

Commentary

# Helping Agribusinesses—Small Millets Value Chain—To Grow in India

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**Abstract:** Small millets, a group of highly nutritious food, have taken a back seat in the Indian agriculture landscape in recent years, due to government policies and failings in the value chain. In this commentary, the unusual decline of small millets in comparison to its substitutes, and the repercussions thereof, were first presented as context. Thereafter, based on analysis of data from literature, survey, and stakeholder contributions, a cluster map for the Indian small millets value chain was designed, and its competitive state presented. This information was used to conceptualize an open innovation driven business model, and an ecosystem for the proposed model was discussed. This commentary provides the first cluster map analysis of small millets value chain in India, and a business model-based approach to stimulating its agribusinesses growth through a synthesis of stakeholders' contributions and market data.

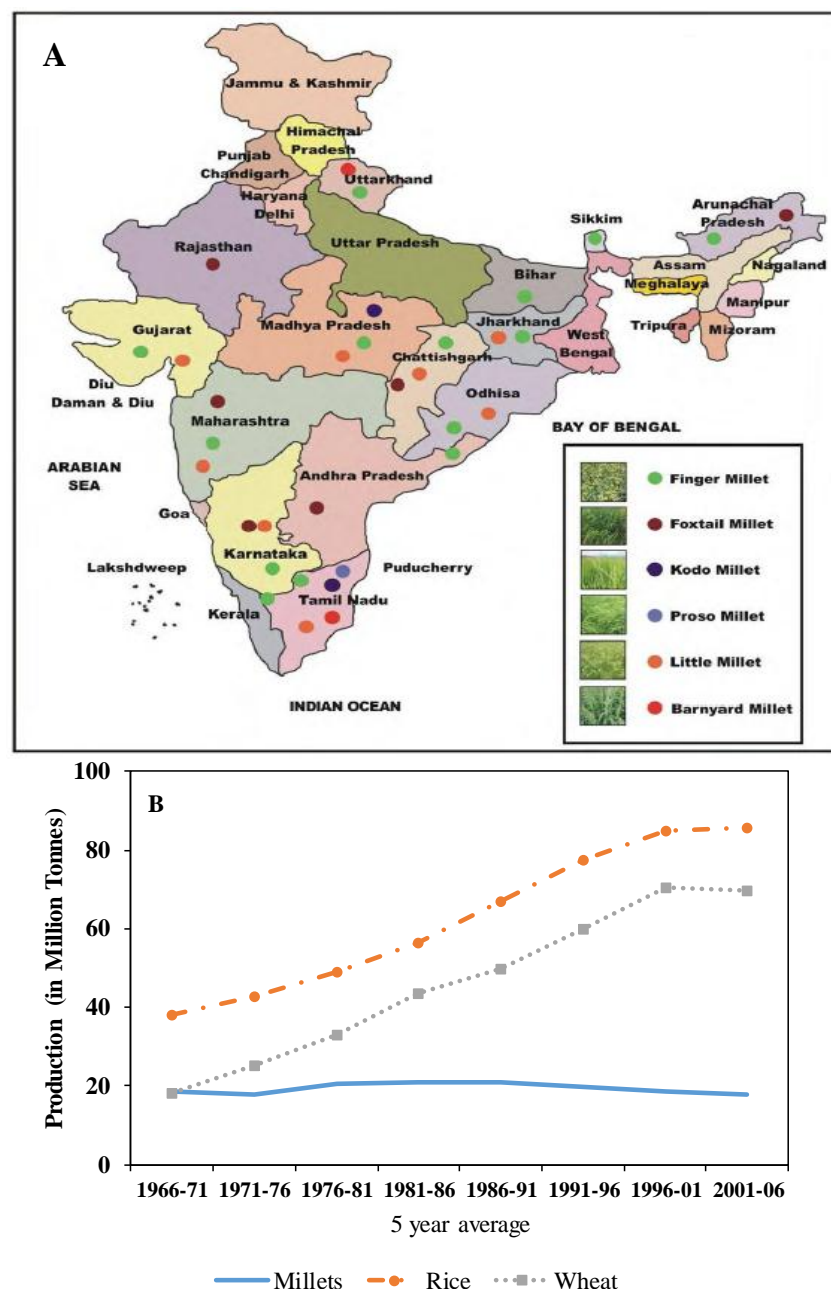
**Keywords:** small millets; value chain; open innovation model

