

Smart Farming Innovations for Philippines: Strategies and Recommendations

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Abstract—This study focuses on Smart Farming Innovations (SFI) of the Philippines. It is motivated by the 5th-agenda of the current Philippine President to increase agricultural and rural enterprise productivity. The study presents a strategy to lead research, development, and market of organic foods as medicine and build social entrepreneurs in using SFI. We assume the a) current establish protocols for micropropagation, cryopreservation, and management of vegetables, vertical farming and hydroponics and monitoring in real-time of the climate, lighting, irrigation through the use of electronics, sensors, and automation in proposing the SFI to map the producers and market of organic foods, and finally build the cluster of social entrepreneurs in using the SFI smart technology's organic farm system. Specifically, the paper discusses SFI's creative features, services and describes its business model through value proposition, SWOT analysis, and financial projections. We conclude that scalable technology-driven products and services to alleviate poverty are a must to contribute to humanity. SFI's organic food production requires a certain radius to be effective and efficient. It must consider setting-up e-commerce, cloud computing, power and security, and utilization of big data analytics to aid in timely decision making to scale up in the future.

Keywords: *smart farming, e-commerce, mash up architecture, Amazon EC, SAP Lumira, Philippines*

I. INTRODUCTION

The 5th socioeconomic agenda of Philippine President Duterte, promotion of rural and value chain development toward increasing agricultural and rural enterprise productivity, requires specific strategies where a wise use of technology supports significant progress. Generally, farmers in various islands of the Philippines are operating individually using traditional processes and whose managements of farm produce to end-users are facilitated through the middlemen at low prices. There are established protocols in micro-propagation such as bananas, coconut, legumes, and oilseed crops [1,2], and in cryopreservation to implement a large-scale project which has yet to see an upscale of a developed protocol for application [3]. Another suitable technology used in the tropics is vertical farming and hydroponics [4].

Despite the agenda support for the farmers, we do not yet have a good understanding of the business model that the

farmers and farm investors are taking advantage of established protocols in micropropagation, cryopreservation, vertical farming and hydroponics to scale up production nor has there been evidence of using technology such as Smart Farming Innovations (SFI). With the development of real-time monitoring of climate, lighting, irrigation through the use of electronics, sensors, and automation, we propose a business model using technology to take advantage of technology advances through SFI's value proposition, SWOT analysis, and financial projections. The second issue is to address are the creativity, services of the SFI. This paper contributes to research on the development and marketing of organic farm produce as medicine, and to build up a pool of social entrepreneurs using the SFI in the islands of the Philippines. These proposed actions and policies may be adopted by farmers and rural investors to improve their value proposition in line with the stated agenda above.

II. METHODS AND ASSUMPTIONS

This paper uses the established agricultural protocols which utilized farm technologies into the proposed business model.

We identified two customer segments, the entrepreneur farmers (herein referred to as entrep farmer) and the institutional market (referred to as insti market). An entrep farmer refers to individual farmers who use traditional farming processes, whose children prefer other sources of income; and whose products are bought by middlemen at low prices [5]. The insti market is a group of restaurants, restaurants, hospitals, and organic produce stores.

The entrep farmer faces problems in weather disasters, farm pests, unpredictable revenue and possible loss of investment, rigid banking requirements, unrelated licenses, and documentation. The insti market is viewed as having high costs of buying organic produce, no internal control in wet market transactions, cannot verify organic produce, and a limited variety of organic produce. The organic produce may likely add costs due to post-harvest handling costs, organic certification, and demand overwhelms with supply. Our customers may have little or zero knowledge of smart technology.

To address our customer's problems, we propose to build entrep farmer as a pool of social entrepreneurs [6] with an

introduction to the use of SFI to the broader social systems in the islands of the Philippines. This platform will lead the entrep farmers to generate income, eliminate middlemen, ease of transaction, matching of organic produce with insti market. While the insti market will benefit in direct contact with sources, verifiable sources of organic produce and more variety of farm produce reasonable costs and smooth transactions.

