sustainability

MDPI

Article

Sustainable Agricultural Business Model: Case Studies of Innovative Indian Farmers

Paul Hong [1], Balasudarsun N. L. [2,*], Vivek N. [3] and Sathish M. [2]

[1] John B. and Lillian E. Neff College of Business and Innovation, The University of Toledo, Toledo, OH 43606, USA
[2] Symbiosis Institute of Business Management, Symbiosis International (Deemed University), Bengaluru 560100, India
[3] PSG Institute of Management, Coimbatore 641004, India
* Correspondence: balasudarsun@sibm.edu.in; Tel.: +91-9952626299

Abstract: Agriculture and allied sectors are the mainstays of the Indian rural population and yet, the vast majority is still poor. The Indian government has introduced pro-farmer schemes and policies for their quality of life, but the improvement rate of their quality of life is still relatively slow. In this context, this paper presents a sustainable agricultural business model (SABM), which defines contexts, practices, and outcomes. This SABM is compared with the conventional agricultural business model (CABM). Innovative farmers were selected from different parts of India. Their practices are examined with key performance indicators (KPIs) regarding strategic focus, labor productivity, vital resources usage, soil maintenance, output quality, and revenue performance. Case study results suggest that farmers that adopt SABM are innovative and productive with a better quality of life. In contrast, those who follow CABM are characterized by relatively low productivity and continuous hardships. Lessons and implications, along with future study topics, are discussed.

Keywords: sustainable agricultural business model (SABM); conventional agricultural business model (CABM); vital resources usage; soil maintenance

Citation: Hong, P.; N.L., B.; N., V.; M., S. Sustainable Agricultural Business Model: Case Studies of Innovative Indian Farmers. *Sustainability* **2022**, *14*, 10242. https://doi.org/10.3390/su141610242

Academic Editor: Carlos Rodríguez Monroy

Received: 30 June 2022
Accepted: 14 August 2022
Published: 17 August 2022

1. Introduction

India is a country where a huge segment of the population is involved in agriculture. Raising the quality of their lives is an important agricultural policy priority [1]. The government's massive subsidies have supported Indian farmers and the sustainable agricultural farming model has been presented for years [2,3]. However, Indian farmers, in general, remain poor with an inadequate understanding of sustainable farming for their productivity and quality of life enhancement [4]. Compared to advanced nations, the productivity of Indian farmers is still very low and their income growth potential is limited [5]. Indian farmers wrestle with basic objectives—productivity and quality. Small farmers are not able to fulfill sustainability goals that require the proper basis of productivity, quality, and value chain network capabilities.

Interesting research is about how to guide how small-scale Indian farmers achieve their goals for sustainable farming [6]. For this purpose, we present a sustainable agricultural business model (SABM) in India and other regions (e.g., U.S.A., Mexico, Europe, Africa, Northeast Asia—China, Korea, and Japan) [7,8]. Some regions (e.g., U.S.A., Mexico, Europe, and Northeast Asia) use technology for efficient usage and to reduce water consumption in agriculture [9]. On the other hand. India's agriculture on average requires more water than the other regions. India has the advantage of three seasons for cropping with the possibility of multi-cropping and intercropping, whereas Northeast Asia, and Europe has got either one or two cropping seasons [10]. A large scale of farming is common in the U.S. However, most of India's farming is on a small scale like other regions (e.g., Korea, Japan, China, and African countries). India's SABM is labor intensive with relatively low productivity [11].

The sustainable agricultural business model offers how Indian farmers employ innovative methods that enhance productivity gains.

This paper aims to present a research model that defines the contexts, practices, and outcomes of sustainable agricultural farming in contrast to a conventional agricultural farming model. Our research question is, "What are the sustainable farming practices in India, and how they are being implemented in different regions"; "To what extent sustainable agricultural farming model has been implemented in grass root level?" To examine these questions, we use case study methods. We involve four different types of farming patterns and report our findings. As a practical step, different research models show how Indian farmers choose what is best for them to move toward quality of life. The discussion section further explains a typology of a sustainable farming model based on partnership scope and economic impact. Lessons and implications are also discussed. India is a major agricultural producing country. Although sustainable farming has been discussed, very little research is available in the Indian context. Some studies have a theoretical and practical business model in the agricultural food sector, ignoring sustainability and innovations in a farming system [8].

2. Key Issues of Agriculture Farming in India

India is the world's second-largest producer of rice, wheat, sugarcane, cotton, groundnuts, fruits, and vegetables [11]. Total agriculture production is recorded at around 303.34 million tonnes as of 2020–2021 [12]. The agriculture sector is predicted to increase by USD 24 billion by 2025 [13]. Post-pandemic consumer spending on food products is expected to grow by 6.6% [12]. With an increasing middle-class segment in India, the growth prospect of organic farming is impressive at a 10% compound annual growth rate (CAGR) between 2015 and 2025 [13]. In this context, the government of India is taking strong policy initiatives to promote sustainable farming with a cumulative budget flow of USD 10.94 billion between 2000 and 2021 [11]. However, sustainable agricultural farming needs to achieve the triple bottom line goals (i.e., economic growth, environmental protection, and social justice) [14]. This means that careful steps must be taken to address operational and process issues to make sustainable farming a reality in India [15].

First, sustainable farming in India requires *improving productivity for economic benefits* for participating Indian farmers. India's agricultural productivity is lower than other neighboring countries (e.g., Bangladesh and Vietnam), the production cost for most crops is high, financial benefits are lower for farmers, and income inequality among rural farmers across the country is serious [2]. Second, the desirable factors of sustainable farming include collaborative/collective work, good quality of soil, and less usage of fertilizers [6]. High agricultural productivity is essential for sustained income growth, which leads to a better quality of life. However, conventional farming methods are not noted for adopting innovative farming methods for continuous productivity improvement. Third, sustainable farming in India demands social justice for Indian farmers, which is about receiving a fair share of value for their labor. Although Indian farmers create and deliver value through their hard work, a tiny percentage of total value is what they receive as a reward for their work [16]. Government subsidy in the form of the minimum supporting price is not even adequate to meet the basic agricultural production costs (e.g., cost of seeds, minimum labor wages, and water bills). Social costs of poor infrastructure (e.g., water, electricity, inefficient road system) plus uneven middlemen involvement raise the prices charged to the final customers of the agricultural products [17].

3. Agriculture Farming Models in India

Since India's agricultural sector is huge, agricultural farming models are quite diverse. India's agricultural business models reflect how farmers engage in value creation, delivery, and capture for their revenue generation through their production capabilities [18–20]. To discuss all of these models is beyond the scope of this study. Thus, this section focuses on the conventional and sustainable agricultural business model.