## 1. Introduction

Millets are one of the oldest agronomic group of grasses that serve as a nutritious staple food in Asia [1]. The small millet variants are particularly suited to the Indian climate, due to their resilience and ability to grow under marginal soil fertility and moisture conditions. Therefore, different varieties can be found in several geographic regions of the country [2] as shown in Figure 1A. Before the Green Revolution in India in the mid-1960s, small millets made up more than 40% of all cultivated grains in an agriculture industry that contributed more than 50% to the Indian GDP [3]. Nutrition-wise, small millets are rich in polyphenols, antioxidants, and fibers that are important for healthy body functioning [4]. They also have the lowest glycemic index when compared to other cereals, such as rice and wheat, and has no gluten [5–7]. In addition, cultivation of this crop has been recently shown to have the lowest global warming potential when compared to wheat, rice, and maize [8].

However, despite these substantial benefits, the small millets industry has declined, due to several factors that can be attributed to a lack of demand stimulation, and a decreasing or stagnant cultivation of small millets (Figure 1B). Although government policy change has been the main catalyst for a downward spiral of the industry, the stagnation is reinforced by an underdevelopment of the agribusinesses in its value chain, especially in their market penetration on an extensive but location-sensitive scale. This situation has led to a perpetual replacement of small millets by other cereals, such as rice and wheat, in the traditional daily Indian diet. Subsequently, India has seen increases in the incidence of obesity, type-II diabetes mellitus, impaired glucose tolerance, as well as increased incidences of chronic and non-communicable diseases [9,10]. The contribution to greenhouse gases emission from agriculture has also increased to 18% because of the intense focus on rice cultivation [11]. Therefore, from health, environment, and economic perspectives, a strengthening of this industry by facilitating the growth of its agribusinesses has major implications for improving

livelihood in India. Specifically, this will lead to an increased GDP contribution, including the potential for export to culturally similar countries, improved nutrition, reduction of diseases incidences, and less environmental impact. Furthermore, in a country experiencing chronic water stress due to reduced rainfall, improving the small millet industry will translate to increased millet cultivation, which will be a welcome alternative to the water-intensive cultivation of rice that currently dominates the country. This commentary conceptualizes a roadmap that can be applied for improving the small millets value chain in India, helping agribusinesses to grow, and improving the livelihood of the population.



**Figure 1.** India's small millets cultivation facts. The distribution of small millets production in India [2] (A); Millet production when compared to substitutes (B).

## 2. Theoretical Framework and Methodology

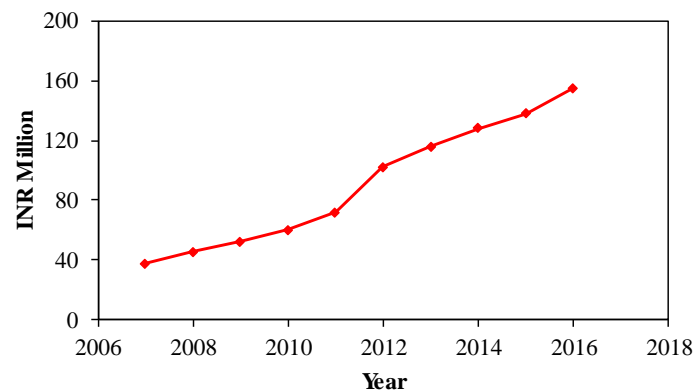
Business models are an abstraction of a specific business with an aim of understanding, communicating, explaining, designing, and achieving specific goals [12]. According to Osterwalder [13], business models consist of nine building blocks: customers, value proposition, distribution channels, revenue flows, client's relationship, resources, cost structure, key activities, and partner network; which can be developed. Osterwalder's model mapping approach in conceptualizing new business models is important for this study, because in connecting the building blocks, a consummate and objective analysis of the Indian small millets value chain is necessary. Also, usage of this mapping approach allows for a tailored strategy, improving the success chances of the conceptualized business model. Finally, the value proposition for an appropriate business model would be to improve the consumption of small millets in the Indian daily diet, as this directly affects the growth of agribusinesses in the small millets value chain, and on a larger scale, an improvement of health and economic stability, and a reduction in environmental degradation.

