



Beyond the Laboratory

Changing Lives through Hardware Technology Enterprises

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BEYOND THE LABORATORY: CHANGING LIVES THROUGH HARDWARE TECHNOLOGY

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4 Preface

6 Introduction

19 Case 1: Inka Moss

29 Case 2: YAQUA

41 Case 3: X-Runner

51 Case 4: Café Compadre

59 Case 5: Ingenimed

66 Conclusion

Preface

NESsT has been working for 20 years to provide dignified employment to lift people out of poverty in emerging market countries. This work has become more important than ever as the United Nations Sustainable Development Goals identify decent work and inclusive employment as fundamental to end global poverty, protect the planet and build a world of peace and prosperity for all. NESsT is committed to contributing to this goal by creating 50,000 decent jobs and income opportunities in the next five years for the poorest communities facing isolation, discrimination, lack of job skills and poor education.

NESsT achieves its mission by raising philanthropic capital and using an engaged investment approach to accelerate the growth of social enterprises that offer access to dignified employment. By committing to these enterprises for five years, NESsT is able to support them through the tough transition of moving from start-up to fully scaling businesses. During this time, we provide several rounds of patient capital investments and connect the enterprises with other co-investors. The NESsT team also offers one-on-one business development support to help them consolidate and grow their businesses, and leverages the expertise of more than 200 mentors for specialized support.

In alliance with the Lemelson Foundation, NESsT has been supporting a portfolio of hardware technology social enterprises in Peru since 2007. These enterprises develop and distribute new technological products that generate sustainable income and employment, preserve the environment and significantly improve the quality of life of people who live in vulnerable communities. To reach this impact, the alliance has supported inventors and entrepreneurs with innovative and sustainable models who have become social change agents. Through its portfolio of hardware technology enterprises, NESsT has reached over 140,000 low-income people, and over the next five years it plans to reach 250,000 more.

Beyond the Laboratory: Changing Lives through Hardware Technology Enterprises is a contribution to the enterprise and innovation ecosystem. It sets out to show the potential of science, technology and entrepreneurship in resolving current and imminent social problems in Latin America and around the world. Its goal is to illustrate how hardware technology is incorporated into sustainable business models that solve critical problems in low income and excluded communities. The book presents five case studies of enterprises that operate in Peru and includes best practices and the internal and external conditions needed to position these types of enterprises for maximum growth and impact.

NESST GLOBAL IMPACT TO DATE

Since 1997, NESsT has invested in and supported social enterprises in emerging market countries.



167
social enterprises
supported



\$11.5 million
invested



31,000+
economic
opportunities
created since 2008



509,000+
lives improved



44%
social enterprises
break even by year 2
in the NESsT portfolio



19%
revenue growth of
social enterprises in the
NESsT portfolio in 2015

Introduction

What are hardware technology enterprises and why did they emerge?

Historically, most technological progress and investment in innovation aimed at economic development emerged in the wealthier, more developed countries. In the recent past, this progress has focused on the development of industries for new products to meet the needs and tastes of middle and high income groups: cars, electrical appliances, computers, etc. Globalization has taken this technology to developing countries, and although its adoption has had profound effects on these economies, such as reducing the national costs of production, establishing quality standards and allowing individuals to communicate from a distance,¹ they have not been adapted to meet the needs of a large proportion of the local population who still lives in poverty, outside of the formal economy and without access to basic services. As a result, these groups remain on the fringes of the very same technological progress that could contribute to remedying this situation and to significantly improving their quality of life.

Latin America is a good case in point where only in the last decade has there been an effort to promote technology and innovation as an economic development strategy. The most common indicator used to measure this progress, the percentage of research and development (R&D) expenditure in regional Gross Domestic Product (GDP), has increased from 2.8% to 3.2% between 2002 and 2011. Even so, total investment is well below the level of Organisation for Economic Co-operation and

Development (OECD) member states. Furthermore, unlike OECD countries where R&D investment is led primarily by the private sector, in Latin America this investment is led by the public sector. Most Latin American governments have designed and implemented policies that promote Science, Technology and Innovation (STI). However, these policies are generally aimed at economic growth and competition and not at poverty amelioration. There is limited interest in and support for the creation of hardware technology solutions that meet the needs of people living in poverty.

In the few cases where hardware solutions have been developed to improve quality of life for poor communities (i.e., clean stoves, agricultural equipment, etc.), outreach strategies have not been market driven. There are numerous cases where technologies are donated but never actually used by poor communities, often because they are not adapted to local contexts. Using a market-based approach not only ensures that use of the technology will be sustainable in the long term, but that the design and development of the technology will be based on the real needs of users.

It is within this context and in response to this scenario that socially focused hardware technology enterprises have emerged.² These market-driven enterprises use science and engineering to create equipment, machinery, new materials and instruments, which are then used by poor communities to increase their productivity and income or to directly improve

¹ Joe Cackler, Emily Gu, and Mike Rodgers. *Technology in Developing Countries*, Stanford University, March 2008.

² For more information on this subject, please see Harvey Koh, Nidhi Hegde, Chandrima Das, *Hardware Pioneers: Harnessing the Impact Potential of Technology Entrepreneurs*, April 2016.

their quality of life. Hardware technology enterprises encompass diverse business models that ensure that the users access and adopt their technologies through processes that are both sustainable and scalable over time. In some cases, poor communities use technologies as suppliers in a global value chain. In other cases, poor communities become customers of enterprises that disseminate technologies that better their quality of life. Enterprises may also use profits from their regular business line to offer products and services at a lower cost, making the technology more affordable to low-income people. In all cases, the end user or intermediary has access to technology through an inclusive business model that maintains a dynamic connection between quality, price and final impact.

Hardware technology social enterprises combine diverse pillars that are set up as a **singular system** ultimately allowing them to be catalysts for social change. As can be seen in Figure 1 (see page 8), these enterprises require the creation of multidisciplinary teams with backgrounds in science, business and social development. This multi- and interdisciplinary approach permits a closer understanding of problems that the enterprise wants to address and of the conditions needed to design new products and ensure their validation among end users. The enterprise also focuses on engaging a variety of stakeholders from both the public and private sectors including government, academia, corporations and user communities. This is of particular importance, since these actors provide the enterprise legitimacy among end users, and as a result strengthens the process of

technology dissemination and the potential for social impact.

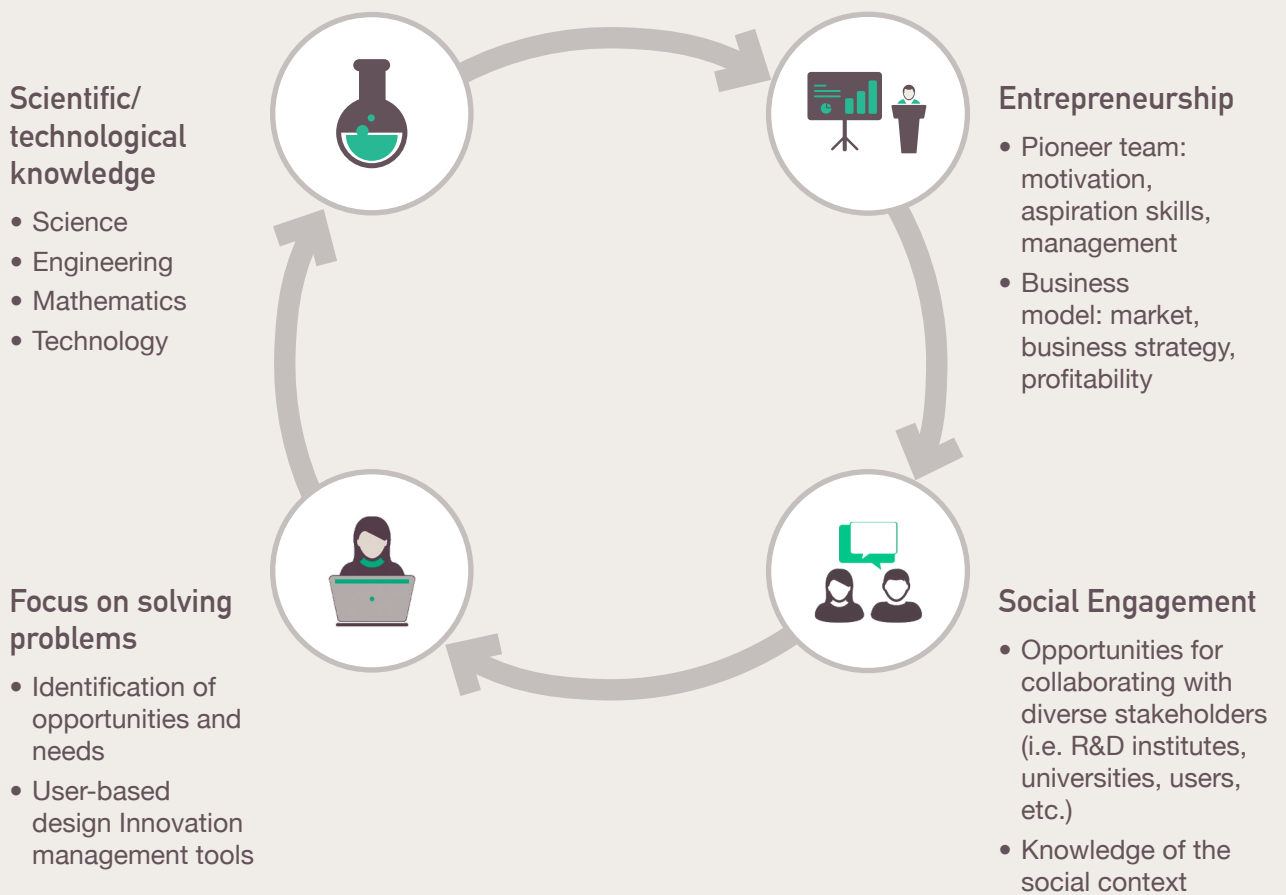
How do hardware technology social enterprises innovate?

Hardware technology social enterprises emerge from a process of business and social innovation. The innovation process implies the engagement of a system with two key elements: **novel idea** (or invention) and **application** (use and distribution of the invention), which together affect a country's productivity, competitiveness and socioeconomic development. A novel idea generally uses basic knowledge to find a solution that can be applied to a concrete problem and can also be commercialized in the market and scaled.

The most successful hardware technology firms are not necessarily those with the most innovative ideas, but rather those capable of managing innovation efficiently to generate value from these ideas. In broader terms, we could say that innovating is turning knowledge into value. In business terms, this value refers to commercial value. In social terms, this value seeks to improve the quality of life of people. Hardware technology enterprises encompass both of these values by using technology and entrepreneurship as a means to change the reality of impoverished and marginalized communities.

The case studies presented in this publication show how innovation has channeled new knowledge to provide solutions to diverse social issues, which have created and added value to the socioeconomic context

FIGURE 1: PILLARS OF HARDWARE TECHNOLOGY ENTERPRISES



Source: Authors.

where they are applied. In this way, these enterprises have channeled resources to groups who have historically been excluded from investment in science, technology and innovation.

The innovation process is generally full of uncertainty, and its final outcomes can be quite different than those originally expected. The most relevant uncertainties include:

- **Technological feasibility:** Moving from an idea to a functioning technological product is a lengthy and risky process, and the results may not be those anticipated in the project design. Technological feasibility depends on the experience of the creators, their partners and service providers in the specific area of technological development. Along with this, it is important for the developers of the technology to be close to and understand the real problems they are trying to solve, in order to empathize seriously and responsibly with local realities and design a product based on the well-being of the end user.
- **Commercial viability:** As we are talking about new and little-known products, there is a degree of uncertainty around their acceptance—or lack thereof—in the marketplace. In order to achieve this acceptance, potential customers must be engaged in the process of developing the business model from the beginning.
- **Organizational fit:** The creation of a new technology has implications in the overall operations of the enterprise. The enterprise must make sure that

any changes in processes as a result of the new technology are adopted by its team and partners. The enterprise will undergo a change in its culture.

- **Social acceptance:** The enterprise faces the uncertainty of not knowing whether the product will be accepted by its end users. The adoption of technology is more of a social process than a technical process, as it requires not only an interest in using the technology but also the capability of communities to do so. The enterprise must count on networks and local alliances that will allow the technology to be effectively adopted.

To address these uncertainties, the role of entrepreneurs is vital. If they want to generate significant transformations, they must be prepared and able to make changes to their technology and to their business models. They must engage in a process of co-creation and collaboration with relevant stakeholders. This can be challenging, as these stakeholders come from different contexts, have different degrees of training, different skills, and diverse perspectives on the transformation that is being made, and the alternatives and opportunities available to address it. Entrepreneurs must be able to overcome these barriers in the short run to enable significant impact in the long run.

What is the enabling environment in which hardware technology enterprises thrive?

Enterprises that want to develop and apply technology need to analyze the surrounding environment or ecosystem prior to generating innovation processes

aimed at resolving issues affecting communities living in poverty. The lack of an enabling environment may prevent an enterprise from attaining its financial and social goals, by posing legal (i.e. gaps in relation to the application of technology), economic (i.e. elevated implementation costs) or financial (i.e. lack of or limited access to flexible financial instruments) obstacles.

Based on NESsT's experience, there are several key factors that must be considered when analyzing the ecosystem affecting a hardware technology enterprise to help ensure its success. These include:

- Cost and type of investment in science, technology and innovation, aimed at solving problems that affect poor communities
- Enterprising capacity on a national level and interest among entrepreneurs in resolving social problems
- Availability of basic infrastructure such as road infrastructure, Internet connection, available power supply (electrical or renewable)
- Institutional and regulatory framework, as well as specific incentives for the creation of enterprises that set out to create a social impact
- Available human resources, level of training and existing skills for running and growing the enterprise
- Available and appropriate financing and investment for creating, validating, consolidating and scaling businesses

- Degree of interaction and engagement between stakeholders, including poor communities, academia, companies, service providers, financial sector, public sector, etc.

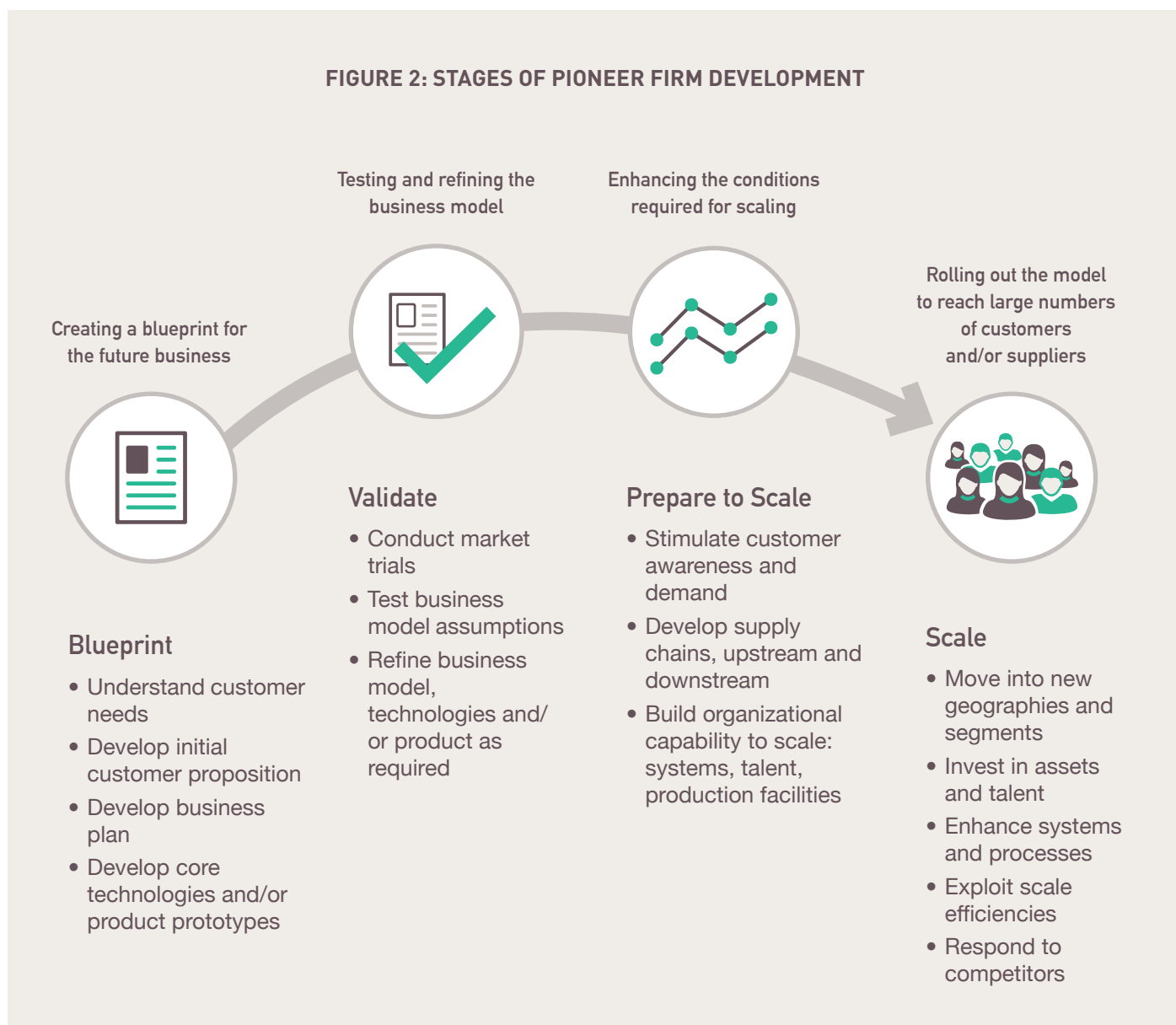
Analyzing and understanding the innovation ecosystem, makes it possible to develop strategies that support systemic solutions to poverty. Specifically, a stronger ecosystem allows hardware technology enterprises to maximize their potential to become financially sustainable and to have social and environmental impact.