3.1. Conventional Agriculture Farming Business Model

Conventional agricultural farming is defined as "an agricultural process if they include synthetic chemical inputs like fertilizers, fungicides are used, and a higher level of external inputs are used" [21]. Farmers in India produce their products with the help of chemical fertilizers, pesticides, and subsidized resources, such as electricity and water, which pass on to the final consumers after incurring additional cost layers of intermediaries [22]. These intermediaries occupy their privileged positions to make up for a lack of infrastructure to serve the needs of the final consumers. Their sheer number has a very adverse effect as they do not increase the product's substance value at all stages but rather keep increasing the non-value-added costs [23].

3.2. Sustainable Agriculture Farming Business Model

The sustainable agriculture business model is "integrating plants and animal products and wastes for the purpose of satisfying human and society needs, focusing on best environmental practices, maximum utilization of natural resources to integrate the natural biological cycles, best-farming operation practices, upgrade and raise the farmers' life and the entire society as such" [24].

Figure 1 shows a sustainable agricultural business model that presents different contexts, practices, and outcomes. Defining opportunities for farmers is crucial to developing innovative farming production methods. Moreover, natural and organic farming requires relevant knowledge acquisition and dissemination. Benchmarking allows farmers to adopt the right growth models that fit their circumstances. An entrepreneurial mindset allows farmers to increase revenue sources, diversify their farming options, and increase their value capture through better technology and strategic cost management. Sustainable agri-outcomes are increased value per farmer (i.e., productivity enhancement), products free from pesticides and chemical fertilizers (i.e., green products), and products that are sold at higher prices in the market (i.e., premium value), which result in a high income for farmers [24]. There has been some research on sustainable agricultural models in terms of various regions, countries, and continents. Different agriculture business models were examined on improving the quality of farmers' life in the earlier studies [25,26] There are a few pieces of research on the sustainable agricultural business model (SABM) in other contexts [27,28]. The sustainable agricultural business model is rich and diverse. A conceptual framework that encompasses different styles of sustainable farming is not noted in these studies. In view of the rich and diverse SABM in India, this article presents a conceptual framework and examines different SABM practices through case studies.

	Contexts	Business Model	Outcomes
Conventional	1. Mono-cropping 2. Chemical/Industrial 3. Sizable machines/tools	1. Large resource investment 2. Environmental pollution 3. Efficiency-focused	1. Low profit 2. Declining soil quality 3. Declining productivity
Sustainable	1. Poly cropping 2. Organic/natural 3. Human-animal power	1. Small resource requirement 2. Eco friendly 3. Sustainability-directed	1. Competitive profit 2. Improving soil potential 3. Improving productivity

Figure 1. Conceptual framework: conventional vs. sustainable farming model.

4. Case Study Methods

Case study approaches include exploratory, explanatory, and descriptive methods. A credible case study design involves four stages of execution (i.e., data collection, critical analysis, conclusion/recommendations, and impact) [29,30]. This study follows the de-

scriptive approach as the objective is to document the current practices in a sustainable farm. Considering the additional intrinsic, instrumental and collective dimensions, this study also examines four separate cases to capture their various practices [31].

Despite the government's emphasis on more employment in the manufacturing and service sector, the farmers still maintain their cultivation through conventional activities. Scarcity of critical resources (e.g., water and electricity) and lack of applications of technological tools result in an overall poor yield of agricultural products. Recently, innovative initiatives have been involving natural, organic, and multi-crop cultivation [32]. The government of India injected various schemes to promote agriculture and organic farming and focus on farmers' welfare [33]. However, actual success cases are not widely seen throughout India. In this context, this case study highlights how Indian farmers change their cultivation methods, improve their soil types, adopt minimal resources, and achieve sustainable productivity and profit.

Case Study Process

Triangulation in case studies ensures the research validity through clarifying data source, investigator qualification, theoretical rationale, and methodological integrity [31,34]. For this study, data sources are specified and the credibility of data is ensured to draw generalized conclusions [29,31]. The theoretical basis of the study indicates the external validity of key constructs. Investigators are experienced researchers that have track records of scholarship.

Table 1 shows case study processes involving both the investigators and case study participants. Internal process refers to research team members' roles, responsibilities, and tasks. The external process is about the interactions, engagement, and activities related to case study participants.

Table 1. Case study process: research team and participating organizations.

Internal Process	Linkage Outcomes	External Process
Defining Case Selection Criteria: 1. Define research scope and focus 2. Select case criteria	Case Selection: 1. BTC (Technological) 2. Tatkim (State's support) 3. Kopi Taluk (Individual level) 4. DGL (Partnership)	1. Identify the potential participants 2. Choose from different states 3. Consider key relevant factors 4. Inquire about participation intent
Research Design • Form research team • Clarify research plans	Research Team Formation • Defining the roles and responsibilities of four researchers (Hong, Bala, Vivek, and Sathish)	Field Work Implementation • Schedule field interviews and visits • Conduct initial analysis
Research Execution • Schedule and conducts research team meetings (e.g., Zoom meeting, file sharing)	Research Teamwork Progress • Clarify research aim and scope • Conducts literature review • Approve overall research plans	Field Work Documentation • Document the field interviews and field visits. • Engage secondary data collection
Research Evaluation • Determine target journal • Monitor research progress	Research Paper • Write up the entire manuscript • Examine the flow of papers • Reach a consensus of the research team about the research paper	Field Work Feedback • Communicate the contents of case descriptions to case participants. • Incorporate the feedback and approval of case participants.

5. Case Descriptions

In this section, four cases are introduced. Each case is first characterized by the context of the case, business process model, and outcomes. Figure 2 shows the locations of four case studies. India's regional differences are noted in business culture, soil quality, cultivation methods, and climate conditions. For this study, two cases are from northern regions (i.e., BTC and Tatkim), whereas two points are from the southern areas (Kopi Taluk and DGL).