Data and inferences for the value chain analysis were collated from a combination of discussions with stakeholders at the Tamil Nadu Agricultural University, surveys, and published articles. Specifically, from the production angle, surveys and discussions at stakeholders' meetings facilitated by the Development of Humane Action (DHAN) foundation in India were used to assess several components of the market: small millets processing units' efficiencies, technology-related experience testimonials, hard and soft skills, utilization, machine and infrastructure, and utilization rates. Finally, a market survey on customer awareness of the nutritional value of small millets, consumption patterns of different varieties, attitudes, and preferences of consumers, and the decision-making process for purchasing cereals was also undertaken in 20 Indian cities (10 urban, 10 rural) to understand the performance of small millets in the market. Food choice decision makers of 500 families, especially mothers of children aged between 8 and 12 years, constituted most of the consumer preference survey base. Analysis of the data collected provided an insight into the state of the cluster, and provided a base upon which a business model approach that combines the right mix of culture and management was developed.

## 3. Results and Discussion

### 3.1. Value Chain Analysis

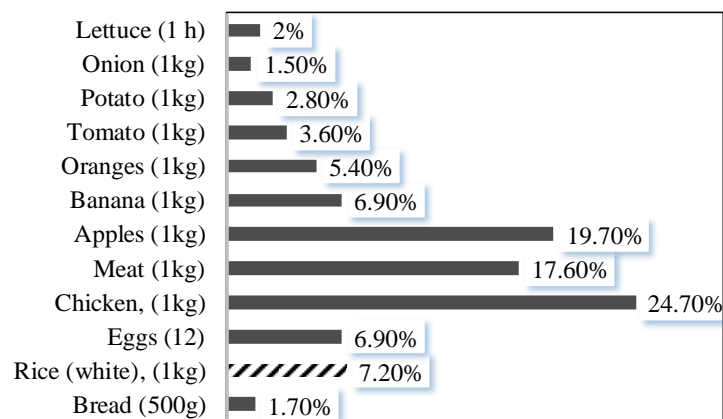
At present, small millets average 70 Rs/kg compared to the average price of 40 Rs/kg of rice, highlighting constraints in affordability. Fortunately, the potential for small millets value chain agribusinesses to grow in the Indian economic climate exists, due to the opportunities created by an increasing average disposable income [14] as shown in Figure 2. Although in India, food allocation from disposable income is approximately 41% [15], increasing apparent wealth has been shown to lead to an increase in income allocation for food, and a drive towards healthy lifestyles [16]. Small millets can therefore benefit from a higher purchasing power especially as it is indeed a healthy alternative. Unfortunately, stagnation in the value chain prevents the market from tapping into this economic opportunity. A demonstration of this can be seen in a steady increase in the demand for the "highly nutritious" quinoa, which is not traditionally grown in India [17], but is gaining popularity, due to its tag as a superfood and adoption by Western countries. Interestingly, quinoa has a similar nutritional profile to those of small millets [17], but small millets are being overlooked by the emerging market due to their weak value chain.