How does NESsT support hardware technology social enterprises?

NESsT works with hardware technology enterprises to create models that provide technology solutions that are accepted by communities living in poverty. These models are both technically and financially viable and have the potential to scale in target markets. The support provided depends on the stage of development of each social enterprise. Social enterprises generally move through the stages illustrated in Figure 2 (see page 11).

NESsT supports enterprises to move from the validate to the prepare to scale stage, and from the prepare to scale stage to fully scaling. This process takes an average of five years, but can sometimes be longer. During this time, the enterprise works through uncertainties (i.e. feasibility, viability, organizational fit, social acceptance) while responding to the realities of all players (i.e. users, market, enterprise).

FIGURE 2: STAGES OF PIONEER FIRM DEVELOPMENT



Source: Harvey Koh, Ashish Karamchandani and Robert Katz, *From Blueprint to Scale: The Case for Philanthropy in Impact Investing*, April 2012.

The five social enterprises presented in this publication were or are currently in the NESsT portfolio. Upon completion of a rigorous due diligence process and an invitation to join the portfolio, NESsT and the enterprise team develop a set of performance goals designed to achieve their financial, social and environmental impact. To support them in reaching these goals, NESsT develops a package of tailored and strategic support services. This package of services is implemented annually by the NESsT team with the support of an external network of mentors and advisors, monitoring and measuring

progress on a quarterly basis. Table 1 (see below) outlines NESsT advisory services at both stages.

NESsT’s methodology prioritizes four aspects that are considered indispensable in positioning hardware technology enterprise to scale: **(1) technology and business model validation, (2) competencies and skills of the entrepreneur team, (3) access to the appropriate type and level of financing, and (4) leveraging public and private networks.**

Table 1: Advisory Services at the Validate and Prepare to Scale Stages

Advisory Services at Validate Stage	
Cross-cutting Services	Tailored Services
Build and support the management team and governance model	Support validation of the business model & cost/revenue structure
Ensure enterprise adoption of the NESsT Performance Management Tool (PMT) including social and environmental indicators	Guide in development of standardized and efficient operational processes, delivery channels and value chain
Assemble packages of patient capital	Train and support in the process of becoming investment ready
Leverage a platform of donors and co-investors	Support development of marketing and sales strategies, including customer validation for each segment
Help develop a risk mitigation plan	Coordinate mentorship program with industry experts

Advisory Services at Prepare to Scale Stage	
Cross-cutting Services	Tailored Services
Build a specialized senior management team	Coach COO, CFO and marketing team in developing and implementing scaling processes for the whole product/service
Develop a three-year multi-faceted strategic plan and identify key challenges	Provide targeted expertise to address the key challenges in a short period of time
Develop financial model	Provide skills in negotiating win-win partnerships
Leverage a platform of donors and co-Investors	Provide clear understanding of the industry and market in geographies targeted for expansion
Document all scaling processes	Help to identify an exit strategy at scaling
Support continued use of PMT	Mentor on calculated risk-taking

Source: NESsT.

Technology and business model validation

Hardware technology enterprises need to ensure that development of prototypes respond to the needs of the end users and customers. Enterprise teams need to rely on their empathetic relationships with these end users and customers to make product/service iterations and informed business decisions so that the technology and the business models can be commercially validated.

An important part of the process is the transfer of the prototype to a final product with the necessary adaptations for the end user and his or her environment. To do this, the enterprise must incorporate an analysis of needs and problems at all stages—from applied research to prototype testing. Lean innovation

methodologies³ provide a set of tools to identify and take an in-depth look at issues. This information will serve as the basis for presenting R&D processes that result in a product that considers the logic, interests, motivations and needs of the end user, including cultural aspects. A hardware technology solution alone is not enough if it cannot be assimilated and appreciated by the end user.

Effectively supporting a technical validation process requires the incorporation of networks of technology consultants and experts in analysis, calibration and certification. These experts and services complement the already existing knowledge and expertise of the

Table 2: Hardware Technology Business Models that Improve the Quality of Life of Low Income Communities

Business Model	Description
Direct customer model	This is a business model where a technology is disseminated directly to a low-income community. Users of the technology are customers who pay for a technological product and/or service tailored to their needs and payment capacity.
Subsidy model	This is a model in which a higher-profit business line partially subsidizes another business line that disseminates technology in low-income communities. Technology users are consumers who use the technology at a subsidized price.
Supplier model	This is a business model that provides technology to small rural suppliers, enabling them to competitively enter the global value chain.
Technology transfer model	This business model creates a business line for technology outreach to low-income communities through a technology transfer process from inventor to enterprise.

Source: Authors.

³ A methodology that enables the entrepreneur to ensure that products, processes and business practices are developed in keeping with the users' problems and needs. Design Thinking, Lean Canvas and Javelin Board are examples of these methodologies.

enterprise team, and will help them to identify technical and legal industry standards and parameters early on.

Alongside the technology validation process with the user, the enterprise must test, refine and validate a sustainable business model. This requires defining who will pay for the use of this technology or the product or service that it provides, what will be paid, and how the payment will be structured. Table 2 (see below) shows different business models used by social enterprises to reach a stable cost-revenue structure and provide technological access to low-income consumers or suppliers. Consolidating these models can take several years in sales, as will be seen in the case studies.

Competencies and skills of the entrepreneur team

Hardware technology enterprises need teams that incorporate and balance scientific and/or technological knowledge with business management skills. This can be challenging for these enterprises since they are often created by an inventor or group of inventors who lack business acumen or by an entrepreneur or group of entrepreneurs who realizes the value that technology can bring to strengthen the business, but who needs to rely on the engineering or scientific expertise of someone else.

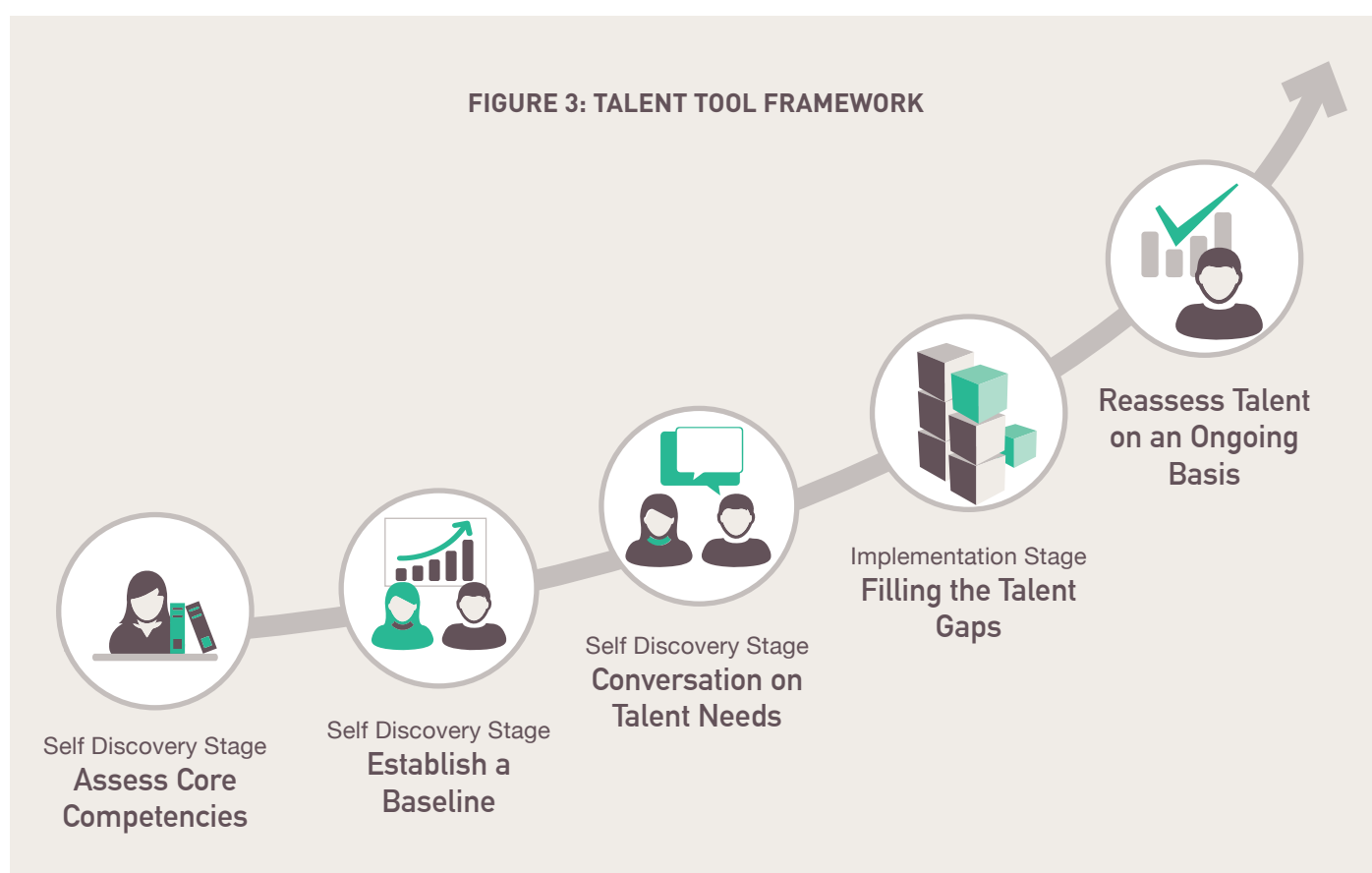
NESsT has developed a framework to help hardware technology enterprises build the appropriate teams and set of competencies needed to validate and grow their businesses. The framework responds to the three following inventor-entrepreneur models, each one requiring adaptations in order to have the right mix of talent to grow the enterprise:

- *Transformation:* The inventor becomes the entrepreneur, gaining the right set of skills needed to lead the entrepreneurial side of the business. The cost of trying to turn a person into an entrepreneur can be very high and rarely occurs. It is therefore important to find the entrepreneurial skills that the inventor holds, assess if the inventor has the capacity to develop them and to strengthen his or her capacity as an entrepreneur.
- *Transition:* The inventor or inventor-entrepreneur ensures that the enterprise has both technology and business talent. This involves having technology developers and enterprise managers on the same team. This is a necessary step if an inventor has not already considered people with business expertise on the founding team. The talents of the leadership team should complement each other, and it is likely that the inventor will need to transition the business side to a new leader and maintain the role of technology manager or chief technology officer.
- *Transfer:* This occurs when the inventor, due to a lack of business skills or due to his or her own personal desire not to get involved in the dissemination and commercialization of the technology, decides to transfer the intellectual property rights and/or commercial operation to a company with market expertise or an entrepreneur interested in managing the technology-based business. Depending on negotiations, the inventor may acquire an economic share in the company (i.e., payment of royalties or fees for ceding the technology) or may sign some type of service or work contract with the company.

NESST has developed a talent assessment and management tool to help the inventor or inventor-entrepreneur conduct a self-assessment of his or her skills, identify needed core competencies based on the enterprise stage (i.e. blueprint, validate, prepare to scale and scale), and produce a road map to follow by applying either the transforming, transitioning or transferring models.

Access to the appropriate type and level of financing

Financial investment required by enterprises also varies based on the enterprise development stage. In the blueprint stage, the first need is financing technological research and development. In most Latin American countries, there are different instruments for financing applied research and innovations to create a minimum viable product for the market. These funds primarily



Source: Authors.

⁴ Patient capital refers mostly to debt capital that has softer lending terms including lower interest rates and longer repayment periods. This type of capital gives the enterprise more time to achieve sustained growth until it is ready to take commercial financing. It is capital that financially backs enterprises during their consolidation process and is often comes from philanthropic sources.

come in the form of grants from the government and international cooperation sources. They often require a counterpart or match, and look for cooperation with universities or research centers. This financing enables enterprises to start their research and develop prototypes that may undergo iterations with users before and during the blueprint stage.

In the validate and prepare to scale stages, patient or philanthropic capital⁴ continues to be very important. In many cases, enterprises have not reached break-even and are not in a condition to take on debt, nor do they have clear exit strategies allowing them to offer equity. In these cases, donations and/or long-term, low-interest loans, whose repayment is tied to performance milestones, are very effective and valuable instruments for the development of these enterprises. Figure 4 (see page 17) shows the appropriate mixed instruments for the enterprise's growth stages.

NESsT considers different variables when determining the most appropriate type of financing for each enterprise:

- What is the life cycle stage of the business?
- How much due diligence and effort is required for each type of funding and to monitor the investment performance? Do we have the capacity to provide the needed effort?
- What do we expect in return for this type of funding? Financial, social or environmental impact? Co-branding?
- How long does the engagement with the enterprise last and what is the exit strategy? What is our overall strategy for staying involved with the enterprise?
- How much control and involvement with the enterprise is desirable from our perspective? How will we acquire it (i.e., board seat)?
- What is the use of the money? For what type of investment is the money required (i.e, working capital needs, fixed-asset expenditure, infrastructure investments, research & development, social costs, coverage of short-term losses, etc.)? Is the level of financing really necessary for each section of the investment plan?
- What are the sources of repayment? Sales revenue, cash flow, accounts receivable, future donations or secured funding contracts?
- What is the repayment risk (i.e. presence/absence of cash flow, presence/absence of collateral)?
- What are the growth and scalability prospects? What is the probability for the social enterprise to succeed?
- Are we able to provide the whole amount? Who are the most appropriate co-investors and how does NESsT's strategy match theirs?

FIGURE 4: MIXED INSTRUMENTS AND PATIENT CAPITAL FOR SOCIAL ENTERPRISES



Source: Adapted from *Enterprise Development Toolkit*, Global Alliance for Cookstoves, 2014, and *Social Enterprise in Emerging Market Countries: No Free Ride*, 2013.

Leveraging public and private networks

A fourth and key driver of success is the extent to which the entrepreneur is able to leverage networks and ecosystem actors to help him or her grow their business. In addition to entrepreneurial and financial support, entrepreneurs need to strengthen their ability to connect with other players that can provide them with access to resources and opportunities. These include alliances with (1) universities that can provide access to space, equipment, research; (2) service providers such as technicians, accountants and lawyers; (3) funding partners for prototypes, market research, certification processes, business development; and (4) business advisors that provide advice in strategy and industry expertise.

In creating these alliances and networks, entrepreneurs need to make sure that they are aligned with their social purposes and that they will truly bring value to their enterprises. They must carefully assess costs and benefits and ensure that the alliances are structured in way that benefits them in the long run. Part of the enterprise's strategic plan needs to include a road map for how these different actors and sources of support will be leveraged, as well as how they will be prioritized over time.

Hardware technology enterprise case studies

The following five cases studies illustrate the main pillars that constitute hardware technology enterprises. The cases also explore how these enterprises evolved, the challenges they faced in terms of technological and market validation, leadership and management, financing, and network and ecosystem support, as well as how they overcame or are overcoming these challenges. From these case studies, a series of best practices emerge that can be used in future models and programs.



Inka Moss

MODEL: SUPPLIER

HARDWARE TECHNOLOGIES: SOLAR DRIER FOR MOSS
AND PROCESSING PRESS

LOCATION: JUNÍN AND LIMA, PERU

Inka Moss collects, processes and exports sphagnum moss from the Peruvian Andean Highlands. Its technologies are a solar drier and a press machine designed specifically to optimize the drying and packaging process for moss collected by local communities. Sphagnum moss is a natural product in high demand by Asian orchid producers due to its water retention capacity and resistance to diseases. The technologies have helped the moss collectors to add value to the product and by so doing increase their income.

www.inkamoss.com →

Inka Moss

History of the enterprise

Inka Moss was founded in 2010. Its founder Marco Piñatelli is a commercial engineer with 18 years of experience in business, foreign trade and logistics. In 2008 he decided to start his own business and set out to find products in Peru with high potential in foreign markets. Marco proactively sought out new and interesting opportunities and participated in several trade fairs, including one organized by Sierra Exportadora Perú.⁵ Through this exploration, he met a businessman from New Zealand, who is considered the father of the international moss industry. This businessman grew interested in Peru after a holiday to Machu Picchu, where he discovered the existence of the moss. He made a second trip to Peru in 2009 to conduct research, and Marco joined him. They traveled to the Junín region to observe growth patterns and the use of moss by the high Andean communities. They learned that moss had been extracted previously by a company that eventually went bankrupt. During this trip they saw firsthand the local reality and realized the depths of the poverty and isolation that affected this region. Local inhabitants burned moss to clear the land for subsistence farming, an environmentally degrading practice that destroys the nutrients in the soil. Crops planted on burned land can be harvested for two to three years, but after that, the land lays barren and infertile.

The initial research paved the way for developing the sphagnum moss species and making land available for its harvest, as a means to help reverse the practice of destroying this resource and to begin using it to generate revenues for these communities.



