing a marketing strategy (including customer segmentation and pricing strategy); and complying with regulations. If successful, this process ultimately results in a **commercially viable product**, service, or technology that is readily available in the marketplace. A product, service, or technology is commercially viable when it competes effectively and is profitable. The development process is not always linear and usually involves a certain amount of trial and error. In the end, the business needs to produce a product that it can profitably sell at a price that the customer is willing to pay.

Diagram 1: The details of the commercialization process vary on a case-by-case basis. However, in Partnering for Innovation’s experience, when research and commercial entities partner after research and some phases of product development have already taken place, the process has generally proceeded as illustrated in this simplified diagram. **The blue boxes denote major phases of the process. The white boxes are an illustrative list of activities undertaken by the commercializing entity. See Appendix I of the full report for more details.**



Funding the Process

The development process requires a significant investment of time and money on the business’s part. It is also risky - the product could fail, and the business’s investment would fail to payoff. Businesses can finance this through their own internal resources, loans, or investors. However, in less-developed financial markets options available may be limited. In developing products for smallholder farmers, businesses can also benefit from donor funding to defray some of the costs associated with this target market. In the context of the businesses interviewed for this briefing, such donor funding was most commonly used for building a smallholder-based supply chain (activities such as farmer training or technical assistance), purchase of manufacturing equipment, and marketing to smallholder customers.

Challenges in the Process

To be commercially successful, businesses need to be able to bring the product to market at a price that is profitable and that the customer is willing to pay. Smallholder farmers tend to be more risk averse and more price sensitive than larger, commercial customers.² With smallholder farmers in particular, this can necessitate several cycles of the development process to arrive at a price that is low enough for the smallholder to afford but is still profitable for the business. For example, if marketing costs are high, the business looks for ways to lower the costs of production or distribution to compensate. As new production technology becomes available, this offers opportunities to lower costs. The following examples illustrate some of the common challenges in the product development process.

- **Creating the Product:** Universal Industries is a Malawian food business that is manufacturing products that use orange-fleshed sweet potato (OFSP) varieties developed by the International Potato Center (CIP) and grown by smallholder farmers. Developing a new product requires an element of creativity to come up with new recipes that are appealing to consumers in terms of taste, texture, and visual appearance and can be produced on a large scale with consistent results. To do this, the business needs a reliable supply of ingredients that are available in the volumes needed and of consistent quality, and respond well to the manufacturing process for the different recipes developed. Varieties that are too high or too low in fiber content could produce undesirable textures in the final product, and some varieties lose their color in the cooking process. Once Universal determined which varieties were best for processing, it communicated this information to CIP and worked with CIP to get smallholders growing the right varieties.

Once a recipe is developed and the product successfully launched, changing the recipe is an expensive process. However, sometimes this is necessary if an ingredient is no longer available, has changed in quality or has become too expensive. Universal also sees potential in selling sweet potato flour or puree to bakery customers as a substitute for more expensive imported ingredients. However, this too requires recipe experimentation, in this case by the bakeries, which will then need a reliable supply of flour or puree.

- **Producing at Scale:** MEA is a Kenyan fertilizer business that is producing a product called BIOFIX, under license from the University of Nairobi. It is a biologically active product - a first for the business. After beginning production in the new BIOFIX facility, issues became apparent. First, the production capacity was not sufficient to meet growing demand. This was a result of limitations in the method and machinery being used. Second, the physical layout of the facility was inefficient. It required workers to move back and forth between different areas of the facility which both wasted time and increased the risk of the product becoming contaminated. Although problems were apparent and better technology was available, the business had already invested significant resources in building the facility and purchasing the equipment. Donor funding allowed the business to offset the costs of investing in improved technology, which ultimately allowed MEA to produce higher volumes of a better-quality product more efficiently.

² USAID (2015). Literature Review: Scaling Agricultural Technologies & Innovation Diffusion.