**Figure 2.** Disposable income growth in India over the last ten years (INR\* Indian Rupees).

Food consumption distribution based on actual food price data and purchases in India [18] was fitted to an Asian food consumption model (Figure 3). In this distribution, one of the prominent substitutes for small millets (rice) occupies 7.2% of the total, emphasizing its dominance over other types of cereals. Therefore, in order to achieve any meaningful penetration into the market held by these small millet alternatives, the prices of millets must be substantially reduced [2]. Based on the foregoing, causes of the stunted growth of agribusinesses in the small millets value chain, despite the reducing food inflation in India (−1.5% as of April 2017), can be summarized succinctly as follows:

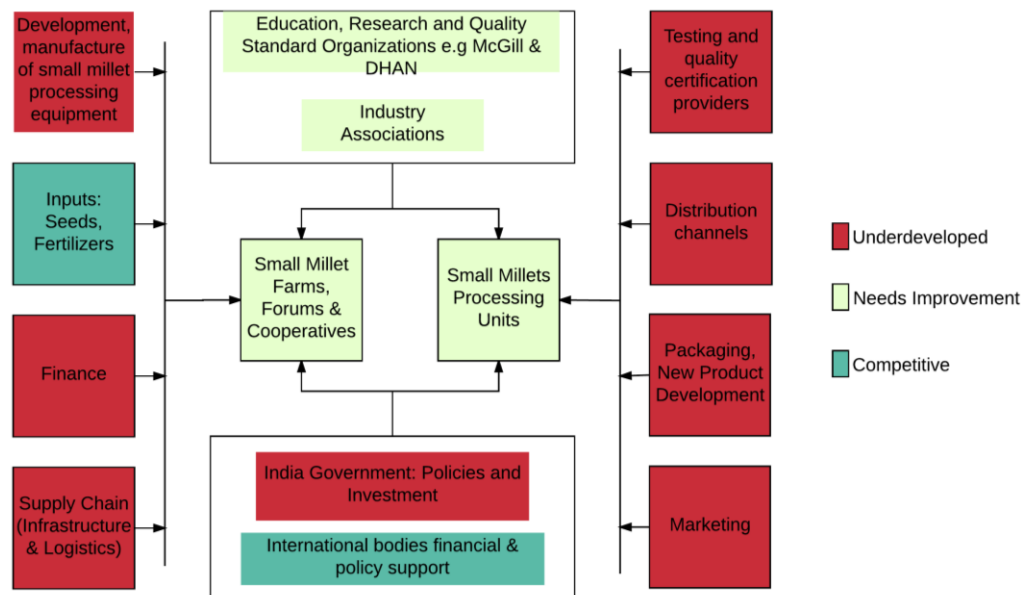
- (a) **Weak Supply Chain:** Unlike rice and wheat, there has been dwindling development of the supply chain, especially as it relates to support for growers, traders, marketers, subsidiaries, and processors to ensure speed and smoothness. Several cases of intermediaries' exploitations are documented online. Therefore, cost components continue to increase. For example, according to the manufacturers, middlemen can increase the cost component by up to 40%.
- (b) **Customer Awareness:** In addition, customer awareness of the better nutritional value of millets, as well as the ability to evaluate quality, is inadequate or practically nonexistent. Customers do not buy what they do not know about. Most of the current customer awareness about millets consists of word of mouth information, or informal discussions on its potential nutritional benefits. However, based on nutritional discussions during the customer preference survey, at least 50% of non-consumers of millets indicated an interest in purchasing them.
- (c) **Poor Yields:** Average yields are still quite low [2]. Annual yields of 4–5 quintals as opposed to 20–25 quintals of rice, 18–20 quintals of wheat, and 25–30 quintals of maize are also drivers of the disparity in price and acceptability. Although, when juxtaposed with other factors, small millets have a better yield potential, since they require less area than rice, for example, and can grow in less fertile soils.
- (d) **Inadequate or Inefficient Processing Facilities:** Based on technical meetings and reports reviewed, innovation is a major stumbling block. The feedback loop needed to improve on innovation, development, and use, while reducing drudgery is absent. With a general 60–65% recovery rate during processing, the “un-exploration” of by-products also contributes to the higher final selling price.
- (e) **Floundering Policy:** After the Green Revolution, the policymakers in India have supported the production of intensive crops in more choice resource areas [19], contributing to the decline of millets (although millets require less cultivation area). Another example is that the Indian Public Distribution System (PDS) in 2017 did not include small millets.