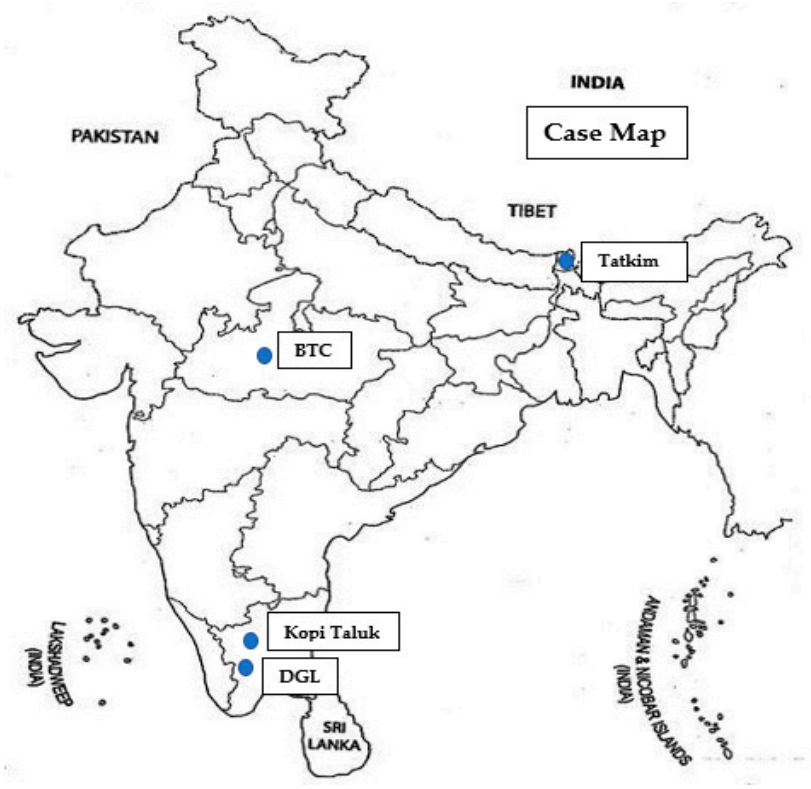

Figure 2. Case study locations in India.

5.1. BTC: Within State Technology-Enabled Farming in Central Pradesh

Farmers in Central Pradesh (CP) varied land sizes from under 5 to more than 12 acres. The farmer's average income is around USD 443 per year from soya beans and wheat. After the harvest, the farmers of CP need to carry their crops to the nearest Mandi for auction, nearly 30 to 50 km from the farmland. In Mandi, the commission agent (CA), the government-licensed agents, will execute the bid [35]. Once CA wins the auction, the farmer will bring the crop in tractors, and farmers will get money.

5.1.1. Context

BTC Chairman Dev challenged Mr. Kumaru to create a unique business plan under the Global Business Division, which would improve the commodities export of BTC in March 1999. Kumaru is aware that the Indian supply chain is not as sophisticated as other developed countries, especially in agriculture. As a result, he related the discussion with essential questions, such as "What can we do to secure the competitive advantage of the entire value chain which can reach its high and possible potential?" Then, as per the chairman's instruction, he started to understand the village, the nature of farmers, and the supply chain they follow. This can be improved to help BTC reach the Global Business Development (GBD) goal of USD 442 million in 2005. He added further that this model should be broken to achieve cost-efficiency. Team members felt there should be a new business model using digital technology to re-organize this channel system. Choupal is the traditional way of knowledge sharing, which is limited to verbal communication. However, the team felt that using technology for effective communication (D-Choup) would be highly productive [35]. The Kumaru team convinced BTC management that the concept of D-Choup was favorable. BTC supplied a computer kit to each village of the CP for technical usage. Internet connectivity is provided with a bit rate between 28.8 and 36 kbp, and 75% of the villages are covered as a part of this initiative with this Internet band. A power pack and solar power panel are also provided to handle the power shortage issues. The scheme provided a Dot-matrix printer for documentation purposes in the villages. Initially, BTC invested INR 40,000 to 100,000 for these fundamental arrangements.

In the conventional agriculture system, farmers used machine tools and chemicals for their mono-cropping style of farming. The technology used to predict the crop demand, weather prediction, pricing control, best practices (using organic fertilizer) followed in agriculture, and information about crop and market conditions, to enhance the farmers' understanding of crop market demand and pricing of the crops [35]. This initiative of BTC started with soya beans; now, it has moved to various products, such as coffee, wheat, rice, pulses, shrimp, etc.

5.1.2. Business Process Model

Indian farmers are predominately relying on the agriculture department for valuable insights on demand and weather. This source of information is only available for them to understand the modern farming best practices across the country [36]. This information was collected from government sources, such as university reports and meteorological department reports [37]. After harvesting, farmers bring the crops to mandis for sales; finally, payment will be delivered to farmers with a minimum duration of 3 to 6 months. The conventional business model is complex, with much intervention from market intermediaries. These middlemen raised the cost of procurement and followed unfair techniques to reduce the price of the crops [35]. Mandi operation consists of several stages, such as inbound logistics, display and inspection of the quality of the crop, the auction process by commission agents, bagging and weighing of the crops by agents, payments to the farmers, and outbound logistics.

The commission agent dominated the conventional distribution system, whereas the BTC D-Choup business process model worked with click and a mortar strategy [36]. In this model, physical support is done at the village level through the leader (the lead farmer who will act as an interface between the computer and farmer). This information is available to the farmers in the local language through the computer setup, and it will be located at the leader's house. Details, such as seed availability, fertilizer pricing, and best practices followed (sustainable farming) in the industry, will be available for the farmers' discussions. Information regarding weather forecasts and scientific farming helps the farmers select and produce the right crop category, improving productivity and developing an eco-friendly environment. The leader has access to this information and facilitates the farmers to disseminate this information. Market information helps the farmers understand the market conditions and demand, leading to better pricing strategies. Moreover, he also collates the communication among the farmers regarding seed requirement pesticides, identifies the best supplier, orders the product, and delivers it to farmers within the stipulated time. This process reduces the transaction cost and reduces the commission, which is depicted in Figure 3. D-Choup ensures the world-class quality of the product through this business model and ensures sustainability.

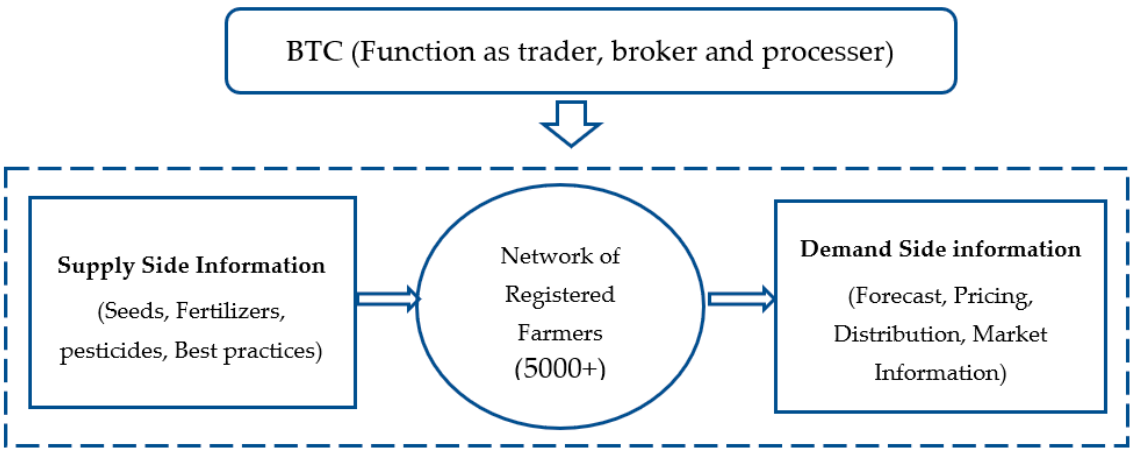

Figure 3. Business model of BTC (Source: Authors).