Most residents in Andean communities work in farming and livestock. Residents can now earn additional income by collecting moss from December to April, as a complementary activity to their farming work.

The partners began to meet with community leaders⁶ to explain that burning the plants was no different than burning money and that they were wasting a valuable natural resource that grew freely around them. They began to work with the Peruvian government to show that there was an opportunity to halt the negative environmental impact of burning moss, while economically benefiting the communities. Later in New Zealand, they tested Peruvian moss and observed that although it was different, it had the potential to be accepted by foreign markets.

Inka Moss began to work directly with the community and government entities in 2009, while it continued conducting market research. It ran several on-site tests

⁵ SIERRA EXPORTADORA PERU is a public organization that promotes and develops quality exports to connect the Peruvian mountain region, or Sierra, to domestic and foreign markets. It promotes local enterprises and innovation in production processes to make the Andean region more competitive.

⁶ In Peru, rural communities are generally organized into assemblies whose leaders are elected for two-year periods. Support is channeled through these organizations from both the private and public sectors.

for drying moss. This was not an easy process. The community was two to three hours from the closest city, located 3,000 meters above sea level,⁷ with no telephone access, precarious infrastructure, roads that were not built to withstand the weight of trucks and extreme climatic conditions. After the results confirmed the quality of the moss and its conditions for drying, the partners set out to find funding for start-up capital. They had no formal business plan, though, and given the difficult logistical conditions that increased investment costs, the bank considered this a high-risk activity. Marco persevered because he was sure of the product's potential and the opportunity to contribute to the economic development of local communities. Later that year, he applied to TechnoServe's Business Plan Competition but was turned down. However, the competition required Inka Moss to develop an initial draft of a business plan, which helped organize its value proposition, identify the necessary resources and community involvement and evaluate the business costs and potential profitability.

The search for support was ongoing. In late 2009 it contacted InCapital, an angel capital network, who found the proposal very convincing and provided its first start-up capital. Inka Moss applied to the 2010 BiD Network competition, a network that strengthens technologically innovative businesses with high social impact. It was awarded first prize of €10,000 in the form of a donation. The award also gave Inka Moss the spotlight in a Dutch business platform alongside other enterprises from emerging market countries. Inka Moss finally launched

Social Impact

The experience and history of Inka Moss has shown the importance of being very familiar with the reality of the communities, which are fundamental parts of the business model. Following is the impact generated to date:

- More than 26 communities have been trained to become suppliers of Inka Moss, reaching 8,000 community members. The company's growth projections expect to reach 40 communities and 60,000 beneficiaries over the next five years.
- Each collector has increased his or her income by an average of 20%.
- The company provides the communities the technology to dry the moss at no cost.
- In addition to providing a fair price, the enterprise invests in the communities to improve basic infrastructure and services such as education, health and access to potable water. These investments are defined by the communities.

⁷ In New Zealand, moss is produced in flat meadows, so its collection conditions are very different than Peru.



Each moss collector who works with Inka Moss has increased his or her income by an average of 20%.

its business in 2010, thanks to external funds raised as well as Marco's own capital contribution. With this, it was able to start up and generate sales the very first year of operations, due in part to the high demand for the product overseas.

Inka Moss began selling five kilogram bags of the moss to orchid wholesalers in Asia, primarily in Japan and Taiwan, who resell it to local orchid growers. This market segment was particularly drawn to Inka Moss' very high-quality product, which surpassed Chilean moss and reached the high quality of New Zealand moss. Inka Moss planned to capture 2% of the wholesale market.

To meet this demand, Inka Moss began to work with the communities. At first, this was difficult, because there

was a high degree of mistrust due to their experience with other private companies who had made promises they didn't keep and who had not established any permanent, trust-based ties with the communities or generated any major benefits for local development. The average community in the area has between 30 and 250 families, living in varying degrees of poverty. Little by little, by spelling out and meeting the terms of the supplier relationship with the communities, Inka Moss began to gain their trust. The invitation to be a supplier for Inka Moss is open, and anyone interested can sign a direct agreement with the company. The land is community property and the concentration of moss and existing harvest conditions (i.e. accessibility, soil quality, among others) are assessed on a case-by-case basis. A community can easily collect between 500 and 600 kilograms of moss daily. Moss is harvested between April and December and is a complementary activity for locals who also work in other farming and livestock activities. In this process, Inka Moss has had to learn about community activities, lifestyles, priorities and other productive activities, so as not to affect traditional crops and avoid being invasive wherever possible.

The first step to community participation in the Inka Moss value chain is to generate a moss management plan, considering that there was no prior reference for this species. Inka Moss worked with the Ministry of Agriculture and adapted its forestry management plan to apply it to non-wood products. This plan defines the resource extraction plan per hectare and estimates a production volume. There is also a harvest sampling standard, which calculates the

approved ratio of harvested moss per square meter based on the existing biomass density. Harvesting moss in a sustainable manner requires managing the percentage of re-population areas and applying alternate crop rotation. Management plans are drawn up every five years and involve annual inspections and adjustments. Inka Moss conducts this work directly with the communities, who have learned about good resource management, care for the land, biomass measurement and the importance of repopulating the moss to maintain production levels. Through this, they have become conscience that these practices directly benefit their revenues and improve their quality of life, since they not only ensure the continuation of the growth of the moss, but they also protect against soil degradation and burning vegetation.

Along the way, Inka Moss received state funding for science and technology research from Innóvate Perú, the government agency responsible for supporting science and technology development (previously known as FINCyT), to work with two important universities. It worked with one university to analyze moss re-population and to develop a process to schedule its harvest. It worked with the other university to validate possible uses of moss based on its biological characteristics, as a means to market the product for additional uses. For Marco, it was really important to learn more about moss species, their qualities and ecological vulnerability for a number of reasons. On the one hand, it was important for the technology to safeguard moss quality, and on the other, the enterprise needed to ensure that moss extraction would be

Environmental Impact

In addition to the social impact, the following environmental impact has been generated by Inka Moss:

- Sustainable protection of a valuable natural resource, specifically sphagnum moss
- Halting soil degradation from burning land for subsistence farming
- Recovering burned land for replanting moss
- Valuation of the Andean landscape and its resources through land registries prepared as part of the moss management plan

carried out in a balanced way that would not harm the environment.

In 2014 the enterprise joined the NESsT social enterprise portfolio. With NESsT's advice and financial support, the company sought to improve the operations and productivity of the business to ultimately expand sales and capture a greater percent of the sphagnum moss market. Through the adoption of various hardware technologies, the enterprise was able to not only expand production but further improve the quality of its product to position itself to bypass the wholesale market and sell directly to orchid growers in Asia and the United States. Since late 2014 Inka Moss has been working to consolidate this market niche, which directly benefits



Sphagnum moss is an organic product in high demand by Asian orchid producers due to its water retention capacity and resistance to diseases. Inka Moss currently has a 2% global market share.

profitability and community revenues, and reduces the vulnerability risks that affect commodity markets.

In these six years, Inka Moss has developed an emerging industry with a natural resource that is in high demand in foreign markets. The company has set industry standards by placing value on the natural environment in the communities and on the work of its suppliers, ultimately creating an equitable value chain among all of its stakeholders.

Key aspects of the model

Technology and business model validation

One of the fundamental elements of Inka Moss's business model is sustainability of the supply of a

resource with high value in foreign markets. This has required two important efforts by the company. The first is working with the communities who own the land, training and supporting them in a sustainable collection process. The second is safeguarding moss harvesting through resource management plans.

Although the product is in high demand, it would be impossible to undertake an initiative like this without the support of the communities. The investment of time and resources for a stronger understanding, knowledge of and respect for the Andean communities has enabled Inka Moss to earn the trust of its suppliers. The company has worked transparently, sharing information on the resource itself, its ecological value, its properties, uses and commercial aspects, market prices, quality, format and available markets. Inka Moss is working with 26 communities, validating harvesting and drying techniques as well as managing logistical procedures that contribute to the success of the business. Communities receive 40% of the product's sale price, and they are guaranteed better prices that recognize the value of their work.

From an environmental perspective, the model adds value to a natural resource that grows in the wild and protects the ecosystem to prevent its degradation and ensure sustainability. This has led to the implementation of management plans, where the community participates actively and is open to adapting its traditional moss harvesting techniques and practices. The impact of these environmental

management plans for moss have not been limited to environmental aspects alone. They have also included social ones. The preparation of each plan requires the formalization of community groups that want to extract moss, a governance plan for the creation of community associations, sector plans including existing equipment and housing, a land registry of natural resources and activities that are held in the area. The plans also allow Inka Moss to access support for the communities from different public institutions. For example, it engages specialists in areas such as livestock production, development of other crops, treatment of meadowland, health issues, etc.

Another key element has been to improve the quality and production of the moss allowing Inka Moss to increase profitability and guarantee a good price and stable demand for the suppliers. Inka Moss was advised and supported by NESsT to install solar driers on site where the moss is harvested. This technology generated a substantial change in the quality and productivity of the moss for two reasons. First, the driers allow the moss to dry in optimal conditions preserving its hydrating properties. Second, the driers also reduce the weight of the moss, which makes it easier to transport than wet moss and significantly increases the production of the moss collectors. Additionally, this helps collectors avoid the physical risks involved in carrying heavy bags from the interior of the Andes to the center of town where the moss is purchased by Inka Moss. This hardware technology, adapted to local high Andean conditions, was quickly



Local workers are employed to process and package the moss for Inka Moss. The workers use solar driers, which has enabled an overall increase in production and made transport of the moss more efficient.

adopted by users, with immediate effects in increased production and quality.

These changes also allowed Inka Moss to increase and diversify its clients. Given the sharp drop in demand in 2013—brought about by an economic crisis in Asia—Inka Moss analyzed the risks of depending on the sale of a single commodity, which is vulnerable to fluctuations in the foreign market price. This analysis identified the need to develop a product that can be sold at a higher price but in a lower volume. With NESsT support, Inka Moss worked to design a moss processing press that allows it to develop an alternative to the five kilogram bags sold to wholesalers in Asia. The press allows for smaller packages of 150 grams



Marco Piñatelli, co-founder of Inka Moss, is a commercial engineer with 18 years of experience in business, foreign trade and logistics.

which only include the best moss fibers allowing Inka Moss to guarantee the highest quality moss and to sell directly to orchid growers in Asia and the United States. This new market niche has provided the enterprise with an opportunity to substantially increase its revenues and in turn, the price it pays to its suppliers.

Inka Moss currently has a 2% global market share, with a sales distribution of 40% to markets that buy it as a commodity and 60% to markets who buy the processed moss directly. It hopes to increase its overall global market share to 5% in the short term. The enterprise is ready to scale, and its founder is building on the product's versatility by exploring new applications such as use of the moss as a water filter.

This shows the importance of developing business models that continue to innovate, complementing products and creating new markets while continuing to ensure the timely delivery of a high quality product in the quantity demanded to existing customers. The enterprise continues its technological development but without neglecting its market base. It tries to keep its growth at prudent levels and takes only calculated risks.

Competencies and skills of the enterprise team

Inka Moss has a visionary leader, not daunted by challenges, with a low aversion to risk and strong commitment to carrying through what he sees as a strong business opportunity. Marco and his team understood and developed a proposal to position the enterprise and add value to a product for the international market, despite the limitations and challenges posed by the environment.

From the outset, its founder recognized the needs of the high Andean communities and was willing to dedicate the time and resources necessary to develop bonds of trust based on transparency and accountability. Marco had the foresight to identify people from the community to join the enterprise team, including Dionisio Jimenez, head of production, and Edinson Jimenez, head of supply management, which has enabled him to concentrate on the strategic aspects of the business. Having part of his team from the community not only contributes to creating stable jobs for them but also provides legitimacy with the moss collectors. The head

of production oversees a reliable collection process, and the collectors have become reliable suppliers who comply with company requirements. Inka Moss sees the community as key participants in the enterprise and vice versa.

As the company grows, Marco plans to expand his management team, both on the financial and production sides. He also relies on his board for strategic decision-making and fundraising.

Access to appropriate types and levels of financing

Inka Moss needed start-up capital to launch its model. It needed access to angel investors with low risk aversion who support innovative initiatives with the potential to develop a new industry for Peru. With this in mind, it found InCapital, who provided US\$150,000 as an equity investment. It also received a BiD Network award of €10,000, which provided a new platform for potential investors.

It has also received ongoing support from Innóvate Perú through three research projects that assessed ways to diversify the use of moss and increase its added value. It received an initial support of US\$80,000 in the 2010-2011 period for the creation of a management plan for sustainable extraction and derivative uses. Other uses it has looked into include: (1) water treatment in pools and spas; (2) heavy metal absorption for tailings; and (3) use of moss for release of bio-insecticides to fight tropical diseases. The same amount of funding was given again in the 2013-



To date, over 26 communities have been trained to become suppliers of Inka Moss reaching 8,000 people. The company expects to reach 40 communities and 60,000 beneficiaries over the next five years.

2014 period, to research the development of a moss propagation system and improvements in the way the moss is processed. The company currently has US\$85,000 in new funding to cover the R&D of a moss-based filter to improve domestic water quality among Andean communities.

The enterprise has also searched for other sources of long-term financing to support consolidation and scaling. Its incorporation into the NESsT portfolio in 2014 has enabled it to access direct funds in the amount of US\$77,000 as a low-interest loan to invest in improved technology, increasing business productivity and expanding its reach in new markets. Its new four-year expansion plan calls for annual investment amounts

of approximately US\$200,000 to expand its plant and equipment, as well as working capital. NESsT will again invest and has identified a group of interested co-investors.

In general, it is not easy to access soft investment funds for amounts between US\$100,000 and US\$300,000. This level of funding is hard to find, not only in Peru, but regionally in Latin America, as generally investors look to projects that need upward of US\$500,000. Therefore, being part of the NESsT portfolio meant an important benefit in terms of access to soft or patient capital at an important moment of growth for the company. In addition, NESsT has provided ongoing and timely mentoring to support different aspects of the business strategy leading to better decisions related to the growth of the company.

Leveraging public and private networks

Key to Inka Moss' development, has been its engagements with the community, the government, the private sector and universities. In all of these relationships, it has sought and established win-win alliances. The company has collaborated around its needs for technology, capital and know-how. In this sense, contacts with public sector networks such as Sierra Exportadora, a pioneer in the moss industry, were key to accessing know-how, potential customers and prospects for new business opportunities.

The enterprise has also learned how to identify networks for private and public financing, such as InCapital, Innóvate Perú and NESsT.

From an academic perspective, Inka Moss works in permanent collaboration with two universities. It works with Universidad Nacional del Centro del Perú, located in the Junín region, with whom it conducted a research project to develop a moss planting process and management plans. It also works with Universidad Peruana Cayetano Heredia, conducting a series of investigations to identify possible alternative uses for moss, leveraging its versatility and properties.

Main challenges of the model

- **Scaling the model:** This requires expanding the reach of Andean communities that can join as Inka Moss suppliers. The enterprise plans to replicate the model throughout Peru, which will mean a significant investment of time, efforts and resources, as it will need to build new trust-based relationships with new communities and ensure that it can systemize and standardize the production process in all of its facets.
- **Leveraging more funding for scaling:** This capital should consider a moderate risk level, as it expects to launch new products with high added value into the market, which will require new investment in innovation and development. In addition, growth means increased infrastructure, a bigger team and more operational expenses, which should be assessed in detail and covered effectively.
- **Consolidating a good team:** This team needs to be capable of representing the spirit and character of Inka Moss as it expands to new areas and grows its supplier base, while also continuing to deliver a high quality product to respond to a more sophisticated market.



YAQUA

MODEL: TECHNOLOGY TRANSFER

HARDWARE TECHNOLOGY: WATER FILTER TO ELIMINATE HEAVY METALS TO IMPROVE THE QUALITY OF WATER

LOCATION: LIMA, PERU

YAQUA sells bottled water and is developing a line of fruit snacks produced by low-income farmers for mass consumption. The enterprise donates 100% of its earnings to projects that solve water and sanitation problems in impoverished areas of Peru. YAQUA worked in conjunction with NESsT to identify a technology developed by inventor Manuel Chávez, which involves a filter that blocks the presence of heavy metals, including arsenic, in water for human consumption. YAQUA and the inventor have a technological transfer agreement that gives YAQUA permission to use the invention in the implementation of sanitation and potable water supply projects throughout the country, thereby reaching poor communities exposed to contaminated water.

www.yaqua.pe →

YAQUA

History of the enterprise

The idea to create YAQUA started in Australia, while one of its founders Fernando Tamayo was enrolled in a MBA program in 2008 and 2009. During this time, Fernando observed a significant inequity in the global use of potable water and became very sensitized to this reality. He had a profound desire to use his knowledge and experience to help close this potable water gap in poor communities. He read about the explosive growth in the consumption of bottled water around the world, but also saw the ongoing lack of access to water in his own country, which affects millions of Peruvians. What he observed was very contradictory. Between 2000 and 2010, the sale of bottled water rose from six million to 750 million. During the same period the number of people without access to potable water remained at eight million people. He decided it was time to do something to address the situation and founded YAQUA in June 2011.