**Figure 3.** A model of food consumption in India.

### 3.2. Business Model Development

A cluster map for the small millets value chain in India has been conceptualized and presented in Figure 4 using the data from industry analysis. This cluster map also presents a visualization of the current state of development of each component in the Indian small millets value chain. For example, data from the industry analysis shows that most processing units use inefficient dehullers that increases post-harvest losses by up to 65%, access to microfinance is poor, infrastructure/logistic limits distribution, there is an absence of tailored marketing, e.g., development of familiar recipes and ready-to-eat millet products are almost non-existent. Interest exists from education, research, and quality control organizations, but not a lot of progress has been made by these players. International agencies (e.g., Global Affairs Canada) are actively involved in improving the situation of the small millets industry through commissioning and funding of projects aimed at enhancing the status and scaling up of the small millets value chain.



**Figure 4.** Cluster map and condition assessment of the Indian small millets value chain.

As shown, only a few areas are competitive, and business tools can be used for improving the cluster. Examples of such business tools include linkage maps analysis, gap analysis, and benchmarking, to mention a few. These tools are useful for the formation of a strategic initiative

at the center of which is a business model. However, it is important to note that the main players in the small millets value chain, such as farmers, processors, technologists, manufacturers, marketers, and policymakers, must be incorporated into every level of the business model. Also, since the drivers of the stagnation of the small millets value chain can be broadly categorized into either technical or marketing components; this business model must accurately tackle these categories. The technical resolution should involve a scale-up of the manufacturing of major processing and packaging machinery that have been developed by domestic, small, medium, and large-scale agribusinesses. As an example, new dehuller designs must be developed, and existing dehullers repaired or upgraded. This example is important, because dehulling is a labor-intensive process that slows down production efficiency, and mechanization of this process can reduce drudgery and help to improve the value chain. With regards to the marketing component, the business model must improve availability, and customer awareness, etc., for example, through the development of ready-to-eat (cakes, biscuits, noodles, and fast food) or ready-to-use (soup mixes, flours) millet products. A business model integrating these factors will have an increased potential for success.

The typical business models that have a good fit with this type of industry situation and its major players, while considering the peculiarity of the market, are the customer intimacy (CI) business model and the product leadership (PL) business type of models. The CI business model caters to the needs of the client; its organizational structure is a matrix of different disciplines, each providing the best possible input and the culture of this model is one of collaboration. This type of business model is essential for localization and customization of the small millets value chains through interaction and participation of the consumers. The PL business model thrives on the product quality i.e., the product sells itself. PL business models are project oriented with several project lines working independently in a competence-driven culture, where each project line depends on the quality and competence of its people, striving to provide the best product or service. This business model seeks to make the most desirable millet products with the lowest or best price. The business model canvas developed using the construct of Osterwalder [13] for both types of business models is shown in Figure 5.