5.1.3. Outcome Measures

In June 2000, BTC started with six D-Choup, and now this model is India's largest Internet-based initiative. In 2003 it covered around 1900 D-Choup, linked 11,000 villages, and served approximately 1.2 million farmers across the country. After two decades, it is also a well-recognized rural digital infrastructure network of BTC Ltd. In 2019, this initiative installed around 6100 installations, covered 35,000 villages, and served more than 4 million farmers. The kiosks are managed by trained local farmers who help the local agricultural community to access the information in their local language. With appropriate knowledge and services available virtually at the farm gate, farmers have been able to raise productivity, improve soil quality, manage risk and earn better prices. By creating a more efficient marketing channel, D-Choup reduces transaction costs and helps farmers to adjust/fine-tune crop types and qualities to changing trends. The journey of BTC is incredible. Another path-breaking initiative called BTC's Choup Prader Kheet (CPK) was started in 2005–06 to help farmers improve their productivity and cover more portfolio crops. The portfolio includes crops such as soya, paddy, cotton, maize, bajra, wheat, gram, mustard, sunflower, and potato. This initiative had 83,388 members and covered 4.4 lakh acres under the crop development project. The excellent outcome is that around 5000 villages benefited; out of that, more than 10 Lakh farmers benefited. Furthermore, the income of 34,000 farmers increased their profit by 107% because of adopting best practices through D-Choup. Income was raised from 30% to 75% among the rest of the farmers.

5.2. Tatkim: Regional Scale Natural Farming

Tatkim, a small State in India, initiated a strategy called "one state at a time", declared 100% organic cultivation, and became the first State in India to follow organic farming methods [38]. Organic farming is growing around 12% per year. However, just 1.1% of the land is certified for organic farming worldwide [39]. One of the Asian countries, Bhutan, has been flagged as the first organic country in the world [40].

5.2.1. Context

Tatkim has pursued large-scale organic farming, and the entire state has become organic. The scope of organic activities includes mono-cropping and using tools for supporting activities. There were protests, dissent, and resistance. Civilians asked, "How could a state that does not produce enough for itself turn to organic methods?" There were worries that production would fall and costs would be involved—the farmers were barely sustaining themselves. "But people were convinced, if it is organic, there will be a valuable addition that can offer healthy products to both farmers and the consumers. Farmers have a terrain that cannot make them self-sufficient in food production. So, farmers decided to focus on what they can grow in Tatkim and give them the value of being organic", said one of the top officials from the Agriculture Department on Tatkim's organic success. Tatkim's sustainable farming focused on clean air and soil, with the source of good water and pure land [41]. The use of fertilizers and pesticides was reduced yearly, and the farmers were trained on the benefit of the organic mission.

5.2.2. Business Process Model

The State's organic transformation started in 2003 [38] as the government passed a bill to convert all cultivable land to organic farming [42]. Ref. [42] studied the policies impacting Tatkim's organic farming efforts after it went fully organic in 2016. The study identified four points related to this: lowered yields as possible constraints to the initiative, improving single commodity farming yields, collectivization efforts in production and marketing to get economies of scale for all crops, and education in organic philosophy and principles being central to sustaining the initiative. They have also suggested an agroecology model for farming, where trees are grown on farms as co-crops.

5.2.3. Outcomes Measures

On 18 January 2016, the Indian Government declared Tatkim the first organic State in India. Tatkim, a small state in Northeast India, became the first 100% organic-based farming state in the world. The State government has made a policy to transition from chemical-based to chemical and pesticide-free land. It also banned selling fertilizers and pesticides within the State. Ref. [38] has outlined the role of farmer–producer organizations in improving economies of scale, connecting to bigger markets, achieving value addition on various products to achieve better price realization, product of organic inputs on the farms, improved awareness of best practices, aggregated training efforts, shared infrastructure between farmers, and helping self-help groups (Figure 4). The State has also improved its infrastructure base, involved more self-help groups, provided crop insurance, reduced the role of intermediaries, undertaken research and development in organic farming, and enhanced value addition at the local level [43]. Refs. [44,45] have identified various impacts, such as better economic development, which has improved the lives of the entire community as more than 70% of them depend on farming for their livelihood, protecting the environment, conserving depletable resources, and vastly improving the quality of food items. Ref. [44] proved this farming mission significantly impacted soil quality and climate changes, leading to better yield and productivity. Beyond this, the State developed value-added products from their organic produce and set brand names with premium prices to attract domestic and international markets.

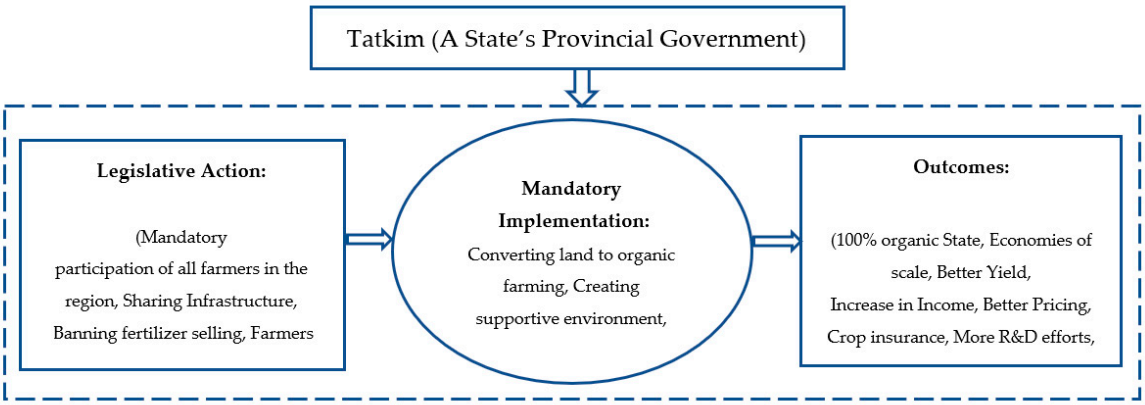

Figure 4. Business model of Tatkim (Source: Authors).