- **Investment in Facilities and Infrastructure:** Niji Foods is a Nigerian business that is producing cassava-based animal feed based on a concept developed by the International Livestock Research institution (ILRI). The feed uses cassava peel that was previously discarded as waste. To maintain product quality, the peel needs to be transported to a processing facility quickly so that it is still fresh when it arrives. This quick transport requires that the processing facilities are located near to the source. However, proximity must be balanced with other considerations such as availability and price of land, security situation, transportation infrastructure, and availability of qualified workers. The process of acquiring land is particularly complex. Of the three processing sites established, one location proved to be problematic in terms of ability to receive the cassava peel while still fresh, and had to be relocated. This required additional investment and caused disruptions to the supply chain.
- **Regulatory Processes:** StrigAway is improved maize seed that is tolerant to the herbicide Imazapyr (a product produced by the chemical business BASF) and is coated with this herbicide to prevent infestation by the parasitic weed striga. In order for the product to be available in a particular country, the seed varieties developed by the International Maize and Wheat Improvement Center (CIMMYT) must be approved for commercial release and the herbicide must be registered. In 2005, when the African Agricultural Technology Foundation (AATF) first started working with seed businesses to commercialize StrigAway, the product was already approved in Kenya. However, to bring the product to Uganda and Tanzania, additional work was necessary to obtain the proper approvals and registrations for the herbicide and the seed varieties. Approval for commercial release of seed varieties requires local field trials and data collection. The approvals and registrations necessary to sell StrigAway in Tanzania and Uganda were obtained in 2013 and 2014, respectively. Regulatory approval processes can be time consuming, particularly when they require testing to be conducted over a period of time.
- **Businesses' Ability to Address Product Development Challenges Internally:** Larger businesses often have their own R&D departments and are capable of addressing many aspects on their own, while smaller businesses often rely on outside support. Regardless of size, businesses at times will draw on assistance from complementary businesses (such as suppliers or equipment manufacturers), the research institution that developed the product, NGOs involved in related projects, or the public sector. For example, NASECO, one of the seed businesses in Uganda that is commercializing StrigAway, had the capacity to design and fabricate its own equipment and to conduct its own seed propagation. Although the business still needed some technical support during the development process, it was able to graduate from needing this assistance relatively quickly. Smaller businesses in Kenya, however, had to purchase equipment, often importing it, which caused delays, and were unable to do their own propagation, instead sourcing seed from public breeding programs. They were also more reliant on groups like CIMMYT, BASF, and AATF for technical assistance.
- **Balancing Supply Chain Development, Product Development, and Market Development:** Businesses face challenges in balancing supply chain development, product development, and marketing. Universal Industries and its orange-fleshed sweet potato products

are a good example of this. As the product was being developed and introduced, Universal needed to carefully balance building an adequate (but not excessive) supply of ingredients, experimenting with creating new products, and building demand for the product at a pace its production capacity could handle. The seasonal nature of agriculture can complicate the process and lengthen the timeframe; in Malawi sweet potatoes are only in season for a few months of the year, which in turn limits the window for developing recipes, testing mass production methods, and producing the product for its commercial launch.

With StrigAway, seven businesses in three countries were commercializing the product. Each was on a different timeline for having the product ready for sale - some had to await equipment shipments for seed treatment from abroad, while others fabricated their own; some had difficulty producing the seed because of weather and disease conditions, while others did not have that problem; some had to wait for regulatory approval, others did not. This made the implementation of a common marketing campaign through AATF a challenge. When the campaign started, the product was available in some areas but not others.

In the case of MEA, demand for BIOFIX grew faster than anticipated after its marketing campaign. It faced a situation where its production facility was overstretched and it needed to scale back marketing so as not to create a demand that it could not meet. Investment in new technology with a greater production capacity enabled the business to address this issue.

Commercialization Is a Long-Term and Continuous Process

Given the complexity of the process, the seasonal nature of agriculture, and the unique challenges of targeting smallholder farmers, it is not surprising to find that most businesses interviewed took 8-10 years to have a viable product on the market, and additional time to determine if the product will take off and be successful in the long term. Getting a product to the smallholder market takes considerable time, human resources and financial investment on the part of a business. It requires patience, dedication and commitment on the part of the leadership team and throughout the business. However, ultimately, to stay competitive, businesses need to continually look for ways and investment to improve their existing products, make production process more efficient, and develop new product lines. In that sense, it is a process that is never truly finished.