Fernando was inspired by the Australian company Thankyou⁸ when developing YAQUA's business model. Thankyou invests 100% of its profits from the sale of food, water and body products in projects that solve food, water, health and sanitary deficiencies around the world. The model's success lies in identifying and commercializing products with high added value, building awareness around the "Thankyou" brand, covering operational costs and taking on market competition, all with a mission to end poverty.



YAQUA donates 100% of its earnings to projects that solve water and sanitation problems in impoverished areas of Peru. To date, the company has benefited 600 families.

When he returned to Peru in March 2011, he shared this with Daniel Franco, one of his closest childhood friends. There is a big problem with access to potable water in Peru, which affects an important percentage of the rural population. In these communities, women walk an average of three kilometers a day to collect untreated water, exposing them to a series of diseases due to the deficient sanitary conditions in which they live (i.e. cholera, diarrhea, fevers, typhoid, hepatitis and others). To combat this reality, Fernando proposed the idea to Daniel of launching a spring water bottling company in Peru, that would use its profits to supply water to rural communities. They called on a group of friends and put together the company's business plan.

⁸ For more details, see www.thankyou.co

For a year, Fernando and his friends worked intensely to start up YAQUA, while also holding down full-time jobs elsewhere. Even so, they didn't get the results they had hoped for, which was very frustrating for the team. As a result, Fernando decided to dedicate 100% of his time to YAQUA. He quit his job, sold his truck and gave up his apartment and went to live with his parents for a while. He realized that he needed to dedicate all of his time to YAQUA if he had any hope of turning this major challenge into a successful business launch. The big question was how to bottle the water. Was it better to build their own plant or should they outsource it to an external plant? If the team decided to invest in a plant, they would have to leverage US\$50,000 and each bottle of water would sell at a high unit cost, which was not the competitive business model they were hoping for. The alternative was to outsource the production to a competitor that was already positioned in the global market alongside major brands such as Coca-Cola and Pepsi.

The team decided to talk to the competition Ajegroup Enterprises,⁹ who were owners of the renowned Peruvian water bottle brand Cielo. The proposal YAQUA presented was to enter as an enterprise that would partner with Cielo to sell water to a niche market segment. This meant it wouldn't compete in Cielo's mass market segment, but in another market segment, with other major players like Coca-Cola and San Marcos. The competition accepted. YAQUA would bottle the water in Ajegroup's plant, with a

Social Impact

The YAQUA model has proven its short-term effectiveness in meeting urgent needs such as access to potable water in communities that are excluded from government programs. Company profits have benefited the following areas:

- Improving the quality of life of urban and rural communities that currently have no access to water through projects that invest in equipment for improving water quality through the installation of filters, or rather, installation of a complete water access system (i.e. reservoir, distribution and connection to fittings). Soon this will be supplemented with YAQUA's new water filter. To date the company has provided 600 families with access to potable water through its social investments and plans to reach 20,00 by 2020.
- Empowering organic fruit producers to sell value-added products, with higher prices resulting in more dignified income for these low-income farmers. YAQUA has identified six fruit producer cooperatives in the Junín region, representing more than 650 small fruit farmers in the region, that will form part of the second product line scheduled to be launched soon. The goal is to reach 1,250 small fruit farmers by 2020.

⁹ Ajegroup (AJE) is a Peruvian multinational corporation with a presence in 23 countries in Latin America, Asia and Africa. It is the tenth largest company in the world in terms of beverage sales. Its emblematic brand is BIG, which is very well positioned abroad.

¹⁰ The Cielo brand 625ml water bottle sells for Soles/1, whereas the YAQUA brand price is Soles/1.5 to differentiate the market segment and not compete with Cielo, but rather with the competition.



In August 2013, YAQUA labeled its first bottle of water with its own brand. YAQUA targets a market segment that values its high quality standards, allowing it to charge a premium for its bottled water.

different market segment focus, selling the bottles at a price 50% higher than the Cielo brand.¹⁰ It would enter a market with high quality standards (i.e. ISO 9001; ISO 14001; OHS 18801; pH balanced, high energy efficiency and environmental management for returning water to its source). Its profits would generate profound changes for millions of Peruvians that suffer from the lack of water for human consumption. In August 2013 the enterprise labeled its first bottle with its own brand. YAQUA water was ready for sale.

The next challenge was to get the word out about the product and the new brand. Its advertising budget was only US\$10,000, and its advisors estimated that a campaign at the level they wanted would cost US\$300,000. The company worked hard to find more

affordable marketing options and obtained its first sales channel with PECSA Perú, one of the major Peruvian fuel companies. In the first month, it sold 1,500 bottles, and in the following months, sales increased to between 2,000 and 3,000 bottles. However, this was still well below the sales level it needed. It was operating at a net loss, a very delicate situation considering it had no financial cushion to fall back on. It was right during this critical juncture that CNN Español reached out to YAQUA to do a report on its unique social enterprise profile. CNN did the report and gave the company three minutes of regional television coverage, which was unheard of for a social enterprise. The report had such a big impact that YAQUA started hearing from major players in the business field and retail companies, including Gaston Acurio, a renowned chef and promoter of Peruvian gastronomy, who decided to incorporate YAQUA into all of his restaurants. This was soon followed by Repsol¹¹ through its Corporate Social Responsibility program, as well as several supermarket chains. From its initial 3,000 to 4,000 bottles per month, it grew to 300,000 to 400,000 bottles per month in sales, an unexpected jump given the size of the company.

YAQUA generated US\$15,000 in profits in 2015 and used it to invest in its first two water projects in rural communities. The first involved installing water filters in Iquitos in northern Peru. The second project was in Huancavelica in southern Peru, where it invested in water reservoirs, distribution and connections for easy access. More than 600 families benefited from these two projects, immediately improving their access to potable water and sanitary conditions. The team

¹¹ Repsol, a company with global presence, dedicated to the extraction and production of petroleum and generation of energy.

is clear that this is only the beginning and that there are still millions of Peruvians it wants to reach. It has defined a vision and goals to continue this growth.

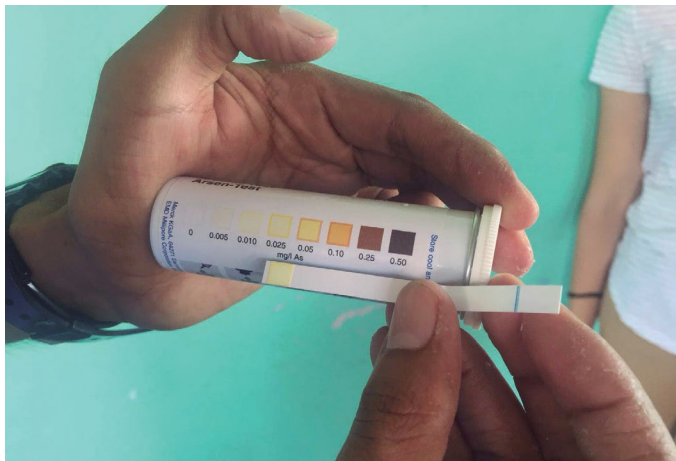
YAQUA has received several awards along the way recognizing it as an innovative social enterprise: (1) CITI Award for Microenterprise PREMIEC 2014; (2) Finalist, Saïd Global Entrepreneur Challenge, University of Oxford, 2012; (3) First Place, 4th Competition of Social Enterprises, Universidad del Pacífico, 2012; (4) CEMEX TEC 2015 Award; (5) Start Up Perú 2015 Award; and (6) IDEHPUCP 2015 Award. Noteworthy was the 2015 Enterprise Creativity Award, awarded for the first time to a Peruvian social enterprise.

In 2015, NESsT invited YAQUA to join its portfolio. The first focus of attention was to support the company to find a technology that could solve the problem of water contamination due to heavy metals from mining activity and water's natural composition which can sometimes include arsenic. This problem affects the country as a whole and is even more acute among vulnerable communities that lack access to potable water. The initial technology that YAQUA provided through its water projects did not address the problem of heavy metals, and the company realized it needed to find alternatives to provide high-quality uncontaminated water. NESsT assisted YAQUA in contacting Manuel Chavez, a Peruvian inventor who was developing a broad spectrum water filter to filter out heavy metals that are toxic to humans.

Environmental Impact

In addition to the company's social impact, it also has had the following environmental impact:

- YAQUA has three international certifications (ISO 9001, ISO 14001 and OHSAS 18001), which guarantee compliance with appropriate environmental and labor management. In addition, its production considers the following best practices: (1) water management using water treatment plants that allow water to return to its natural environment, safeguarding the future availability of water; and (2) energy management, which has reduced 10% of electricity consumption through an energy savings and efficiency plan for water production and bottling.
- Reclaim water that has been contaminated by the presence of heavy metals. YAQUA has proven the effectiveness and safe results of the filter, and in a short amount of time is changing a situation that has been going on for years.
- YAQUA is also aware of the need to reduce the use of plastic and is introducing glass bottles for its bottled water. It is working on implementing recycling campaigns to create awareness of the importance of recycling, not only on an end-user level, but also to establish and share a plan for eliminating plastic bottles across the industry.



To increase its social impact in rural Peruvian communities, YAQUA acquired a new water filter technology from a local inventor that it plans incorporate into new potable water and sanitation solutions.

Manuel had come up with the idea to create a heavy metal decontamination system for drinking water after visiting communities and detecting that the local water was contaminated. While getting his masters degree in chemistry in 2013-2014, he ran several tests with materials to analyze their absorption capacity to address this problem effectively. He began to develop materials to separate heavy metals from drinking water. Manuel was able to develop a water purification system that eliminates chemical pollutants in water, such as heavy metals and organic pollutants and pesticides. The system filters particles and absorbs chemical pollutants with plant-based filter materials, whose physiochemical properties trap the pollutants in the filters, cleaning the water and leaving it 100% safe for human consumption.

The filter was still at the laboratory stage at that time and Manuel couldn't imagine how his technology could be adopted to benefit society. With NESsT support, he was able to conduct field validation for his invention and apply it in one of YAQUA's communities of influence in Huacho to observe the capacity of the filter to absorb pollutants in the community's water supply. This filter improves the quality of water for human consumption to levels not normally provided by other filters.¹² It also reduces the cost of supplying water to communities, as the only cost is the manufacturing cost, which is significantly lower than the cost of filters previously imported by YAQUA.

After making the initial introduction, NESsT also led and advised on the technology transfer process including the development of a mutual agreement to transfer rights and ownership from the inventor to YAQUA, thereby making a valuable invention available for mass use and benefit. The technology transfer agreement represents the first time that an inventor has transferred his patent to a social enterprise in Peru. It is an extremely important milestone in the Peruvian enterprise ecosystem.

YAQUA has identified a group of 4,000 families in different urban and rural communities who lack access to potable water and could benefit from the use of the water filter. Due to their size, these "invisible communities" do not benefit from government programs. YAQUA plans to install the water filter at no cost for these families. In the future, it will explore

¹² Details of the Invention Patent: Inventor, Manuel Chávez Ruiz, Title "Purification system for natural water contaminated with heavy metals and organic compounds for human consumption" with file N° 000483-2016/DIN in Indecopi.

¹³ The transfer agreement with the inventor does not permit the sale of the technology. The cost of the technology transfer with the possibility of sale was very expensive, so the agreement for the time being only allows YAQUA to donate the technology to the communities. The communities provide the labor and conditions needed to install and maintain the technology in the long term. In the future, after making the first improvement or change in the technology, YAQUA will be able to sell to paying customers.

developing a business model to sell the filter to paying clients.¹³

As YAQUA's business model matured, it identified the possibility of a second business line that would leverage the supply chain already in place for its bottled water business. The enterprise decided to launch a healthy fruit snack line made with organic fruit produced by local farmers. NESsT is supporting the launch of this new product line with a focus on retail customers. The business will use YAQUA's already existing points of sale, which will facilitate the market entry of this new product line. This new business model also looks to finance water accessibility projects with its profits while generating sustainable revenues for the farmers.

Key aspects of the model

Technology and business model validation

YAQUA's business approach aims to achieve two main goals: (1) create awareness on water conservation and (2) provide clean potable water to urban and rural communities. One of the company's key success factors is its clarity of vision and strategy development. YAQUA's founder was committed to addressing the harsh reality that excludes millions of Peruvians from potable water consumption. The company knew that it was entering a highly competitive industry, which required involving major players.



YAQUA has identified a group of 4,000 families in different urban and rural communities who lack access to potable water and could benefit from the company's social investments.

YAQUA was able to form alliances with the largest competitors in Peru, but with clearly differentiated market segments and at a price that set it apart. Cielo has 50% of the mass consumption bottled water market in Peru. Its price per 600 milliliter bottle is Soles/1 (US\$0.30), and it competes in price with the other big names. YAQUA has efficiently managed costs, and the current price per 625 milliliter bottle is Soles/1.50 (US\$0.50), competing as a premium brand. Its minimum sales level is 300,000 units. It also has other bottle formats and minimum monthly sales estimates for each: 60,000 units/month for 1 liter bottles; 20,000 units/month for 2.5 liter bottles; and 5,000 units/month for case of 20 liters.

Another success factor has been the development of sales channels to reach a mass market that pays the YAQUA price and understands its differentiation. The impact generated by CNN Español with its regional report was a springboard for YAQUA to quickly connect to important retail companies, supermarkets, prestigious restaurant chains and major corporations, while also generating a mass youth movement through its presence at universities and in social networks. Currently YAQUA has 1,500 points of sale and has signed the only exclusive contracts with pharmacy chains, demonstrating the strength of its brand and its important market validation.

To achieve its goal to provide quality potable water to urban and rural communities, the incorporation of a water filter with a high metal elimination capacity, through a technology transfer agreement, provides a far-reaching and effective solution at a low cost. A key milestone was a meeting between the inventor and YAQUA to identify ways to reach the end user. In other words, the inventor was interested in finding a partner to implement his technology in the community allowing him to stay focused on research and development, while YAQUA was interested in a technology that improves the quality of water for the communities it supports. These factors were key in defining a win-win agreement.

Both parties were unfamiliar with the technology transfer process, and this is where NESsT stepped in, initially to connect them and then to support and invest in the

field validation of the prototype, advise and financially support the transfer of the patent, and mediate the negotiation between the inventor and the company. The legal advice the parties received served to define the legal process and to negotiate the transfer conditions, which are always sensitive and complex.

The technology transfer is a valuable opportunity for YAQUA to further its vision. As sales continue to grow with both of its business lines, the company will increase its investment in new potable water and sanitation projects that distribute the filter. From Manuel's perspective, the invention of the water decontamination filter has a competitive advantage due to the lack of other locally available technology. Another advantage is that the system uses natural supplies for treating and cleaning water contaminated with heavy metals, which means that even communities with no power source can access healthy water.

YAQUA's strategy involved the development of attractive branding and messaging that appeals to its customers and links it directly to helping others: "You help while you quench your thirst." This has supported its rapid market expansion. The company has a solid knowledge of the interests and motivations of YAQUA's end users (i.e., people who are willing to pay more to obtain a higher quality product while also helping to solve the health care and social needs of poor communities in Peru).

Another key aspect of the model has been management and adequate maintenance of the cost/revenue structure. This is a sensitive aspect, as the company policy is to donate 100% of profits to social projects, which has implied operating at break-even point. For this, some costs have been kept very low, including staff salaries that have consistently been below-market rates. The company hopes to be able to change this situation as it scales and consolidates its model, and expands its operations to a new product line. This consolidation will eventually support an increase in salaries that will help retain and recruit talent, both key to the scaling process.

As the business model matures, the development of a second business line shows that YAQUA continues to innovate and create impact through product diversification, enabling it to reach a new group of beneficiaries in its target communities. The opportunity to make the most of the business chain already in place, with its multiple points of sale, and to expand its social impact as a company, demonstrates YAQUA's scaling capacity.

A final factor has been the strategy to invest profits in projects to improve the quality and access to potable water. YAQUA's strategy is to reach agreements with social organizations that are doing work—or want to—with invisible communities (i.e., communities with less than 1,000 homes which fall outside the scope of government programs). Organizations apply with their projects, and YAQUA selects them based on a set of criteria for evaluating and prioritizing the investment. The





Everyone who joins YAQUA shares a common philosophy: they start out with no salary and need to raise funding to support themselves, thereby contributing to YAQUA's sustainability.

amount of investment in each project varies and depends on the size of the community, the type of need, logistical aspects and management capacity of the organization. In addition to financing, the company provides mentoring, supervision and dissemination of initiatives in social media. All application requirements can be found on its website.

Competencies and skills of the enterprise team

The YAQUA team is made up of four professionals with business, management and marketing backgrounds, who are fully dedicated to the company. The team has organized itself into different areas of responsibility. Fernando, the founder and CEO, is an economist. He

has significant experience with high impact enterprises, studies in transformational leadership, organizational advising and enterprise mentoring. María Elena Ballón, co-founder, has a degree in marketing and business administration, and is responsible for commercial analysis and management. She has ample experience in planning and analysis in retail companies, consulting in diverse industries. Robert Salazar is responsible for marketing and advertising. He has prior experience in branding campaigns for transnational companies. Finally, Camila Chipoco, director of strategy, has studies in business administration. She leads the social projects in Lima and the provinces and is responsible for logistics and project implementation.