5.3. The Kopi Taluk: Individual Scale Natural Farming

The Kopi Taluk is comprised of 60 villages. One-third of the population [46] is engaged in agriculture, with significant production of paddy, coconut, sugarcane, banana, turmeric, and tobacco [46]. All of the farmers from this place slowly transitioned from natural farming to fertilizer-based farms over the decades.

5.3.1. Context

One Mr. Arucha is the 6th generation and educated (B. Tech-Agriculture Engineering) farmer interested in family farming activity in the 2000s. He noticed that his parents were not making a profit from mono-crop (paddy) cultivation on their 4 acres. He was upset about the low income against the hard work and efforts. After a detailed discussion with age-old farmers, he came to know that extensive use of pesticides and fertilizers spoiled the health of the soil and that natural nutrition contents diminished over time. They could get yield from a single crop that merely meets the production cost. High dependency on machinery and equipment (e.g., tractors) increased their cost. He has expanded his farming land from 4 to 12 acres and doubled his income by following practices such as human harvesting and moving from mono-crop to multi-crop.

5.3.2. Business Process Model

Arucha decided to change the farming strategy and strengthen the soil condition. Figure 5 illustrates how Arucha has designed the farm to be operationally lean. The waste from the cattle, goat, and poultry sheds is designed to go into a urine and dung pit from which, by gravity, it enters an artificial lake where it gets diluted. Fish grow in the lake and enrich it with their waste. Only water from this lake is used for irrigation.

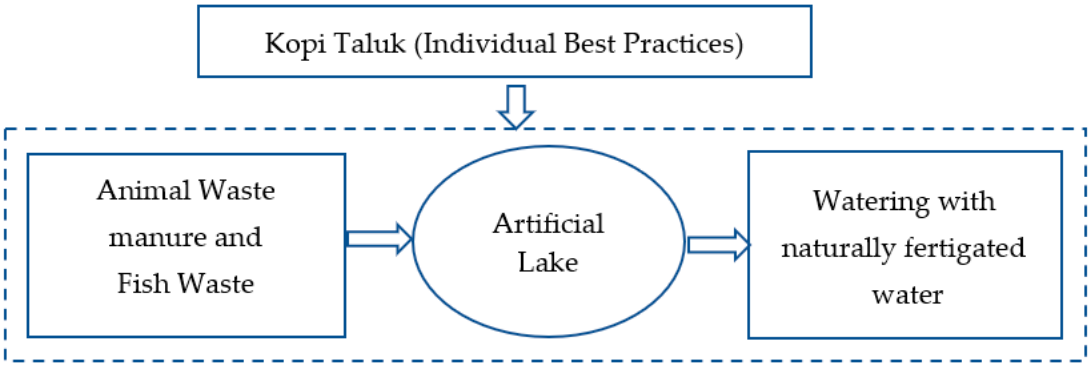

Figure 5. Business model of Kopi Taluk (Source: Authors).

No manual labor is required to ensure nutrient-rich irrigation water to the farm. Now, his farming practices are low cost of production, low level of labor requirement, low water requirement, no chemical inputs, no pesticide or insecticide, and higher yield. Multi-cropping and intercropping are the most critical features on his farm. A study in China has proven that intercropping increased the per unit area yield and substantially lowered pest and disease occurrence [47].

5.3.3. Outcome Measures

Arucha has ensured that he is not at the mercy of the market forces. He does not sell all of his produce directly to the market. In the case of sugarcane, he converts his produce into jaggery with a longer shelf life and higher value in the market. Similarly, he has cured, dried, and processed turmeric to increase its life to sell at a suitable time. He has a few years' stocks of processed turmeric to be sold when the price is right. His turmeric has a curcumin level of 4.5%, whereas turmeric available in the market has only around 2%. He also produces fodder to be used by his livestock. By forward integration in the value chain and performing value creation activities himself, he has ensured that he is not very dependent on intermediaries/private companies/speculators. A typical Indian Agri supply chain would involve the following agents—farmer, trader, commission agent, wholesaler, retailer, and consumer. Arucha has reduced the number of supply chain intermediaries, and thereby the final cost of his produce. In addition to the farm produce, Arucha earns money from selling cattle, poultry, and fish. His cattle have traditional breeds that do not require extra care or maintenance while growing to be sold to the market. Overall, by ensuring that production costs are very low and keeping human intervention to a bare minimum, Arucha currently earns on average a net income of INR 360,000 per annum per acre and reinvests the profits in acquiring more land; thereby increasing the sustainability of the business. Arucha intends to make nature do the work and merely to harvest the efforts put in by nature.

5.4. Case of DGL: Community Cooperatives Scale Natural Farming

Rainbow is a social community organization started on 21st October 2017 to support and protect natural resources (water, soil, natural fencing) and provide an efficient way of managing water. It is located at Vellodoo, a small village in the DGL district. The following are the objectives of Rainbow:

1. Rainwater harvesting, developing groundwater sources, water rejuvenation and recharge, and creating awareness on water management.
2. Green revolution: plantation, maintenance, and encouragement to go green.
3. Initiating natural and organic farming and educating the local farming community.

5.4.1. Context

The Vellodoo and Mallanatham villages from the DGL district have more than 1000 acres of cultivatable agricultural land. Forty years before, it was green, healthy, and rich soil, which helped with human well-being and healthy lifestyles. No one from these villages would have expected the green revolution to turn their lives around. To increase productivity, farmers used fertilizers and pesticides per the government's guidelines. It was a success in its early stages, but slowly, the land lost its charm of health and nutrition. It badly affected the environment, soil condition, and the economic and social welfare of people. At one point, the water level in the Wells went down and started digging into the earth through deep borewells. Unhealthy land consumed more water and human resources, but the yield was negative. Later in the 2000s, the villages became dry land, and farmers started selling it for windmill purposes recently.