The SFI's competitive advantage is built on improving the community that uses a scale-up technology that supports social entrepreneurs/farmers. It solves our customers' problem with the introduction of the SFI technology into the operating system managed by social entrepreneur farmers, engages government's technology support, refines value proposals with the farming managers to the investors/venture capitalists, analyses data and improves the e-commerce's mapping of producers and marketers of organic foods.

Ownership of the relationships between the social entrepreneurs-farmers and the insti market must be articulated by each customer. SFI only manages the interactions especially for the organic production requirements, and build a company image of transparency and real organic produce as medicine for health.

SFI utilizes IT infrastructures; mash-up architecture, as part of industry web 2.0 applications that integrated communication with external and internal stakeholders will be used [7]. Although we are witnessing the current status of the industry 4.0, we deemed this appropriate for the island environment. Secondly, it will utilize Amazon EC in storing its data [8]. It is a collection of remote computing services. Using cloud will further strengthen SFI's competitive advantage because the security of data will not be its concern but of its value proposition for the social entrepreneurs/farmers and institutional markets. And finally, the SAP Lumira technology analyses the big data from all its stakeholders in micropropagation, cryo-preservation, management of vegetables, vertical farming and hydroponics. These technologies [9] are applied in India.

III. RESULTS AND DISCUSSION

A. *Characteristics, Creativity, and Services SFIP Provides*

Firstly, SFI focuses on end-to-end communication, logistics, and operations management. This prioritizes the creation of the supply; forecasting and financial control for revenue, costs, and investments; most importantly, the human resource for achieving the optimum mix of talents. It expects to enhance SFI's online presence in terms of its products and services as well as customers' relations (aftersales) using the IT infrastructure, mash up architecture, Amazon EC in storing its data in the cloud, and SAP Lumira technology in analysing big data.

B. *Description of Business Model*

SFI's key Partners / customers are Social Entrepreneurs / Farmers (Entrep Farmer), Institutional market (Hospitals, Restaurants, Hotels, and specific organic markets) or Insti market, Government support in farming technology and sciences, farming managers, and Investors/venture capitalists.

Government support in farming technology and science will be tapped in terms of local government and national government. Local government will include the province and the city. These local government agencies have access to budget as well as the people organization of farmers. SFI enhances only the agricultural productivity and will not in any way interfere with framing processes. The national government is a major player because it has some budget for technology and science-related endeavours. This will be channelled directly to the Entrep farmer and not to SFI. SFI focuses on its consulting and management role in agricultural products such as matching the Entrep farmer with the Insti market.

SFI's key activities include refining its competitive advantage of scaling up its smart technology's organic farm system into as many social entrepreneurs/farmers as possible. It is envisioned that this technology will cluster the farmers according to the radius with the insti market. This smart technology utilizes the mash-up architecture to have an end to end communication; Amazon EC to store its data; and SAP Lumira for big data analytics. SFI engages the government's technology support, refine value proposals with the farming managers to the investors/venture capitalists, and analyse data and improve e-commerce's mapping of producers and marketers of organic foods.

SFI's customer relationships start with an orientation to know each customers' expectations. Who we are, what we are doing, and what we can do to enhance agricultural productivity. SFI's expects that these customers will own the relationship with SFI, with each kind of customers, and with the government agencies who support on the farming side.

Managing the interactions especially for the organic production requirements and the capacity of each of the entrep farmers are monitored. In this case, SFI is building a company image of transparency and real organic produce as medicine for health. It illustrated the tracing of the organic produce to a specific entrep farmer.

Thereby, customers are segmented by a radius of location so that fresh organic produce can be expected aside from low carbon footprints. Social Entrep/Farmers' capitalization and knowledge of SFI's smart technology modules and preferences, demographic, geographic, and ethical behaviour are important factors to understand the segment.

Capitalization is the primary consideration of social entrepreneurs. Major reorientation of SFI's two main customers is needed, to transform them from traditional myopic attitude to global, ethical, and sustainable characteristics. Big words to speak of but being myopic will not encourage future farmers to do farming. A global ethical farmer will consider how important farming produce to the lives of people. It requires care and being transparent of any chemical added into the soil or spray into the leaves. Ethical consideration is a must to plant the seed of transparency and thinking of the good of others. Insti market must be classified into the type of organic produce needed. Likewise, in the same radius with the entrep farmers. Demographic, Geographic, and preferences which consider seasonal or not.