Everyone who joins YAQUA shares a common philosophy: they start out with no salary and need to raise funding to support themselves, thereby contributing to YAQUA's sustainability. They have professional profiles and strong social commitment. They are responsible, serious and familiar with business tools. They are sensitive and realistic in terms of trying to change the reality of Peru. The team has shown a true social commitment through the projects the enterprise has implemented and, as a result, is credible with potential donors, partners and the community.

Its founder's leadership helped to establish a clear definition of the company's goals and objectives and the need for a solid team to work together on defining a strategy. One of the complicated elements was the

certification process required to produce the water with Ajegroup. As part of its contract with Ajegroup, YAQUA went through a certification process that confirmed its commitment to developing a high quality product that met necessary requirements including compliance with environmental certification. The strong cohesiveness of the team helped them to overcome the challenges of this process, and YAQUA succeeded in obtaining the certification. It also went through a similar process to register its brand with the government.

Access to appropriate types and levels of financing

YAQUA was able to start up its business model thanks to a combination of resources, including a significant contribution of personal savings from the founding team as well as other sources of funding to complete the initial capital necessary to develop the brand, complete the certification process, develop the sales chain and sustain operating expenses. Complementary sources included a contribution from an individual who invested US\$30,000 in start-up capital. The company later received the StartUp Peru award for US\$50,000, which was significant both in terms of the actual resources and in terms of the network of contacts and promotion platform it offered.

While undergoing the NESsT due diligence process, YAQUA received an initial donation of US\$8,000 to validate the filter technology. Once it entered the portfolio, NESsT gave a second investment of US\$55,000 to cover the cost of the technology transfer and to train the fruit farmers on best practices and

quality control. NESsT is also planning to support YAQUA through its credit line with Kiva. The goal is to raise a soft loan to be used to complete the implementation of the new healthy fruit snack production facility and to strengthen operations including working capital, administrative, labor and commercial expenses. The loan would be given for a three-year period, with 4% annual interest rate and a two-year grace period.

Leveraging public and private networks

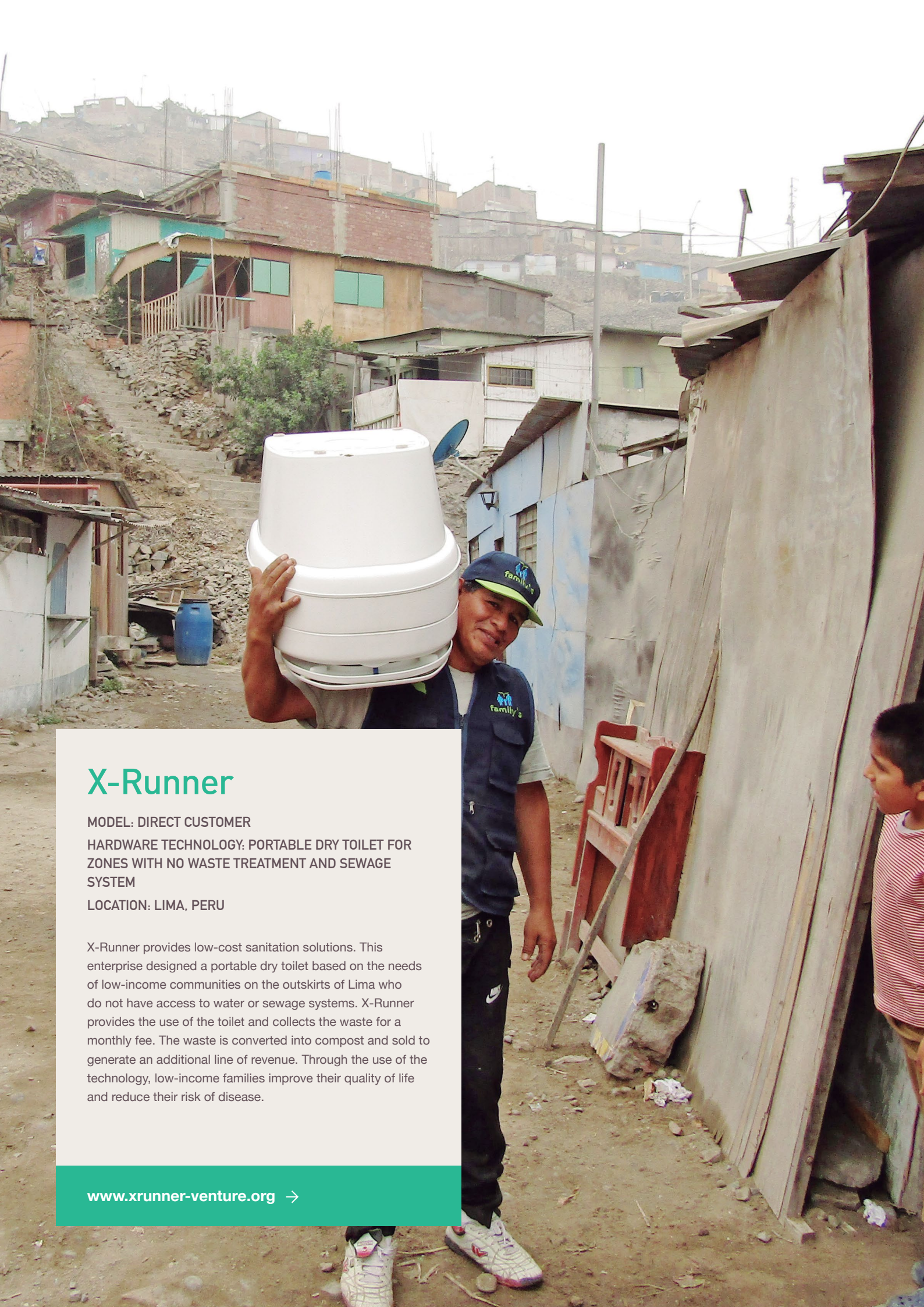
The strong motivation of its founder to resolve the tremendous need for water in rural communities in Peru, led him to be very proactive in the search for and development of networks and contacts to help address the different aspects of the business. He contacted important business groups in Peru and negotiated with already positioned brands and retail shops to sell its bottled water. The company reached out to several universities in Lima to research solutions for the logistics and production of the product.

NESsT has also provided YAQUA with access to a new network of national and international contacts based in the United States, which will hopefully lead to new partnerships and funding opportunities.

In terms of visibility and recognition, YAQUA's participation in national and international competitions and presentations has been invaluable. This has given it an important window to display a unique social enterprise in the country.

Main challenges of the model

- **Entering a highly-competitive industry:** The bottled water industry is run by well-positioned international companies with long-standing track records in the market. Efforts to maintain a competitive price to meet growing demand have been important and have also required significant personal cost for the YAQUA team. Their willingness to do this speaks to their confidence in the model and commitment to make significant change for millions of Peruvians.
- **Successfully organizing and consolidating its distribution channels:** To date, YAQUA has secured more than 1,500 points of sale throughout the country, of which a large portion of the revenues come from Lima. It distributes to 300 warehouses and has placed its product in retail and high-visibility outlets, such as Mifarma, Wong supermarket chains, Repsol service stations and hotels and restaurants, including all of Gastón Acurio's restaurants in Peru. These distribution channels can easily incorporate the new healthy snack line, considering that the points of sale for healthy snacks are the same as those for bottled water (i.e. supermarkets, coffee shops, restaurants, pharmacies, gas stations, etc.).
- **Acquiring valuable technology:** The inventor of the filter was looking for an opportunity that would allow him to apply and make his technology accessible to many users. Through his contact with NESsT and YAQUA, he saw the business model they were implementing, and decided that it fit perfectly with these goals.
- **Obtaining funding to sustain operating costs:** This is especially important to retain the talent of a professional team who had personally assumed the costs associated with allocating all profits to social ends and who hope to continue its growth. Access to different types of soft funding will be fundamental in consolidating the company and preparing to scale.



X-Runner

MODEL: DIRECT CUSTOMER

HARDWARE TECHNOLOGY: PORTABLE DRY TOILET FOR ZONES WITH NO WASTE TREATMENT AND SEWAGE SYSTEM

LOCATION: LIMA, PERU

X-Runner provides low-cost sanitation solutions. This enterprise designed a portable dry toilet based on the needs of low-income communities on the outskirts of Lima who do not have access to water or sewage systems. X-Runner provides the use of the toilet and collects the waste for a monthly fee. The waste is converted into compost and sold to generate an additional line of revenue. Through the use of the technology, low-income families improve their quality of life and reduce their risk of disease.

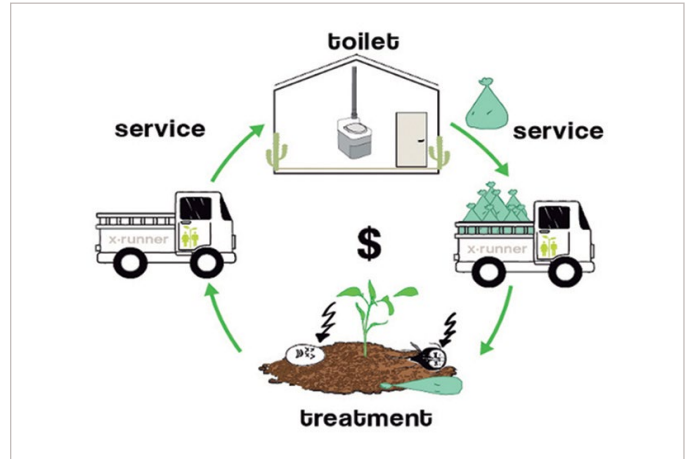
www.xrunner-venture.org →

X-Runner

History of the enterprise

X-Runner was incorporated as a Peruvian enterprise in 2013. Its origins date back to a meeting in Berlin in 2010 between Jessica Altenburger, who was working on the design and development of dry toilets, and Noa Lerner, who was working on her thesis to assess the potential use of human waste as an organic product. Both were interested in working with communities in developing countries. It is estimated that more than one billion people in the world live in communities with no access to sanitation systems and are immersed in very unsanitary conditions and prone to a variety of diseases. Together Jessie and Noa designed a sustainable sanitation model for India, which involved a waterless toilet and a full-circle ecological system.

Isabel Medem, a Peruvian-German with an academic background in business administration, was very proactive and interested in the development and challenges associated with the alleviation of poverty in developing countries. In 2010 she was working in Tanzania and Madagascar, using microfinance as a tool to generate significant changes in the impoverished realities of poor rural communities. After a year of hard work, she saw that the results were ineffective and decided to resign from her job, very disillusioned by the model. She moved to Berlin, and through some friends of her parents, she met Jessie. Isabel was drawn to Jessie's interest in resolving waste treatment for poor communities through the use of a dry toilet. Through her experience in the business world, she saw this as an interesting opportunity that would allow her to branch out on her own. It was something different, uncommon, and she was drawn to the idea of trying and seeing what



X-Runner provides sanitation solutions for low-income communities who do not have access to water or sewage systems. X-Runner provides the use of a dry toilet and collects the waste for a monthly fee.

would happen. As she said “I gave myself the luxury to try!”

X-Runner was launched in Berlin in 2011, and Isabel joined the founding team as the finance manager. Their vision was to apply their technology and business know-how to solve sanitation problems of the poor in a sustainable manner. During that time, company's efforts were focused on introducing the technology in India. Soon the team realized that it wasn't working due to major cultural barriers that prevented the market validation of the dry toilet. Interest among the partners began to wane and they began to feel uncertain about working in India. They made the decision not to continue in India and to identify another market to test. Other options considered were in Africa or other Asian countries.

During this process, Isabel thought of Peru, her own country of origin. The poverty index and lack of infrastructure and sanitation met the criteria that they were considering in their market assessment. In January 2012 she traveled to Peru for three weeks to conduct research on the reality of the country, gather information and carry out site visits to confirm and directly observe the conditions in very poor communities in Lima. She saw firsthand the reality of different communities on the outskirts of Lima, such as Villa el Salvador and San Juan de Miraflores. She conducted a survey on the possible use of a new sanitary solution and received a positive response from the 70 families interviewed.

The team approved Peru as its next market, and Isabel and Jessie moved to Peru to set up headquarters in Lima, while Noa stayed in Berlin to develop other projects, She left the enterprise shortly after. In March 2012 X-Runner opened its doors and hired three people: two industrial designers to create toilets to be manufactured in Lima, and one agricultural engineer to define the human waste collection and recycling system for composting, final sale and user management.

The X-Runner toilets, under the brand name Family's, are known as urine-diverting dry toilets. They do not require water for their use. The seat contains a blocking component that keeps harmful gases out and diverts the urine away from the feces, directly towards the soil or into a plastic reusable bottle. Feces accumulate in an extractable receptacle placed below the seat. After each use, users throw in a handful of sawdust to cover the content, absorb gases, prevent odors and keep insects away. To date, X-Runner has designed and

Social Impact

X-Runner currently benefits close to 750 Peruvian families who live in poor urban areas. The company is creating a healthier and more hygienic daily life for its customers. By the end of 2018, the company plans to:

- Reach 15,000 homes
- Improve the daily lives of 75,000 people
- Reduce the propagation of deadly diseases

The toilets are aesthetically pleasing and customers feel proud to have them in their homes. In addition, families that use X-Runner's products and services save a great deal of money in comparison to other sanitation and hygiene options available. The company is showing the world that it is possible to provide user-based affordable sanitation services to vulnerable communities in developing and emerging market countries.

manufactured four different versions of the toilets, each with improvements to size, weight and use. It currently uses a toilet with several key improvements, such as a mechanism that releases sawdust automatically after each use.

The initial work was intense. Once the team was established, it ran pilot tests on toilet prototypes in a community. It manufactured and installed 10 toilets, a major start-up milestone for the company. This pilot provided an abundance of valuable information to the team, which allowed it to refine its technological model

and receive comments directly from the user in terms of satisfaction level and needed improvements to the toilet or to the waste recycling system. During this period, follow-up and monitoring work was intensive, with weekly visits to the community to gather information on the system in operation. The pilot ran between May and September 2012, and five of these 10 initial pilots are still in use.

One of the lessons learned from the pilot was that it was more efficient to stop manufacturing the equipment in Lima and start importing X-Runner-designed toilets directly from Germany. Manufacturing the toilets in Lima cost 50% more than importing them. There were problems with equipment quality in comparison to production from European companies, who have the technological know-how and have been making them for decades. It also required a major investment in time and resources because the work was small-scale and needed to be supervised, and there were problems with delivery compliance.

X-Runner's founders leveraged resources from Austrian investors to finance the production of the equipment for the pilot project in Lima, buy biodegradable materials and supplies for the operation and recycling system, cover salaries and rent land for composting. This required a US\$80,000 investment. The next step was to develop a more detailed business model for the social enterprise and put together a financing plan to make the model sustainable. During this process, Isabel heard about NESsT, and X-Runner joined the portfolio in 2013. NESsT gave funding to import toilets from Germany to validate the prototype on site and to develop the operating plan.

Another issue was waste management. In Germany, this was already consolidated as a virtuous cycle of technology-community-recycling, but the situation in Peru was quite different. Domestic waste recycling systems are not very developed in Peru, nor is the treatment of human feces to generate compost useful for agriculture. X-Runner is currently composting the waste but has not yet completed the validation process required to sell it to third parties.

With NESsT support, the company received mentoring on different business aspects, such as the legal aspects associated with formalizing the enterprise and the operations plant, human resources, cost analysis, sales plan and strategy for reaching the enterprise's social goals.

X-Runner has now been in operation for three years, and has grown to serve more than 750 families. The impact is direct and immediate, and the company has earned the trust and credibility of the communities that have embraced this new technology. Its primary focus is on the well-being of the user. X-Runner's vision is to reach 60% of the population without access to water and sanitation in Lima.

Key aspects of the model

Technology and business model validation

X-Runner recognized a reality that affects thousands of people in developing countries and proposed addressing it specifically in urban low income communities in Lima using a business strategy. Residents in these communities were so accustomed to using latrines that it was a natural way of life for them.

In order to validate the product in a market that was unaware of the existence of this type of sanitation system, X-Runner worked hard to establish a good relationship with potential users and to be sensitive to their needs and motivations. With this approach, the enterprise was able to interact with users, whose feedback helped the company to adapt the use and installation of the dry toilets in the communities. Between May and September 2012 the company focused its efforts on piloting the adoption process and was able to measure results through surveys and interviews, revealing a high satisfaction level. The following results were obtained:

- Most customers reported that use of the X-Runner toilet had a positive impact on their lives.
- Many family members who didn't initially want to try the toilet changed their minds after seeing the pilot plan in action.
- Reported cases of diarrhea from customers dropped from 53% before the pilot to 9% afterwards.
- There was a clear reduction of insects around the toilets.
- Customers appreciated the lack of odors with the application of the new toilets.
- Customers preferred the dry toilet to latrines.
- What customers most appreciated about the toilets are that they are hygienic, comfortable and simple, and as dry toilets, they eliminate the need for water.
- Overall, 93% of customers decided to keep the toilets after the pilot was over.

Environmental Impact

X-Runner toilets are installed 100% above-ground and do not contribute to weakening or destabilizing land, as is the case with digging holes for latrines. By 2018, the company plans to:

- Prevent 516 tons of feces a month from contaminating groundwater
- Produce 172 tons of high-quality compost monthly
- Save 10 million liters of water per year due to recycling of water in the operations center

In fact, these are even benefits for those who do not have these toilets, thanks to a cleaner and healthier environment that they generate for their neighbors.