#### BUSINESS MODEL DEVELOPMENT FOR SMALL MILLET VALUE CHAIN

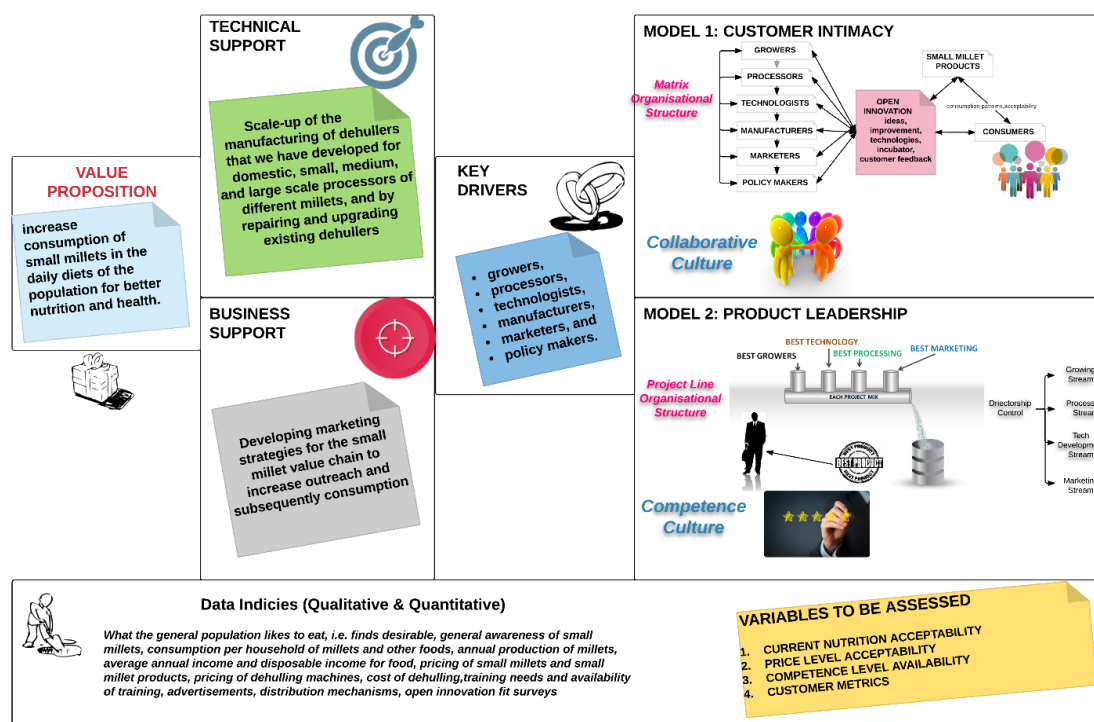


Figure 5. Business model development canvas for the small millets value chain.



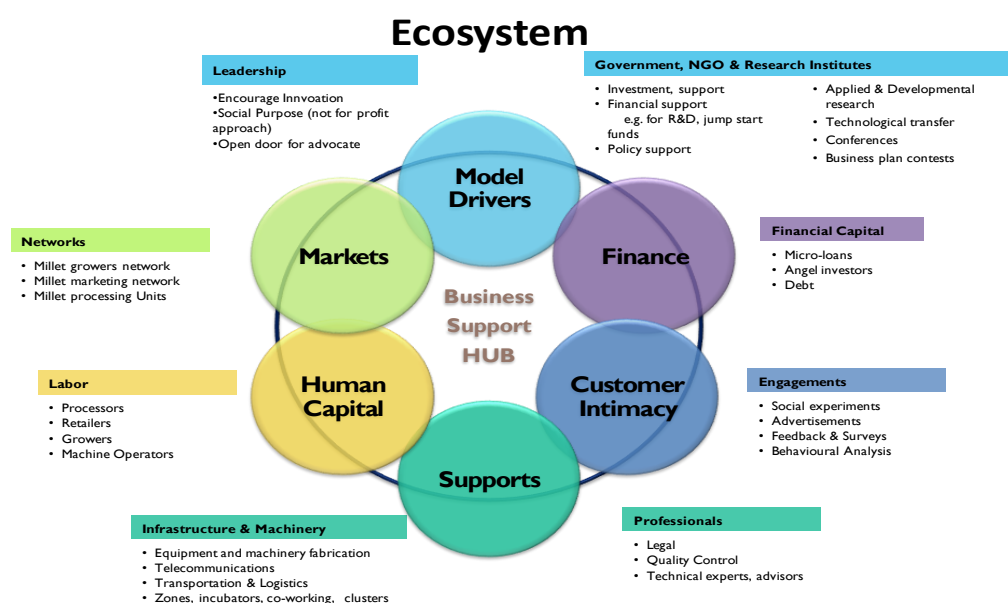
Using the data from the market analysis in the business model canvas, it appears that the small millets value chain development should be done with a CI–PL business model mix, especially since there are well-established alternatives (rice and wheat) in the Indian market. This model mix opens up the opportunity for the development of a unique incubator-style, open innovation-driven business model. This model will be unique to the small millets industry, because it allows for open information sharing and collaborative work between the major players of the value chain in a culture (Indian) that is typically segregating. In this proposed approach, growers, technologists, processors, and researchers will be working in a collaborative environment of producing, innovating, learning, and sharing knowledge, to improve market penetration of high-quality small millets and value-added products through innovation and technology. In this network, agribusinesses will be supported to improve yield, reduce drudgery, and improve marketing. As shown in the cluster map, these industries/components of the small millets value chain are not succeeding on their own, and this model will give them a chance to improve through the stimulations, supports, and collaborations that it fosters. Also, care will be taken to ensure minimal societal resistance that may arise with the agricultural innovation in developing climes [20]. The success of this model, therefore, relies a lot on the capabilities of the cluster heads, a reduced societal resistance and very importantly, the degree of coordination within the local domain.