Channels include digital ads, content marketing, word of mouth, and social messaging. These e-commerce channels educate who and what is SFI, what is its mission and objectives, and most especially the venture capitalists who will believe that SFI can be replicated into the other 7,000 Philippine Islands and the world in general.

The initial revenue streams that SFI will have being the consulting and management role in SFI smart technology's organic farm system will include charging a transaction fee based on savings on Lower costs for institutional market and higher income of entrep farmer. The cost structure includes the development of SFI and its expansion, payroll for 2 IT practitioners, admin assistant, CEO, CFO, farm managers, and contractors. IT's minimal infrastructure and transaction costs for the mash-up architecture, Amazon EC, and SAP Lumira. It will have consulting costs, pre-operating and operating expenses for legal, insurance and other operating expenses.

C. Value Proposition

SFI's value proposition of its consulting service will feature ways of increase and consistent income generation, ease of transaction, matching of organic produce with the market, and continuous training of SFI's smart technology. How can we deliver this promise? Through strengthening our competitive advantage which is using technology to ride on to increase agricultural productivity. Increase and consistent income will come true when the entrep farmer's organic produce will be matched before harvesting with the identified insti market. Real-Time Updates of the organic produce will be viewed once connected to the SFI's smart technology. Ease of transaction means updates on the logistics (including delivery) can be traced up to pay through credit card. Transactions can be reviewed and economic order quantity (EOQ) can be generated per organic produce. Sales can be viewed as vis-a-vis with the related product costs.

For the institutional organic market, the value proposition that will consider our SFI's smart technology as the smartest way to connect with the entrep farmer's organic produce at low costs. On this side, real-time updates of the delivery of the organic produce. Likewise, ease of transactions because the market knows exactly how much to receive. Seasonal produce can be considered in making market lists for a specific menu in restaurants, hotels, hospitals, and identified an organic produce market. Menu planning can already be made possible with the specific seasoned organic produce. More variety of organic produce because our SFI smart system will match the planned menu with the actual organic produce in the field. Verification of the organic produce can be made possible since the matching from planting to the table. Indeed, transparency of transactions can be achieved.

D. SWOT Analysis

Strategies to maximize SFI's strengths with the identified external opportunities (SO) a) Plan the IT overall plan that will align the vision/mission, objectives relating to the use of technologies (Mashup architecture, Amazon EC, and SAP Lumira) within the SFI's IT strategy. b) Ethics is the core values that must be set-up properly to carry out the IT strategy. This is the core of SFI's success factors. C) For Expansion: SFI

smart technology can be applied to other industries of which the same resources and applications can be sourced out.

Strategies to reinforce SFI's strengths with the identified external threats: (ST) a) Focus on the IT strategy's implementation, of how the available resources facilitate in successfully launching the SFI's smart technology so that competitions can't overtake our company's position.

Strategies to minimize SFI's weaknesses with the identified external threats opportunities (WT) and (WO) a) Hire IT, practitioners that have the same values with the founders, this will make sure that the intended vision and mission will be realized such as for expansion, co-branding, and by-product tourism activities.

E. Financial Projections

Product costs will be 30% to 50% of which the gross margin must not below 30% to 50%. If below such gross margin percentage then do not proceed with the project. Other costs include advertising for the new product, promotion, and increasing market share of 10% to 15%. Over a thousand delivery for logistics accounts for 5%. Product shooting /post design is 3% to 5%, website maintenance cost of 10% to 15%, Staff (revenue of 2milion Philippine Pesos below 3-6) 15% to 20%, and finally office rental/miscellaneous management expenses 5%. The net profit should be 5% to 10%. Thereby, this SFI, the project has 8% net profit rate and at most 5- year payback period. We can initially say that the project is feasible subject to a full-blown business plan.

IV. CONCLUSIONS

Scalable technology-driven products and services are a must to alleviate poverty and the good of humanity. SFI's organic food production requires a certain radius to be effective and efficient. It must consider setting-up e-commerce, cloud computing, power and security, and utilization of big data analytics to aid in a timely decision making scaling up in the future.

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