A second key factor was how X-Runner addressed the main sanitation barriers faced by urban residents in Lima. It focused on the user's well-being, both in terms of hygiene and an affective-emotional component related to the social discrimination that these vulnerable groups encounter. Houses and neighborhoods with contaminated land and water carry a social stigma, and families feel uncomfortable having guests over to their houses when they lack adequate sanitary facilities. The message of its Family's brand — "The bathroom that improves your home" — reflects the importance of caring for family and that X-Runner, as a company, is here to support this by helping to solve its customers' sanitary problems. The value that users assign to the technology

translates into their willingness to pay for the service provided by the company and thereby ensuring their families' well-being, putting an end to a very wearisome and unhealthy condition that plagues their communities. Traditional water-based toilets are expensive and useless in areas with no sewage and potable water system. Likewise, pit latrines are also expensive and hard to empty and clean. To establish prices, the company developed an aspirational value proposal for the service, as explained by the founder: "For families in the D sector of Lima who need/want a hygienic solution for their home, Family's is a home sanitation brand that provides a complete modern solution, because it offers a comfortable, safe and hygienic product and service at an affordable price."

Another key aspect of the business model was determining the right price for the product. From the beginning X-Runner had decided that the price of the toilets would be too high for the families. As a result, it decided that the best model was not to sell the actual toilets, but rather to sell the service of waste collection. This meant that families would pay to have a toilet installed in their homes and to have the company collect the waste on a regular basis.

Once this was decided, it was very important to set a price that would reflect the value the user places on the technology so that they would become loyal customers. Through the process of market validation and input from users, the company defined two price plans which considered two elements. The first element relates to a family's variable costs, which include transportation

costs, materials for collection, cleaning and composting and labor costs. The second consideration is the prices that families are willing to pay for monthly services such as electricity, cable, Internet and telephone. Currently, each home that hires the Family's service can choose between two plans: (1) a standard plan for US\$14 a month for families that use up to two buckets a week or (2) a gold plan for US\$17 a month for families that use more than two buckets per week.

The company has worked hard to increase sales. However, investment and operational costs continue to be high relative to what the product's end users are able to pay. In this sense, X-Runner proposes maintaining a subsidized model whereby part of the costs of the production and sales is subsidized through another business line or through a third party. The company is currently developing a sustainable financial strategy that will allow it to retain the families who are currently paying for the service while continuing to grow its customer base. Considering the magnitude of the social problem it is addressing, X-Runner believes a market driven strategy that includes a subsidy component is probably its best option.

A fourth consideration in developing the business was the need to study and analyze the legal requirements to design and set up its operations facility. This has not been any easy process. The Peruvian environmental regulatory system is complex and is still not well managed. There are many loopholes and non-standardized requirements, particularly for a non-traditional sanitation company such as X-Runner. It

has taken the enterprise four years working with the government to understand and comply with regulations. X-Runner has finally been qualified as a sanitation service provider and can now take the needed next steps to be in full compliance and be eligible to obtain the permit for its facility.

Apart from this, the company has also undergone a process to validate the compost made from the waste. Since the compost comes from human feces, this has entailed analyzing the presence of pathogens by accredited laboratories. Once this process is finalized, X-Runner will be able to sell the compost.

Competencies and skills of the enterprise team

Having a founding team with technology design and business skills has been key to the successful development of X-Runner. The team has been flexible in addressing the different challenges that emerged during the process of product and business model validation. It has maintained the business objectives of the enterprise while safeguarding the quality of the product.

After four years, the team has expanded and become more specialized. It now includes seven professionals with clearly defined roles in research, technology development, technical assistance, monitoring, customer relations, operations, communications and finance. The process of growing the team has in some cases meant having to make difficult staffing decisions. The founders have gone through helpful coaching in this area, understanding that having the right team ultimately will



For X-Runner, the relationship with users is key and it is important to be attentive to their needs and feedback, and to never assume that the company has everything figured out.

allow X-Runner to be better positioned to achieve its business and social goals.

An important success factor for X-Runner in its launch has been the development of a team that is committed to a common vision and is willing to work together to overcome company challenges. The philosophy of the founders is to have team members who want to grow with the company and develop their potential, who understand their purpose in the company and also have specific responsibilities that contribute to its success. According to Isabel, “Things do not survive on the founder’s vision or initial idea alone. They need the entire team to do its part. They need everyone involved because this is our company.”



Isabel Medem, a Peruvian-German and CEO of X-Runner, was interested in bringing the company's dry toilet sanitation system to her country of origin to serve very poor communities in Lima. Since opening its doors in March 2012, X-Runner has grown to include seven professionals.

The resilience of the team is also key. Being in direct contact with very poor sectors of Lima, can be emotionally draining. The team has needed to build its capacity to face these stark realities, persevere and overcome barriers.

The team has been able to understand and manage its finances keeping a close eye on its projections, cash flow and balance sheet outcomes. Although the company has not yet reached break even, the team has been able to develop a plan to scale sales, directly involving community members, who earn commissions by selling to their peers.

Finally, X-Runner's leadership kept the team always focused on the problem at hand. For X-Runner, the relationship with users is key and it is important to be attentive to their needs and feedback, and to never assume that the company has everything figured out.

Access to appropriate types and levels of financing

The founders of X-Runner were from the beginning very proactive in searching for diverse funding sources, both from both international and local sources. The first donation it received was from Austrian capital for US\$100,000, which enabled it to start up in Peru, order the first locally-made toilets, hire the initial team and cover operational costs for that year.

Later, upon joining the NESsT portfolio, it obtained an initial donation of US\$63,000 for additional start-up costs, once its pilot test was complete. This donation was used to import the first toilets from Germany and to test and adapt them to local conditions. It also covered user validation, branding for the service and implementation of the initial sales strategy. In addition to financing, NESsT provided a network of legal and technological advisors to ensure the viability of the business model, and its own ongoing business advice especially for the sales strategy and development of a financial sustainability plan. The latter includes defining business goals and a navigation chart for consolidating the company and projecting its growth while safeguarding its social goals.

X-Runner has also leveraged resources from the Canadian government, Start Up Perú and crowdfunding campaigns. The Swiss RE Foundation, Borealis Water for the World and AVINA Stiftung have provided significant funds to cover human resource expenses, toilet purchases, supplies and materials for the collection and treatment of waste, and office operations.

Given the high costs of running the enterprise, X-Runner has also developed a strategy to leverage funding for the social and environmental aspects of the enterprise. It created a non-governmental organization named Sanisol to apply to projects with national and international public funds. In this way it is able to sustain the model in the short-run while reducing subsidies through increased sales in the long-run. The new government's commitment to address the country's water and sanitation situation could provide an opportunity to help accelerate this process.

Leveraging public and private networks

X-Runner was able to engage a valuable network to obtain support in different business areas, despite the fact that its founders had no prior experience and contacts in Peru. It relied on important technology allies for the product adaptation and adoption process which ultimately validated its product. These partners include: (1) Sandec, a leader in research for sanitation in developing countries, that provides scientific support and exchange of knowledge to X-Runner; (2) AKUT (formerly Rotaria), a specialist in ecological and alternative sanitation technologies, who with its in-depth

knowledge and field experience provides technical support to X-Runner; (3) Borealis AG, a producer of polymers, who has incorporated X-Runner into its global program "Water for the World" and featured the company in a number of magazines in Austria.

From a business perspective, it has also worked with partners who have supported and advised its business strategy. One of these was Agora Partnerships with which X-Runner participated in a five-month program in 2013, receiving advice on the business model and investment readiness services.

From academia, the company has worked with Universidad Agraria de La Molina, who helped assess the process and looked for uses for the human waste and how to obtain a good final product. For fieldwork, user testing, quality analysis and perception, it had the support of a large number of students from Stanford University.

For the sales strategy and obtaining a viable model, the company developed a network of salespeople from the same community where it operates. The major advantage is that it is working with users who know the product and its benefits firsthand, and who know their peers, which facilitates expansion to new customers. It also manages a volunteer program with Universidad del Pacífico to promote the service and increase sales.

X-Runner has been in the NESsT portfolio for three years, receiving ongoing support in the development of its business model and mentoring in its business

strategy and consolidation. NESsT has provided advice on streamlining the business model, market studies, specialized technical and business services for patent requests, installation of dry toilet and validation of compost processing. X-Runner has also been advised by members of the NESsT mentor network, which has benefited the founder and team members in issues such as leadership and strategy, human resources, knowledge management and marketing at the base of the economic pyramid. X-Runner values this support, since it stems from an understanding that the company is developing a new industry, which entails overcoming many obstacles and navigating many uncharted areas. NESsT's knowledge of local realities and relationship with relevant actors has been very useful in addressing these uncertainties.

In a short amount of time, the X-Runner model has become known for its innovation and social impact. It has obtained the following awards: (1) B Corp's "Best for the World"; (2) The Next50 Global Innovation Challenge 2010; (3) Finalist at Unilever's Sustainable Living; (4) Young Entrepreneurs Award; (5) Runner-up at Global Sourcing Council's 3S Awards, in the commitment to the community category; and (6) Runner-up at Global Sourcing Council's 3S Out-of-the-box category.

Main challenges of the model

- **End user (final client) acceptance of a new sanitary system:** This required generating changes in habits and valuing a new product. X-Runner was careful from the beginning to meet user needs and developed a technology to make the product accessible and attractive (i.e. easy to use, aesthetic, very hygienic and easily adaptable to the living conditions in communities that lack access to water and sanitation). In its experience to date, it has seen cases of misuse and disarming of equipment, which shows that there is still work to be done, although overall it has obtained a high level of customer satisfaction in a short amount of time. In general, users recommend the system and have seen the benefits from the change in hygiene quality and reduction of diseases.
- **A competent work team committed to the mission of the enterprise:** X-Runner is constantly challenging itself to empower the team around the mission, so that all members consider the company their own and value their roles as they work towards the eradication of such a sensitive issue. The company has also identified the importance of bringing on professionals for certain roles. For example, it has hired a finance director, which has enabled the company to better manage its finances and to develop its financial system as the company continues to grow.
- **Staying focused on user well-being:** The success of this project requires a team with perseverance, flexibility and the ability to confront obstacles that arise along the way. This is the cost of being pioneers in an unknown industry in Peru. This has enabled it to develop an entrepreneurial philosophy and culture, that puts the user at the core, without putting aside the need to achieve greater efficiency in its cost/revenue structure and the quality of its service.
- **The lack of environmental regulation for treatment of human waste:** X-Runner has continued to work toward meeting the legal requirements for waste treatment to be able to obtain the permit for its operations facility. Since the enterprise is not a traditional sanitation service provider, the process has not been easy and the company is still working on this.



Café Compadre

MODEL: SUPPLIER

HARDWARE TECHNOLOGY: COFFEE BEAN ROASTER WITH SOLAR ENERGY

LOCATION: PERUVIAN JUNGLE, CUSCO AND JUNÍN REGIONS, PERU

Café Compadre sells roasted organic coffee grown by jungle communities in central Peru. The company has developed a solar roaster to be used by small coffee producers to add value to their production by selling it roasted rather than as green coffee beans, thereby generating a better price and increasing their income. The enterprise provides the coffee roasting service to farmers and then buys the coffee, grinds and packages it, and takes care of distribution and sale to the final client, under the Café Compadre brand.

www.compadre.pe →

Café Compadre

History of the enterprise

Café Compadre was formally created under the legal name ACCESOL S.A.C. in November 2014. In June 2015 it launched its coffee company under the Café Compadre brand. The company was started by a group of friends who were classmates at Pontificia Universidad Católica del Perú (PUCP). Juan Pablo Pérez, José Uechi, Fiorella Belli and François Veynandt had been studying producer chains in the jungle region since 2009, where they saw firsthand the reality of many small farmers whose lack of access to technology and sales networks prevented them from maximizing the benefits of their production. In November 2014, after obtaining significant results roasting coffee with solar energy, they decided it was time to act. They developed the solar roasting machine prototypes and conducted product validation testing and analysis in coffee producer zones on the edges of the Peruvian jungle in Cusco and Junín. The resulting Solar Roaster involves a Scheffler¹⁴ solar concentrator, with a roasting drum and cooler, which proved to be far more energy efficient than traditional roasters. Based on these results they identified a business opportunity to offer eco-efficient, value-added coffee, working with the same local community that produced the raw material.

Coffee is Peru's main agricultural export. Eighty percent of production is in the hands of small farmers who manage between one and five hectares of crops. The remaining 20% of production comes from large-scale farms averaging more than 20 hectares in size.



In the next four years, Café Compadre aims to work with 47 small- and medium-scale coffee growers in central jungle communities of Peru and to contribute to a 70% increase in their revenue.

The commercial value of roasted coffee is at least five times greater than the value of green coffee. However, farmers do not have access to the technology needed for roasting coffee. The commercial roasters in today's market use complex machinery that requires a stable energy supply, high investment costs and high volumes of raw material, all of which is inaccessible to small- and medium-scale farmers. In addition, although a significant percentage of coffee is cultivated organically, the roasting process generally uses fossil fuels or electricity from non-renewable energy sources.

The average coffee consumption in Peru has grown by 10% annually over the past ten years, increasing per capita consumption from 250 grams to 600 grams a

¹⁴ Solar energy concentration, unlike other technologies that take their energy from the sun, can reach elevated temperatures for different uses and applications. The solar concentrator model used by CAFÉ COMPADRE was developed by an engineer named W. Scheffler 25 years ago. For more details, see: Delcol, J., Hadzich, L.M., Perez, J.P., Vergara, S., Veynandt, F. (2012) Proyecto IntiKalla: tostador solar de café para el desarrollo de las zonas rurales en el Perú. In <http://miguelhadzich.com/wp-content/uploads/2013/04/Informe-Tostador-solar-de-Caf%C3%A9-2012.pdf>

year. Globally, the industry is growing at a rate of 2.5% annually, making it one of the highest growth industries that generates US\$75 billion in foreign earnings per year. However, benefits are not currently distributed equitably throughout the coffee production chain and farmers receive the least in terms of price and overall compensation, despite the fact that their work in the field is the most difficult part of the process.

An underlying social problem identified by Café Compadre is that farming in rural areas is undervalued, causing many young people to migrate to cities after seeing the low social and economic value placed on the family profession. If youth migration continues at current rates, local agriculture production will also begin to fall at increasing rates. This is a significant problem for the future of agriculture, which is such an important activity for the Peruvian economy and for the thousands of Peruvians who depend on it. Café Compadre's social enterprise aims to turn this reality around, by revaluing agriculture through technological innovation and development and community participation.

To kick off the project, the group applied to StartUp Peru in 2015 and was awarded US\$15,000. It became part of the UTEC-Ventures portfolio, which provided professional advice, valuable contacts and office space for business development. Café Compadre is also supported by Pontificia Universidad Católica del Perú, which provides the space to house the machinery, access to research advisors and ongoing technological

Social Impact

- Café Compadre has identified a group of 150,000 families that are small- and medium-scale coffee growers in different central jungle communities of Peru that could potentially be part of its supply chain. In the next four years, Café Compadre aims to work with 47 of these coffee farmers (reaching around 235 indirect beneficiaries) and to contribute to a 70% increase in their revenue.
- Ultimately, the training and empowerment of very poor coffee growers so that they become sustainable coffee producers will not only affect the quality of life of their families, but will ensure viable livelihoods for the next generation.

trials to maintain the quality of its product. The quality of the roasted coffee has received a high rating, and has been qualified as Specialty Coffee, receiving 78 out of 100 total points on the Specialty Coffee Association of America scale.

Involvement with coffee communities proved to be a valuable experience in learning about the attributes of coffee and traditional harvesting systems, and learning firsthand about the needs and challenges faced by these farming communities. To reach these communities, Café Compadre reached out to Cooperativa Cafetera Agrícola de Satipo, a coffee cooperative in Satipo that exports organic coffee and



Café Compadre has developed a solar toaster to be used by small coffee producers to add value to their production by selling it roasted rather than green like they usually do, thereby increasing their income.

supports producers to sell through intermediaries. The group met Hardy Velásquez, an agronomist who works in the cooperative, who had mapped out coffee cultivation in the region and suggested that the group visit one of its members, a farmer named Cristóbal Olortegui Pacaya. Cristóbal was known for the excellent quality of his coffee and good environmental practices in production and harvest. Meeting Cristobal proved fundamental as it led to the adaptation of the technology and business model to meet the real needs of coffee farmers and ultimately to market demand.

The initial proposal was an enterprise that would develop the technology to roast coffee with solar power and sell it to producers. However, the team realized that if the

producers began to roast their own coffee beans, they wouldn't have a market to which to sell. There is no intermediary market for roasted coffee in Peru. As a result Café Compadre decided that it would provide use of the technology to the farmer and purchase the roasted beans from them directly, taking over distribution and sales and eliminating intermediaries. The ability to reach customers through Café Compadre would enable producers to receive higher prices and significantly increase their income.

Café Compadre identified a market that would be drawn to this value proposition. The company sells high-quality roasted coffee under its own label in a half-kilogram format to socially and environmentally committed retail consumers and companies. Café Compadre sets itself apart from the rest because of its seal of quality, price fairness and energy conservation.