#### Implementation of the Open Innovation-Driven Customer Intimacy Model for the Small Millets Value Chain

The success and validation of an adopted open innovation customer intimacy driven model within the small millets value chain depends on:

- Acquisition and sharing of internal knowledge from the major players in the small millets industry.
- Acquisition of external knowledge about the customer and the small millets industry.
- Improvement of the working relationships between the different components of the small millets cluster group.

With these factors in mind, an ecosystem for the open innovation model for the small millets value chain was conceptualized and is presented in Figure 6.



**Figure 6.** Ecosystem for a proposed open innovation concept for the Indian small millets agribusiness chain.

The ecosystem of this model is based on the logic that tackling issues that stymie small millets production expansion and efficiency with appropriate technologies will lead to the growth of agribusinesses in the value chain. More importantly, however, is the willingness of all the agribusinesses to participate in this type of model that encourages innovation and information sharing. The top end drivers of this ecosystem will be not-for-profit leadership, especially the Ministries of Agriculture in local governments of small millets producing areas to ensure maximum impact and accessibility. Through involvement, these local governments will also be responsible for advocacy of policy change at the federal level for political capital, due to the opportunity for locals' livelihood improvement. Agricultural engineering institutes will be responsible for developing "appropriate technology" and improved seedlings that can be tested by small millet processing units and small millet farmers, respectively. In the feedback loop encouraged by this model, iterations are expected to be faster, and the round-the-clock continuous improvements will lead to quicker adoption and spread of technology. Furthermore, when the technology is ready to be marketed, this model stipulates for the use of a central workstation, e.g., run by skilled local artisans for assembly and manufacturing to increase affordability. Non-governmental organizations (NGOs) with grassroots networks are important for coordinating surveys, sensitization campaigns, gender equity enforcement, and training for technological transfer. These NGOs are also very important for attracting international funds that can be used for commissioning studies and supporting specific small millets-oriented research. Improving market delivery through customer intimacy will be driven by food marketing companies, who can use easy access to information and products from growers to tailor their marketing to a specific population. Finally, this model incorporates the creation of a business hub, run at the local government level, to serve as a connector for small millet agribusinesses, as well as the provision of specialized services, such as legal aid, control quality experts, advisors at subsidized prices (volume incentivized). A major step towards model implementation would be the commencement of a business incubator, where all representatives described above will have workspaces to facilitate interaction. Finally, testing and implementation of the proposed model and timelines are presented in Table 1.

**Table 1.** An implementation guide for executing the open innovation concept in the small millets value chain.

Tasks	Timeline
<b>Stage 1 (Initiation):</b> Determination of the direction and responsibility of each of the components in the small millets cluster. Redefinition of achievable goals on a 5-year scale. Discussion/resolution of concerns and potential problems.	1 year
<b>Stage 2 (Engagement):</b> Stakeholders engagement for determining the need & feasibility of innovations in their sector as well for other drivers in the ecosystem within the cluster.	1 year (concurrent with stage 1)
<b>Stage 3 (Monitoring):</b> Development of a feedback loop for sharing information within the small millets value chain cluster. Performance assessment Information review	Continuous
<b>Stage 4 (Continuous Improvement):</b> Incubator organization support adjustments Review and modify information sharing loops, policies, and procedures. Analyze feedback, more surveys to access success within the small millets value chain (mostly with reach and sales). Market & Customer Surveys	Continuous