5.4.2. Business Process Model

Rainbow initially formed a group with 20 farmers and educated them about organic farming, agriculture allied business, farming methods, rainwater harvesting, borewell rejuvenation, tree plantation, integrated farming, and so on. In addition, they organized several agriculture-related training programs for free through many volunteers, including Kumar, Saro, Chamy, Sharavan, Kumaresh, Soundar, and the Agriculture Officer, Mr. Raj. Rainbow also assisted in weather forecast through independent weatherman Selva, which helped them in plowing season and water irrigation [28]. Now, the Rainbow has more than 200 farmers together and has successfully opened organic stores in two different locations. The store procures all organic products produced by the local and organic farmers and caters to the local community. Mr. Balasubbu, one of the farmers from Vadukampadi and a close associate of Rainbow, said that they have reduced using chemical fertilizers and pesticides and even stopped weeding and that there are no chemical fertilizers used for weed control, which causes pollution and poisons fruits, vegetables, and the field. The existence of intermediaries does not help farmers to gain additional profits, which is illustrated in Figure 6. Direct marketing is the only way to overcome the existing crisis, said Peekay. Having an IT background, setting up an e-commerce website, Mannvaasanai (smell of earth), and competing with market challenges, it sells its entire organic product to consumers at the retail price or with a nominal increase (10%) to the existing rates as it eliminated the middleman. Peekay offers various programs to those interested in natural farming through his farm named Ranga Organic Farm (ROF).

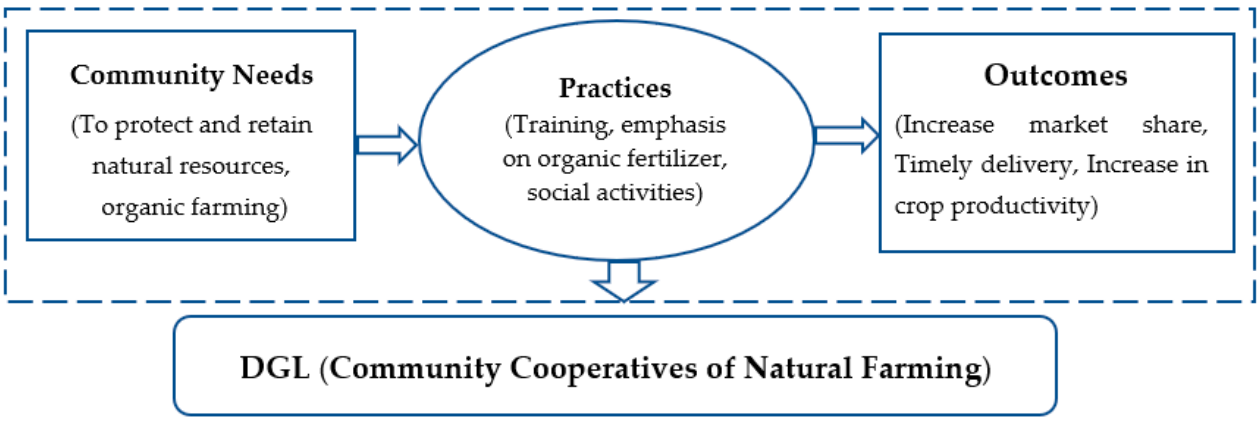

Figure 6. Business model of DGL (Source: Authors).

Farm Internship Program and Farm Visit: Farming is a labor-intensive profession and has a shortage of agricultural laborers. This internship program aims to achieve a win-win for both farmers and the interns (volunteers also learn farming methods) from various parts of the country and several educational institutions. The interns are paid and offered free accommodation with a kitchen, basic groceries, and fresh vegetables from the farm. They live as a farmer and manage the farm operation end-to-end themselves, learning hands-on experience of natural farming, micro irrigation, farm mechanization tools, preparing panchakavya, organic manure, fertilizer, and pest repellent. They are trained on seed collection, segregation, classification, and indigenous storage methods (in natural storage building construction). They experience value addition of products, packaging, direct marketing, and a healthy lifestyle. Farm visits encouraged the rest of the farmers to understand the importance of organic and natural farming activities. ROF documented the real-time experience, learning, and challenges they encountered at their farms to help the next generation of young farmers and farming aspirants.

5.4.3. Outcome Measures

Rainbow's rigorous activities changed the farmers' cultivation method from convention to natural farming but has yet to reach the benchmark. It also has taken several societal welfare-based activities. For example, the Kudakanaru River Dam is one of the major water storage sources for the farmers in the district, but the dam did not have water storage and distribution to the neighboring villages for some reason. Rainbow and its volunteers (including Mr. Ram, a senior person) initiated multiple levels of discussions with government officials and political parties to bring back water storage and water distribution to the local farmers through the dam. They had mass gatherings and protests against local bodies, water and irrigation departments, and the government.

Community Seed Bank for Native Seeds: The main objective is to collect, preserve, multiply and propagate native bio-diversified native seed varieties among farmers and home gardeners. For example, brinjal has 21 native varieties (Figure 7); rice has more than 800 native varieties. To maintain native seeds, they use locally available cost-effective, natural building materials to store native seeds, which is called a community seed bank (Figure 7).

Table 2 summarizes a comparison of four types of agricultural farming patterns. The four cases in this study demonstrate their unique practices in the form of distribution channel simplification, soil protection programs, environmental protection, livestock cycle management, and cooperative work methods. Through continuous improvement efforts, the outcomes are noteworthy in terms of cost reduction, agricultural productivity enhancement, environmental benefits, and revenue growth. These four cases suggest the diversity of options that can be implemented successfully in emerging economies, such as India, with realistic alternatives and tangible benefits. The case study findings indicated that the sustainable agricultural business model (SABM) is implemented at various levels—socio-technological, regional, individual, and community cooperative. All these cases show that SABM provides farmers with *higher* productivity, *a bigger* income stream, *a better* quality of life, *more* wholesome and nutrient-rich products for customers, and *longer* soil life extension. Based on the conceptual framework and the case findings, future studies may expand the scope of inquiries by using a large-scale survey that examines how different types of sustainable farming are implemented in India. Such studies may open research opportunities for other emerging Southeast Asia and African economies. Agricultural sectors are key to the sustainability of this planet. In this sense, a continuous fruitful research stream in sustainable farming is worth pursuing in the future.