The founding team came primarily from the engineering sector and had no prior business experience or participation in similar companies. Juan Pablo is a mechanical engineer, José is an industrial designer, Fiorella is an anthropologist and François has a PhD with a concentration in solar energy. Their diversity and commitment has made it possible for them to take on the different areas of the business. They bring to the table their knowledge and experience in engineering, renewable energy, social development, industrial design and sustainable business design. They also have experience working in rural areas of Peru, where they have acquired an in-depth knowledge

and understanding of the difficulties and particularities of coffee production, as well as the culture of the local community.

When the enterprise joined the NESsT portfolio in mid-2015, Café Compadre was supported by UTEC-Ventures. UTEC-Ventures and NESsT worked together, with UTEC-Ventures focused on final product sales and NESsT on technological validation and creating the supply chain with small coffee producers. The company needed to take a qualitative leap from the prototype they had designed to testing and on-site installation of the coffee roaster. After graduating from the UTEC-Ventures portfolio, work with NESsT has continued and the Café Compadre team has received ongoing training in business planning and management, and support in business skills development. The team has also developed a new financial model, defining goals and strategies to reach new funding sources.

Key aspects of the model

Technology and business model validation

Café Compadre was successful in its technological and commercial validation due to its experience in renewable energy research, its knowledge of the roasted coffee market, and its understanding of the local realities of coffee grower communities. It observed the low value placed on green coffee for one of the most important export industries in the country. As coffee growers had no direct access to

Environmental Impact

Café Compadre's experience in the research of renewable energy has led it to develop a very efficient technology that uses solar energy for the entire roasting process, making it 100% environmentally friendly. The idea is to continue using solar energy in all its processes as its operations grow and it reaches a bigger market for its products, thereby decreasing the carbon footprint for different production activities.

markets, they were forced to accept a high level of intermediation and low level of retribution for their hard work. Café Compadre was able to identify a step in the production process—roasting—that was not being capitalized on, which generated an immediate change and resulted in a direct economic benefit.

The technology developed was designed to be used directly by coffee growers in field conditions (i.e. easy to use and maintain, resistant, transportable and 100% solar operated given that parts of the region are off the grid). Café Compadre developed an energy-efficient technology that added immediate value to the coffee production for the farmer. This was appreciated by the coffee growers and was directly reflected in the sale price, which was 50% higher than the price of green coffee beans that they usually sold.



The company was started by a group of friends who were classmates at Pontificia Universidad Católica del Perú and who had been studying productive chains in the jungle region since 2009.

Café Compadre has assumed responsibility for the entire distribution process—from the moment the coffee bean is harvested, roasted and transferred to the packing plant, to packaging and distribution to the end customer. The company's current business model is based on two types of customers. The first focuses on consumer channels, selling to retail outlets and personal coffee consumers who appreciate organic products. This customer is reached via online marketing, specialty stores and local markets. The second focuses on corporate channels, selling to medium-sized companies whose employees and executives drink coffee regularly. In the case of companies, Café Compadre reaches clients by appealing to their corporate social responsibility strategies. To date, Café Compadre has sold 600

kilograms of coffee per year, but plans to increase sales to six tons in the next few years, which means a production of 500 kilograms per month. This goal will be met by sourcing from ten coffee producers who own land that fluctuates between three and ten hectares and can grow at least three tons per year.

Knowing how to reach the coffee grower community was key to validating the product and generating the desired social impact. Engaging with the Cooperativa Cafetera Agricolade Satipo, which was familiar with the work of its members, allowed the enterprise to meet Cristóbal and the community in Junín. The reasoning behind the name Compadre—which informally translates as close friend—was based on the company's relationship with coffee growers, a friendly relationship based on respect and commitment that values farm work at fair prices. In 2015, Café Compadre began to work with Cristóbal, who was open to trying something new and learning how to operate this new technology. He quickly saw the difference in quality and the increased value of his coffee. He soon became another partner for the company, and based on this trust-based relationship, they have been able to draw in other farmers who know Cristóbal and respond favorably to learning about the new system and express their interest in using it.

Competencies and skills of the entrepreneur team

The team sets itself apart due its multi-disciplinary experience and its commitment and ability to work with the small producer. The team has shown interest

and openness to external advice, especially in the business area, and is quick to recognize its needs and look for support on strategic issues to create and scale the enterprise. Most recently, it organized and grew the team around the different responsibilities of the enterprise. Juan Pablo and José mostly work in the business area, Fiorella is responsible for strategic planning and François (working remotely from France) supports technological improvements. Although all team members have participated in sales and regular visits with potential customers, with the support of NESsT, they are working to develop the commercial area and put together a dedicated sales team. Over the past few months, the team has grown and now has a head of technology development, a head of administration and finance, and a head of communications. In addition, the company has obtained the support of a general business advisor, who has broad experience in business and administration.

Access to appropriate types and levels of financing

The opportunity to participate in the StartUp Peru competition gave Café Compadre a valuable opportunity to quickly launch the enterprise and undertake a business strategy with social benefits. This made it possible to turn an academic initiative into a business.

With the help of UTEC-Ventures, it was able to develop product demand, which was key to convincing the coffee growers of the benefits of the technology and its ability to increase earnings.



The roaster was designed to be used directly by coffee growers in field conditions, meaning it was easy to use and maintain, resistant, transportable and 100% solar operated.

NESsT arrived on the scene with strategic support for business development and financial support to make the model sustainable. NESsT made an initial US\$8,000 donation during the due diligence process in 2015 for technological validation and sale of the first batch of coffee. In 2016 NESsT provided a US\$55,000 donation for the start-up of a new plant and purchase of solar panels to be installed in Satipo, a town located near the farmers in Junín, to improve efficiencies in the distribution chain. This allows Café Compadre to send the coffee ready for sale straight from the production site. It needs an additional US\$140,000 for machinery to reach the projected production of six tons per year. Café Compadre anticipates reaching break-even in 2019 at which time it will be ready to take loans for growth and working capital.

Leveraging public and private networks

Café Compadre has built a small network of stakeholders who helped the company get off the ground and develop its business model.

From an academic standpoint, its engagement with Pontificia Universidad Católica del Perú gave it an important platform to develop its technology, run a series of tests and trials, and to produce high-quality coffee.

From the private sector, in conjunction with UTEC-Ventures and NESST, Café Compadre has obtained support for operations, advice for developing demand and ongoing mentoring on strategic planning.

The team will now need to further build its network of funders and investors. The team is young, and its network is perhaps somewhat limited by this. As it builds its track record, and with the support of its initial supporters, it should be able to expand this network.

Main challenges of the model

- **Engagement with coffee growers:** During market validation, Café Compadre had difficulties in reaching out to coffee growing communities. This required patience and sensitivity in generating and building trust with farmers to establish long-term relationships. Meeting Cristóbal and seeing his willingness to innovate in his own productive process was key to the company, as he was able to show other producers the results and additional earnings he had generated from his own experience working with Café Compadre.
- **Coffee quality control:** In terms of quality, the coffee bean is sensitive to the roasting process and requires consideration of other aspects such as the size and type of coffee (i.e. harvesting a specific, pure variety). Quality control, therefore, continues to be an important challenge, as it requires training efforts with producers regarding best farming practices for coffee to meet international standards. Consequently, Café Compadre proposed to incorporate farmers into its value chain for free, as it requires their commitment and willingness to enact changes, to learn and commit to a formal agreement designed to benefit them directly. Based on Café Compadre's coffee sales to date, it has increased the price of coffee per kilogram bought from the farmer from US\$1.50 to US\$3.00, doubling the farmer's revenues.
- **Sales and distribution planning:** Another challenge has been strengthening the team on the commercial side. The team has invested a lot of effort into understanding the strategies required to reach its commercial and social goals. It has obtained and is selling its coffee at strategic points of sale throughout Lima and has entered into repeat contracts with important companies. It is working to consolidate its sales experience within the team, expanding to incorporate other support, such as advisors to help it in this process.
- **Differentiation in the market:** The coffee market is very competitive with many local brands. Investment in the development of a brand with a social purpose has been key as a means to compete with other gourmet and high-quality organic products.



Ingenimed

MODEL: DIRECT CUSTOMER

**HARDWARE TECHNOLOGY: NEOLED NEONATAL
PHOTOTHERAPY EQUIPMENT**

LOCATION: CUSCO, PERU

Ingenimed is an engineering company that designs, produces and sells blue light phototherapy equipment called NEOLED, a high-quality, cost-effective treatment for neonatal jaundice. It offers two solutions: a conventional solution used directly on incubators in public hospitals and an alternative solution known as “Kangaroo Mother” or kangaroo-bag. The technology addresses jaundice problems in rural Cusco, where hospitals have not been able to offer an effective treatment. The adequate and timely treatment of jaundice prevents subsequent problems and neurological damage, benefiting many newborns and providing an opportunity to impact the quality of life of rural, low-income communities.

Ingenimed

History of the enterprise

Ingenimed S.A.C. was founded in 2009 by Sandro Gamarra, Iván Leva, Santos Oscco, Juvenal Condoma, Hernán Condori and Gian Carlo Román, all electrical engineering students and professors at Universidad San Antonio Abad del Cusco. They were joined in 2010 by Luis Jimenez, also a professor. Sandro and Iván had an idea to develop phototherapy equipment with an LED blue-light panel that could be used to treat neonatal jaundice, which is very common among newborns, especially in Andean areas. Studies show that approximately 50% of newborns have jaundice, and of those, 4 to 5% develop pathologic jaundice. Mindful of the situation in rural communities in the Cusco region, the enterprise founders worked together to develop an effective and accessible treatment for use in public health clinics where they could reach a large number of low-income newborns and their families. In rural regions where health coverage is limited, equipment is generally poor and advanced technology for specialized types of treatment is scarce.

The prototype was developed in 2008 and through contact with CARITAS,¹⁵ Ingenimed became part of the NESsT portfolio. This provided the team with the support and mentoring needed to validate their product in the market and turn their idea into a viable business. During the next three years of incubation, the team received advisory and other services to further develop the technology, design a business plan, create the company and acquire business skills. The company also received an initial donation to support its launch.



Approximately 50% of newborns have jaundice. Ingenimed's founders developed an accessible treatment for use in public health clinics, where they could reach a large number of low-income newborns.

To develop the NEOLED equipment, the entrepreneurs conducted in-depth research on methods used to treat neonatal jaundice at that time. They investigated existing equipment, finding that the jaundice treatment provided was very basic and ineffective. It consisted of exposing newborns to fluorescent tubes, which emit ultraviolet light. Through the research process they began working closely with a team of doctors in the neonatal unit of Cusco's Antonio Lorena Hospital to obtain feedback and direct recommendations from the doctors who would be using the equipment. As a result, they adjusted the size of the equipment design, evaluated the type of light needed as well as the position and form of the equipment. In 2011 they tested the new equipment for the first time with a

¹⁵ CARITAS was NESsT's regional partner in RAMP-PERU, a program operated by NESsT with support from the Lemelson Foundation from 2007 to 2011. Its goal was to provide professional and financial assistance to inventors to develop and distribute their technology products and contribute to meeting the needs of low-income communities living in rural areas.

newborn. The resulting equipment has an LED blue-light panel known as NEOLED that is highly effective in treating neonatal jaundice with a shorter exposure time, preventing dehydration of the infant and reducing exposure to ultraviolet radiation.

From 2011 to 2013 the business model was being validated with a hospital. In addition to developing entrepreneurial skills, the Ingenimed inventors made changes, based on user needs, to the technical design, the prototypes and the engineering design, and most importantly, a clinical trial was conducted that included testing the equipment on patients. This enabled the team to make its first equipment sales to regional hospitals in Cusco and Apurimac.

To prepare for sales on a larger scale, Ingenimed consulted with the Directorate General for Medicines, Supplies and Drugs (DIGEMID) regarding requirements for this type of product. According to DIGEMID, which is part of the Peru Health Ministry, the company was required to have a certified laboratory. Ingenimed then began the process of setting up and certifying a laboratory, a process that lasted almost one year. This was a complex issue because certification required legal recognition of biomedical companies, which did not exist at the time as the sector was mostly made up of foreign firms. Through a burdensome process of completing technical and other certification requirements, Ingenimed successfully pushed for the first law authorizing the production and marketing of medical equipment in Peru. This was an important

Social Impact

During the time that Ingenimed was operating, 2,800 newborns were treated with the NEOLED technology. Neonatal jaundice is highly prevalent in the rural Cusco and Apurimac regions of Peru, so the treatment that Ingenimed was able to provide was important for the health of thousands of babies.

achievement not only for Ingenimed, but for future biomedical enterprises created in the country. This new scenario would allow the company to begin large-scale production of NEOLED equipment and the ability to quickly respond to the high demand for this low-cost, effective treatment for jaundice. The company expected to sell around 150 of the NEOLED units in the subsequent four years.

The entire certification process required a significant investment of time and resources. In addition to using its own limited funds, the company received financial support from NESsT. Once the company was ready to begin laboratory operations in 2013, another legal obstacle arose. DIGEMID rejected Ingenimed's application to register as a laboratory and notified the company that to certify the product, it must also provide pharmacy services. To comply with this requirement was next to impossible, not only due to the costs that it

would entail, but also due to the lack of clarity on what complying with the demand would actually encompass.

Despite their disappointment, the team overcame this challenge and advanced toward a new business proposal. They decided to seek a partnership with an established company in the biomedical products industry with appropriate facilities to certify NEOLED. Medical S.A.C., a company based in Lima, was interested in purchasing the intellectual property rights of NEOLED, which meant figuring out the process for a technology transfer process. The agreement between the two companies involved certain commitments from Medical S.A.C.: (1) payment of a fee to market the product domestically and (2) the inclusion of one of the members of the original team in the new company. During the negotiation process, Ingenimed received advisory services from NESsT, which through its network of experts investigated different formats, fees, conditions and a series of requirements to ensure that the technology transfer agreement would be reliable, transparent and sustainable for both the team and Medical S.A.C.

The Ingenimed team ultimately decided not to continue with the technology transfer agreement, as it wanted to have its own laboratory. As of 2015, Ingenimed continues to undertake R&D projects and develop and provide engineering services, but it does not currently have operations and the technology is not able to be used by hospitals. Despite this unfortunate outcome, Ingenimed's process and the efforts it took to bring its

technology to market did open the possibility of new changes in the legal environment of the country that will hopefully eventually allow for the development and growth of biomedical enterprises that can solve not only jaundice, but other life-threatening problems that vulnerable communities face in the country.

Key aspects of the model

Technology and business model validation

Ingenimed worked diligently to demonstrate to the medical community that the proposed technology was more effective and beneficial for treating jaundice than existing treatment in public hospitals. The team worked closely with doctors to facilitate clinical trials of the equipment, following an iterative process to evaluate the efficacy of the treatment. It wasn't easy to convince teams of doctors who were not familiar with the LED blue-light tube technology to replace the fluorescent tube treatment. The team's seriousness, knowledge and commitment to technological development, as well as their knowledge of the situation affecting the rural population, enabled them to validate the product with users and demonstrate its benefits to the medical community.

The appeal of having a safe and low-cost solution available in all of the public health clinics in the country was an attractive proposition. In Cusco alone, Ingenimed projected that the technology could help more than 70,000 newborns, but eventually the plan was to reach the hundreds of thousands of newborns

who need this treatment throughout the country. The business proposition was that public hospitals would purchase the equipment, offering this service for free to patients.

To strengthen the business during the incubation period, Ingenimed received ongoing assistance from NESsT for both the validation of the product and the business model. Although the Ingenimed team was a bit skeptical about the relationship at first, the team gained confidence and skills by following NESsT's process. The company was able to design the business model, identifying two main market segments: (1) public hospitals and (2) private clinics. The idea was that the sales to the latter would help cover some of the costs of the former. In the market study phase, Ingenimed contacted hospitals and clinics, receiving positive feedback about the product. The advantage of Ingenimed over companies that import equipment is that Ingenimed could provide maintenance and repair services on site, whereas the latter did not offer these services. This represented a significant value to the hospitals and clinics.

The complexity of the legal requirements for certifying a laboratory and the financial implications of the investment needed to achieve that ultimately affected the viability of the model. Although the team looked for options that would make it viable, when the possibility arose of transferring the technology to a company that already had the necessary certification to sell biomedical products, it was not an easy decision for

Environmental Impact

The NEOLED technology does not expose newborns to ultraviolet light, so it is much less harmful. LED light is also more effective in treating newborns with jaundice, and more efficient for the medical team that is using the equipment. The greater efficiency of the technology also results in energy savings.

Ingenimed to make. For that reason, after several months of evaluation, they did not feel confident about a technology transfer agreement and ceased to explore that possibility. In the end, the product was never brought to market, although two NEOLED units that were installed as part of a pilot program remain in place.

Competencies and skills of the enterprise team

The founding team was persistent and rigorous in planning and delivering a quality product, which was reflected in the effectiveness of the final technology developed. This enabled the team to validate the product in the market in order to begin its commercial phase.

The team, after committed work and ongoing enterprise assistance from NESsT, gradually acquired

the skills to understand and apply the knowledge and tools needed for enterprise management. Because the team's members came from the electrical and industrial engineering sectors, they were unfamiliar with financial and commercial aspects, which they found challenging to manage. The team's effort and motivation enabled it to gain important leadership skills. The company also added a partner who had both engineering and business experience to strengthen the commercial side.