### 3.3. Supporting Cases

Open innovation supported business models are increasingly being developed for Agrifood business chains. Although this approach is not as common as can be found in the electronic (GE, Samsung) or manufacturing (LEGO) industries [21,22]. Case studies of the Hungarian Wine Sector [23] and the Coconut Growers Association in Trinidad and Tobago [24] are examples of success stories that can be looked at as examples. A case study that bears some striking similarities to the proposed model to improve the small millets value chain in India is Unilever. Unilever focuses on international markets in developing countries and its operation, product development, and innovation is driven by customer preferences. In their ecosystem cluster, other components include suppliers and universities, and they have been able to achieve tremendous success. These model parameters are to be examined with a customized survey which will be carried out to acquire stakeholders' views, gain more knowledge on the current small millets value chain, and identify innovation issues that need to be tackled. The customized survey will also aim at classifying the current stakeholders into functional categories (e.g., growers, processors, marketers, etc.), acquire their business goals and objectives, ownership structure, employee strength, access to information capital requirements, and incentives needed. Surveys may be carried out according to any international surveying guides.

### 3.4. Marketing Plan

With the business model selected, the highlights of a suitable marketing penetration strategy are explored and presented. Although there may not be any specific financial objectives for the project as stated above, the small businesses of the clusters represented should have their specific goals (complete with financials). For example, the marketing plan that an execution of this project can undertake (within the available budget), in general, can be as outlined in Table 2 (and as applicable within the cluster).

**Table 2.** Sample marketing plan to drive the small millets industry using the model presented.

Item	Actions
Nutritional awareness drive of the small millets value chain and methods of sales amongst the Indian populace	Capitalize on the healthy drive around the world Health Rallies Free giveaways at clinics as alternatives to prevent diagnosis or prognosis
Intense Advertising	Social media: Food challenges, hashtags, promotions on Twitter®, Facebook®, Instagram®, and Snapchat® Cooking Competitions Sales Kiosks Tricycle Branding Posters Special Millet Carts for value-added products Occasional TV adverts
Educational and Policy Drives (Campaign policy makers and the customer)	Capitalize on the wave of concerns about climate change Emphasize the effects of intensive farming
New Product Development	Develop easy-to-use derivatives
Product Packaging Rebranding	Surveys to determine the best size, style, acceptable price range (needed)

## 4. Conclusions

This commentary established a roadmap to improving agribusinesses within the Indian small millets value chain, because of the impact that they can have in improving livelihood, and the environment and health of the Indian population. The approach presented in this work was based on available data, discussion inferences, and surveys in the customer, production, and policymaking realms of the Indian small millets industry. The analyses carried out in this work indicated that a potentially larger market exists for small millets in India, but this is weakened by the poor state of

several facets of the value chain. The weakest links in this cluster map were identified to be technology, innovation, supply chain, policy making, distribution, packaging, and new product development. In particular, the results indicated the need for a customer intimate and product excellence approach to enable small millets-focused agribusinesses to reclaim the market share it lost to alternatives such as rice and wheat. Therefore, to improve this value chain, an open innovation business model approach capable of strengthening these identified weak links of the cluster map was developed. The developed business model specifically promotes information sharing, innovation, collaboration, and feedback loops within the value chain, and successful supporting cases of similar approaches were presented. Finally, an implementation guide for the adoption of this model has been presented for use in a related small and medium-sized enterprise (SME) project, to help in the development of a small millet business incubator, and to guide policymakers. Indeed, a more empirical data is needed to improve the model, especially since the business model type approach offers the opportunity for continuous improvement. Overall, it is expected that the conceptualized model will help agribusinesses in the small millets value chain to grow, and that the Indian nation will be the better for it.

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**Conflicts of Interest:** The authors declare no conflict of interest.

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