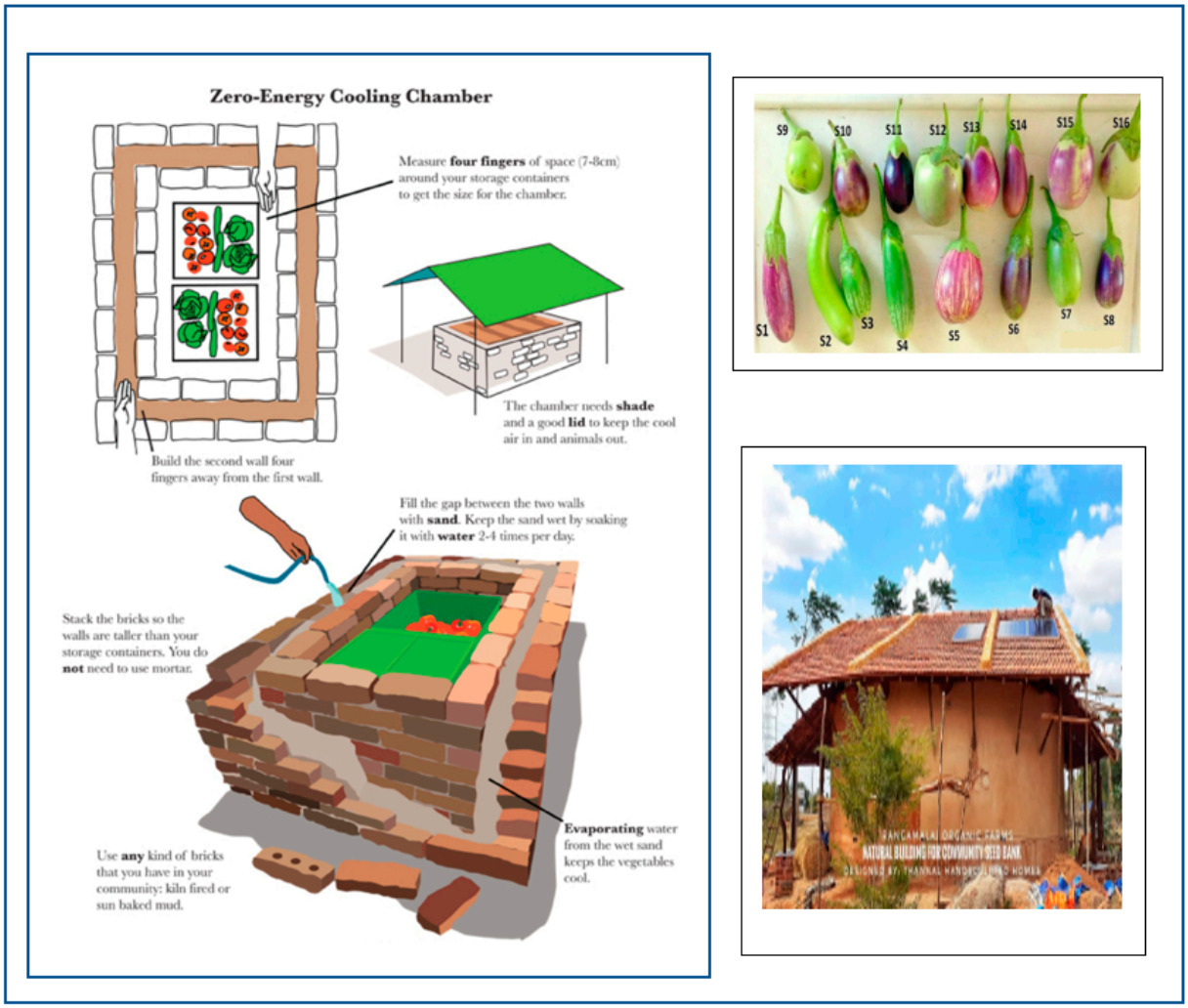

Figure 7. Cooling chamber and community seed bank (Source: manvasanai.in).

Table 2. Comparison of four cases: business model, practices, and outcomes.

	Business Model	Practices: Programs	Outcomes: Comments
BTC: Central India	Technology-enabled farming within a state	A joint partnership between Barat Tobacco Company (BTC) and 5000+ farmers through • distribution channel simplification • technology-enabled information services on weather forecasting, seed quality assessment, and selection of suppliers and fertilizers • education and training programs on supply chain management	• Cost reduction • Responsiveness to market changes • Revenue enhancement and increase in cash flows • A higher standard of living for farmers • Sustained business growth of BTC An example of a business-farmers partnership through technology enablement and field-based training programs.
Tatkim: North East India	Statewide implementation of natural farming	Active partnership between a state government and farmers through • soil protection program (e.g., minimal use of chemical fertilizers) • environmental protection (e.g., substitute to pesticides) • promotion of statewide natural-farming initiatives	• Soil quality improvement for multiple cropping • Agricultural productivity enhancement • Supply of healthy farm products to final customers • Export volume increase of farm products for domestic and international markets An example of public and private partnership

Table 2. *Cont.*

	Business Model	Practices: Programs	Outcomes: Comments
Kopi Taluk: South India	Entrepreneurial approach of natural farming	An innovative soil improvement practice by an entrepreneurial farmer through • innovative problem solving (e.g., mulching, artificial ponds, intercropping) • livestock cycle management (e.g., animal manure for fertilizer usage) • diversification of value-added products (e.g., sugarcane, tamarind)	• Input cost reduction • Robust plants growth • Higher productivity of organic products • Family business income growth An example of agri-cultural family ownership
DGL: South India	Community cooperatives of natural-organic farming	Community cooperatives through • employing collaborative work methods: • sharing best practices of farming methods • marketing value-added agri-products through "Rainbow" (i.e., organic stores) • utilizing the expertise of a professional agricultural officer	• Timely delivery of healthy seasonal agri-products • Better access to government subsidies/benefits • Increase market share through organic stores • Increase in crop productivity An example of community cooperatives

6. Implications of the Study

This is a rare study that examines various patterns of agricultural farming methods in India. A brief summary of this study suggests the following observations: (1) the consumption level of natural and other resources needs to consider replenishable capability; (2) the protection of the ecosystem is an important priority of any sustainable farming efforts; (3) successful sustainable farming initiatives requires the support of the majority of the farming community; (4) a profitable financial outcome is an essential ingredient of successful projects; and (5) the nutritional value of sustainable farming methods needs to be at least equal or superior to that of conventional farm produce.

The above lessons are expected from any kind of setting, for any kind of crops, and on any scale of operations. The four case studies discussed are all of different scope, scales, and climatic settings. The growing seasons and the crops considered are different. Yet each of the four has managed to satisfy the five goals of a sustainable farm mentioned above. Hence, these goals can serve as a checklist for any new sustainable farming activity in any new setting across the world, whether it be in Africa, Northeast Asia, or even the U.S.A. In these four cases, only one of them has been driven by clear government policies, which has led to the total coverage of the entire state under the umbrella of sustainability. In other cases, in the absence of strong government-level policy support, this initiative tends to flourish only in pockets, mainly because of the deep conviction and perseverance of selected individuals who brave all odds to travel the difficult path until they achieve the goal. Often it takes decades to attain the goals as this is uncharted territory and a deep level of conviction, education, patience, and support is required to make this happen. It is often like swimming against the current in a river, which is not only difficult but also fraught with difficulties and challenges to meet. This is one of the reasons why it becomes difficult to do a survey study on topics such as this. There is a lack of sufficient numbers of cases and even in the ones available, the practices, settings, and challenges are unique to each of them, which is why the case approach is probably the best approach to studying and publishing the stories in a research context.