The leadership of Sandro, one of the founders, enabled the enterprise to deal with the complex situation and demands of the certification process in an environment in which there were no laws and little appreciation for the power of local technology to solve an endemic national problem. The team became as involved as possible in learning about and understanding, along with support from advisors, specific aspects of the legal and regulatory framework for the biomedical sector overall, as well as for this industry in particular.

Access to appropriate types and levels of financing

Support from NESsT through RAMP-PERU allowed Ingenimed to move from a basic prototype to an industrial product validated by the market. With an initial donation of US\$8,000 for prototype validation, as well as training and mentorship, the enterprise was able to begin both technological and business development. It was the first support the enterprise received to bring its idea to fruition.

In 2012 the company received a donation from Innóvate Peru, (then known as FINCyT) for research and a soft loan from NESsT totaling US\$4,000. These investments provided the capital needed, specifically to finance the costs of equipping a workshop where the technology was manufactured and a portion of the personnel, training and operating costs. Having access to this working capital was key, since traditional banks don't have financial products for these types of initiatives, requiring both revenue and credit histories that new companies understandably lack.

Leveraging public and private networks

Ingenimed was proactive in finding partners that could help get its technology enterprise off the ground.

In addition to the support provided by NESsT and external experts in validating the technology and business model, the Catholic University of Peru and the National University San Antonio Abad of Cusco played a key role by providing space for these young entrepreneurs as well as the assistance of professors for feedback and advice. It also gave them the legitimacy needed to access a public network of clinics and doctors in the country. As a group of young inventors, having the backing of a well-respected university was fundamental.

The hospitals and medical personnel involved in the pilot became key allies who took ownership of the Ingenimed's proposition from the start, not only by participating in the clinical validation process but also by becoming key proponents of both the technology and the treatment that were being proposed.

Main challenges of the model

Aside from the risks faced by all new hardware technology enterprises, the Ingenimed experience features two very important aspects. The first has to do with the environment, which often affects enterprises by limiting their development or growth, while the second has to do with the profile of the team itself. Specifically Ingenimed faced the following challenges:

- **Lack of legal standards for biomedical companies:** The lack of a legal framework for a new sector for the country and the lack of standard criteria and requirements from the national health authorities created strong barriers to market entrance. Government authorities did not fully understand the opportunity that this new technology presented to provide a low-cost solution to a significant part of the population.
- **Other barriers to market entry:** This was also reflected in the national procurement system which offers very few opportunities for local suppliers to enter new or evolving sectors, as is the case of the biomedical sector in Peru. In this situation, public hospitals were not able to purchase available equipment not because of a lack of funds but rather due to a series of legal and other bureaucratic hurdles that prevented Ingenimed from certifying its technology. A more streamlined and flexible procurement process would have helped to overcome this situation.
- **Limited business management capabilities on the leadership team:** The Ingenimed team was primarily made up of inventors. Their strengths were in knowledge of science and engineering. To carry out the business model and make the product accessible to the market, though, they needed to develop their entrepreneurial and business skills. Despite the work and dedication invested in training and assistance, and the commitment and efforts to find ways to do it, the team was not able to elevate their business management skills nor were they able to pass on this responsibility to an established company through a technology transfer. It is very challenging to know if start-up teams will fundamentally have the capacity to grow and scale a business. Through this experience, and others like it, NESsT has strengthened its own capacity to identify strong teams and has made this a fundamental driver of its new portfolio strategy.

Conclusion

The cases presented in this publication demonstrate different technology innovations and business models designed to improve the lives of the poor. Each has its own unique story, but there are some common themes, drivers of success and lessons learned that are important to share. One worth noting from the start is that growing hardware technology enterprises is not easy, but given their ability to provide sustainable solutions to lift people out of poverty, they are well worth supporting. This said, how can we facilitate the development and growth of these companies in emerging market countries? To follow is a set of best practices that emerged from the case studies and that lay the groundwork for the kinds of support mechanisms that need to be created to accelerate the development of hardware technology enterprises and their impact.

Strong relationship with communities

Each of the business models described demonstrates the relevance of patiently building and cultivating a transparent, empathetic and responsible relationship with its target community. Slowly working with the communities, the enterprises begin to gain a very clear understanding of the many problems that they confront or may confront once they engage with the technology and business. As poverty is complex, and based on a set of diverse territorial, economic, environmental and social conditions, the enterprises realize that they need to respond with a technology and business solution that takes these factors, as well as the relationships that are being built during the enterprise development process, into account.

The communities are the protagonists of this process and contribute to its construction. As they begin to see that change is indeed possible, they also begin to gain confidence and their commitment to the enterprise grows. They become just as driven as the enterprise to produce products and services that are of high quality at higher volumes and provided on a timely basis. The need for honest and transparent relationships becomes the norm and an integral part of the validation and scaling process.

For example, in the case of Inka Moss, the enterprise needed to address cultural issues associated with the value placed on the natural resource. The communities had no knowledge of the attributes of the moss growing in their lands, and therefore burned the land to clear it for subsistence farming activities. Slowly they began to see the value of using the moss for another purpose. This realization was key for the success of the business and has become its key driver. The same situation occurred with Café Compadre. The adoption of a technology to add value to the coffee crop required working together with the coffee grower community to show the benefits of the roasting process. Although it took time, this engagement was indispensable to validate the business model.

Early adopters of the technology act as role models for other community members, often becoming part of the enterprise staff. In the case of Inka Moss, incorporating new communities into the collection process is done by Dionisio, the head of production, who is from one of the communities. Coffee grower Cristobal plays a fundamental role in incorporating new coffee producers into Café Compadre's supply chain.

Market-driven business model

The experiences studied show the significant effort that it takes for an innovation to enter the market. In some cases, when the end user is the customer, as in the case of X-Runner and Ingenimed, this effort begins during the technology development process. Users who will become the final customers are introduced to the product, begin to test its use and to provide relevant feedback on needed changes and willingness to use and pay for it. These early users become the promoters of the product. In those cases where the user is not the customer, such as Inka Moss and Cafe Compadre, there is also a need to validate the end product with the final customer base in order to drive the use of the technology on the part of the user, who is also a supplier in these models. If customers don't purchase Cafe Compadre's coffee, there is little value in the use of the bean roaster among the coffee producers.

Developing a clear and well-thought out marketing and sales strategy, with distribution channels has been key in every case. There are multiple ways to do this: (1) engagement with partners who already have a distribution network, (2) points of sale, (3) corporate social responsibility channels, (4) promotion and direct sales through social media and other media, (5) retail chains, (6) word of mouth, etc. In the case of Café Compadre, the team quickly learned that they would have to become the distributors of the roasted coffee in order to reach the end customer. They identified both individuals who value high quality, organic coffee made by local producers and companies with proven corporate social responsibility cultures as their main customers. For YAQUA, using the same retail points as its bottled water for its healthy

fruit snacks, where it has already become a reliable supplier, presents a less risky opportunity for growth. For Ingenimed, the technology would be sold to public clinics where the doctors and patients could be found. In every case, the sale of the product correlates directly to the social impact sought—greater sales lead to greater impact.

Virtuous balance between the invention/innovation and the business

The value of the technologies in each of these cases lie in their capacity to solve problems that affect thousands if not millions of people. From a solar-operated moss drier to a complex organic waste treatment and sanitary system, each invention has great value. However, the invention itself will not lead to change if it is not made accessible to the people who most need it. To do this requires a dynamic process where both the technology and business models are developed side by side, and where different challenges to each are resolved by taking the other into account.

For example, in the case of X-Runner, the original idea was to fabricate the dry toilets in Peru with local materials and by local people. However, this have would made the price of the service prohibitive and ultimately the enterprise opted to purchase an imported technology based on the original design. In the case of Ingenimed, manufacturing the NEOLED technology needed to be done at an established laboratory to be approved by the government. This required a completely different business model than the one originally anticipated by the team.

The search to make the use of the technology affordable and sustainable leads to models that focus less on selling the actual technology and rather on offering the use of the technology as a service. This is the case with X-Runner and the Family's collection service, and also the case of Inka Moss and Café Compadre where the technology is provided to the suppliers at no cost as part of the supplier agreement in order to improve production, and its costs are ultimately covered through sales.

Resilience and openness to grow of the founding team

In all of these cases, the determination and resilience of the founding teams has been central to the development and success of the enterprise. It is no easy task to be a pioneer in an industry. As one of the founders shared, "You have to know how to bounce back from difficulties." In each of these cases, the founding leader or team have shown a strong ability to tackle problems head on, demonstrating tremendous tenacity to overcome barriers that have often taken years to resolve. Remaining hopeful, they have been willing to take measured risks, to put their own personal resources behind the enterprise, to be open to making needed changes and to persevere despite what at times seemed insurmountable.

The belief that they can significantly improve the lives of others has made many founding teams willing to transform themselves, always learning and obtaining the skills needed to lead and grow their companies. The cases presented show that this is not an easy process, as it requires a team that is willing to acquire new skills, to grow and learn, to bring in new talent and step aside when needed.

The founder of Inka Moss transforms from a traditional entrepreneur to social entrepreneur as he incorporates an understanding of social issues into his model. At Ingenimed, there was an ongoing effort to help the team undergo this transformation, but finally the team's scientific focus predominated. Transitioning to a new team was also not an option, as the team was predisposed to want to lead the business.

In none of the cases has the original founding CEO transitioned the enterprise to a new CEO. However, in all of the cases, the founding CEO or team has had to make sure they have both the technology and business know-how in place and have transitioned some of their responsibilities to others, creating a team that has the core competencies needed to grow. This is the case for the multidisciplinary teams of X-Runner and Café Compadre. In these two cases, skills were more concentrated along technological and social lines, so leadership was complemented by support from new members who stepped in to strengthen the business and commercial areas.

In the case of YAQUA, there was a transfer of technology to an enterprise when the inventor of the water filter found an opportunity to ensure that invisible communities would have access to the technology. For the company, this was a tremendous opportunity to bring an effective solution to the work that it was already doing to bring water to these communities. Acquiring the new technology requires that the team will need to build their capacity to understand the technology and continue to expand its uses. For now, the model is to distribute the technology at no cost. However, this might change as the team begins to consider ways to generate revenues from its use.

Importance of soft and flexible financing and ongoing support

Access to funding is key to any business and is almost always a challenge for start-ups that don't have a track record or previous relationships with investors. These businesses are often not eligible for traditional commercial financing, and when they are, the interest rates and repayment terms are often very difficult to meet. However, the challenge is even greater for socially-driven enterprises that have higher social costs, are introducing new products and services, are perceived to be riskier, and often take longer to break even and become investment ready. These businesses need soft capital in the form of grants and low-interest patient loans in smaller amounts of US\$50,000-300,000 until they are able to rise out the start-up phase. However, this type of capital is very difficult to find, since even impact investors start at higher amounts of investment once companies are consolidated and have begun to grow. Equity is often not an option given the lack of a clear exit strategy.

The enterprises highlighted almost always had access to some form of start-up capital, either from friends and family, public sources such as Innóvate Perú, as well as NESsT. Key to attracting this capital was the capacity to undergo a rigorous due diligence process demonstrating the strength of the management team, the strength of the business idea, capacity to grow and scale, as well as sound financial management practices. Although the funding was in some cases costly, or not enough, most of the enterprises have been able to build and access additional funding with time. In the case of Inka Moss which is preparing to scale, several impact investors are currently considering a larger package of co-investment.

All of this points to the need to grow these sources of capital and to ensure that donors and investors are collaborating around these opportunities.

Providing the appropriate and timely strategic and capacity support is as important as financing. All of the enterprises have depended on this not only at the blueprint stage, but perhaps even more importantly during the validate and prepare to scale stages, where the issues they confront become even more complex. The one challenge is that this type of ongoing enterprise support also requires resources, which are difficult to secure, although there is increasing recognition among the sector that providers of these services need to be supported and strengthened. An example of this is the Innóvate Perú Program Strengthening Incubators and Similar Organizations.

Importance of networks and an ecosystem that facilitates enterprise growth and innovation

As mentioned in the introduction of this publication, hardware technology enterprises are complex and need constant interaction with and support from key stakeholders in order to become viable and have the impact they are aiming to reach. This very much applies to the enterprises showcased as they sought to have technology feasibility, commercial viability, organizational fit and social acceptance. They relied on the support of academic, private and public sectors at different points in time to test their technology prototypes, to develop their business models, to access human and financial resources, to identify national and international markets, and to become better acquainted with local community needs. This process is ongoing, as they seek to innovate new products and prepare for

the next stage of their growth. And key to its success, is the strong and proactive networking skills of the entrepreneurs at the helm, who know how to identify and maintain strong relationships.

No doubt that the enterprises went and continue to undergo cumbersome validation processes around certain aspects of their business. X-Runner's ongoing efforts to validate its waste treatment process and compost, and Ingenimed's failed efforts to launch its laboratory and be certified to sell its technology. In many ways, these pioneer enterprises are paving the way for future ones as they create procedures, regulations and certification processes that were totally non-existent.

Recommendations

Perhaps a key lesson is that bottlenecks and barriers will always arise, and it is important for leaders not only to anticipate them, but to have the skills needed to be fully informed and to negotiate on behalf of their companies. Enterprises need support in negotiating with universities and other technology centers as well as public entities to ensure that they have ongoing opportunities to create and develop new technologies that improve their companies along the way. They also need to be able to ensure negotiations around intellectual property rights are equitable. Finally they need to be able to navigate onerous certification and validation processes in order to enter the market.

In many ways, these pioneer enterprises are paving the way for future ones as they create procedures, regulations and certification processes that were totally non-existent.

The academic, public and private sectors need to work to create the conditions, mechanisms and procedures to better meet the needs of hardware technology enterprises. They should focus on making change in the following ways: (1) investing in technology aimed at solving the underlying issues of the poor, (2) building the country's enterprise capacity, (3) investing in basic infrastructure, (4) building an institutional and regulatory framework, (5) fostering talent and (6) by offering the right types and levels of financing. Together, these actions will be able to accelerate the growth of hardware technology social enterprises and help them realize their transformative social impact.

Through its work, NESST plans to continue to support hardware technology enterprises on behalf of poor communities. The experience it has gained in the last ten years working with these companies and building relationships with key stakeholders, positions it well to identify and support an increasing number of enterprises that show strong potential for success. By working to address key gaps, engaging with partners to strengthen the ecosystem, NESST plans to not only increase its impact in Peru, but throughout the region.

BEYOND THE LABORATORY: IMPROVING LIVES THROUGH HARDWARE TECHNOLOGY ENTERPRISES

NESsT's *Beyond the Laboratory: Improving Lives through Hardware Technology Enterprises*, provides compelling insight on the importance of supporting enterprises that bring inventions and innovations to the market to solve the toughest problems facing low resource communities throughout the world. The cases describe inspirational change agents who have, with the support of NESsT and others, succeeded in capitalizing on breakthrough ideas that provide new technology and business opportunity that will improve the quality of life in these communities. The Lemelson Foundation uses the power of invention to improve lives, by inspiring and enabling the next generation of inventors and invention-based enterprises to promote economic progress for the poor in developing countries. We are proud to be NESsT's partner in Latin America in their support of these inventors and work to strengthen the local ecosystem so that others may follow.

Carol Dahl, Executive Director, The Lemelson Foundation

The Multilateral Investment Fund (MIF) is pleased to endorse this seminal publication. NESsT's focus on the importance of technology social enterprises in lifting people out of poverty is at the heart of the MIF's new strategy where a key goal is to build the knowledge economy and promote job creation by powering technology-driven enterprise growth. The cases featured illustrate clearly how technology and innovation can be used to address social challenges. In our work on strengthening the ecosystem for social innovation in Latin America and the Caribbean we hope to be able to partner with NESsT and other social enterprise organizations to seed new technology driven firms and employment opportunities.

Elizabeth Boggs Davidsen, Chief, Knowledge Economy, Multilateral Investment Fund, Inter-American Development Bank.

The Ministry of Production, in its goal to foster productive development in the country, is deploying a mix of policies aimed at reducing market failures that prevent Peruvian businesses and entrepreneurs from innovating and from incorporating knowledge into their production processes. Ultimately, these policies are designed to improve the productivity of the workforce, by mobilizing specialized competencies and solving social problems that often inhibit these competencies from developing, particularly in local regions of Peru. It is through these efforts that NESsT has become an important ally of the public sector, promoting social innovations through creative, feasible and scalable solutions that seek to improve the living conditions of people and increase regional productivity. Given that many of the cases presented in this book have been funded by the program Innóvate Perú of the Ministry of Production, we also feel a part of this work and are pleased to support this valuable publication.

Sergio Rodríguez Soria, Director of Innovation, Ministry of Production

This month we completed the transfer of the intellectual property rights of the filtration system for contaminated water in rural areas to the enterprise YAQUA. This historic moment represents the first time that such a transfer of technology to a social enterprise has ever taken place in Peru. From a personal perspective, this represents an important opportunity to disseminate this technology, and ensure that my invention reaches thousands of people who do not have access to potable water in our country. In this sense, I would like to infinitely thank NESsT for investing time and resources in this type of initiative. And to congratulate you for this publication that highlights the importance of taking effective, low-cost technologies to the market, and demonstrates models of cooperation between inventors and enterprises in creating innovative and sustainable solutions on behalf of invisible communities.

Manuel Chavez, Inventor