The research model and case studies highlight the practices of the sustainable agri-cultural farming model. What matters is not abstract, macro-, and policy-level planning and discussions, but grassroots level implementation to make fundamental changes in huge Indian farms. Farmers are a huge repository of agricultural wisdom. They should

be made to realize that it is possible to make nature work for them in an integrated farm management scenario. They need to become sensitive to the fact that the requirements for a farm should be met from within that ecosystem and structure their farming systems accordingly. This would also reduce farmers' dependence on government schemes, policies, and subsidies. Our research model and practical case studies provide actionable paths for Indian farmers of all sizes. Future research should concentrate on understanding the rationale behind the high prices of organic produce, farmers' resistance to shifting back to natural farming, and low investment options to farmers for processing and value addition of their products before selling to the markets.

The major principles of sustainable farming have been codified so that they can be used as a generalized set of practices in any setting in the world. The model here identifies the practices, policies, and education drive needed to initiate and sustain the initiative. This study suggests that without government support, the adoption of organic agriculture seems to be a highly challenging task in a situation where the majority of the farmers fall under the small and marginal category. Hence, to promote organic farming in a developing country, such as India, the government has to invest more in schemes where farmers should get exclusive training and support to strengthen their intention behind the adoption of organic farming.

7. Limitations of the Study

This study involves in-depth case studies of four different types. Four case studies are not large enough to draw generalized conclusions. Despite this limitation, this study's findings provide valuable lessons and implications. These case studies represent relevant practices of SABM, but do not exhaustively depict the nature and scope of sustainable farming in India. Therefore, caution needs to be taken to generalize about India's SABM based on the limited case studies. This study has considered four cases in different backgrounds and hence is constrained for data availability. The case study has used the published literature from various sources, and hence the variance in data reported is a possibility. Organic farming, though appreciated, is a fragmented set of practices and each practitioner uses totally different sets of theories and inputs. This makes a generalization attempt extremely difficult and subjective even though it is of global importance. Organic farming has had its share of ups and downs, meaning it takes a long time of sustained efforts to reach any level of consistency to be generalized. This has severely reduced the number of available instances for the selection of cases in this research. Despite such limitations, this study provides theoretical and practical implications.

8. Conclusions, Recommendations, Future Research

Our research has several practical implications. Table 2 shows how these four patterns are classified regarding partnership type and economic impact. First, there are ample opportunities for testing this sustainable agricultural farming model. All these four cases do not require huge investment, nor do they demand government subsidies. The process is not complex, either. Since our sustainable agricultural business model (SABM) is implementable at the grassroots level, this is highly actionable. Second, SABM is also applicable in different contexts. A vast majority of Indian farmers have a small size of land.

Therefore, a practical model requires flexible types of partnership. Indian farmers may prefer to adopt any model on an individual basis. This SABM is relevant to such farmers. At the same time, individual farmers and entrepreneurial businesses can cooperate to create win-win partnership scenarios. Our case presents such an example that it will likely achieve a bigger economic impact. This model also provides how public–private partnerships may result in positive productivity gains and revenue enhancement outcomes.

Author Contributions: All authors have contributed to the research equally. P.H. contributed to conceptualize, organize, oversee and implement the research process. B.N.L. contributed to formulate the research idea and developed case scenarios of Kopi and DGL. V.N. contributed to plan and

conduct case scenario of Tatkim. S.M. contributed to case scenario of BTC and formatting the con-tent. All authors have read and agreed to the published version of the manuscript.

Funding: There is no funding sought for this research.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

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

References

1. Kingwell-Banham, E. Dry, rainfed or irrigated? Reevaluating the role and development of rice agriculture in Iron Age-Early Historic South India using archaeobotanical approaches. *Archaeol. Anthropol. Sci.* **2019**, *11*, 6485–6500. [CrossRef]
2. Suresh, A.; Krishnan, P.; Jha, G.K.; Reddy, A.A. Agricultural Sustainability and Its Trends in India: A Macro-Level Index-Based Empirical Evaluation. *Sustainability* **2022**, *14*, 2540. [CrossRef]
3. Laborde, D.; Mamun, A.; Martin, W.; Piñeiro, V.; Vos, R. Agricultural subsidies and global greenhouse gas emissions. *Nat. Commun.* **2021**, *12*, 2601. [CrossRef] [PubMed]
4. Kumar, P.; Singh, S.S.; Pandey, A.K.; Singh, R.K.; Srivastava, P.K.; Kumar, M.; Dubey, S.K.; Sah, U.; Nandan, R.; Singh, S.K.; et al. Multi-level impacts of the COVID-19 lockdown on agricultural systems in India: The case of Uttar Pradesh. *Agric. Syst.* **2020**, *187*, 103027. [CrossRef]
5. Jouzi, Z.; Azadi, H.; Taheri, F.; Zarafshani, K.; Gebrehiwot, K.; Van Passel, S.; Lebailly, P. Organic Farming and Small-Scale Farmers: Main Opportunities and Challenges. *Ecol. Econ.* **2017**, *132*, 144–154. [CrossRef]
6. Agarwal, B. Can group farms outperform individual family farms? Empirical insights from India. *World Dev.* **2018**, *108*, 57–73. [CrossRef]
7. Aznar-Sánchez, J.A.; Belmonte-Ureña, L.J.; Velasco-Muñoz, J.F.; Manzano-Agugliaro, F. Economic analysis of sustainable water use: A review of worldwide research. *J. Clean. Prod.* **2018**, *198*, 1120–1132. [CrossRef]
8. Barth, H.; Ulvenblad, P.O.; Ulvenblad, P. Towards a conceptual framework of sustainable business model innovation in the agri-food sector: A systematic literature review. *Sustainability* **2017**, *9*, 1620. [CrossRef]
9. Ochoa-Noriega, C.A.; Aznar-Sánchez, J.A.; Velasco-Muñoz, J.F.; Álvarez-Bejar, A. The use of water in agriculture in mexico and its sustainable management: A bibliometric review. *Agronomy* **2020**, *10*, 1957. [CrossRef]
10. Juhász, C.; Gálya, B.; Kovács, E.; Nagy, A.; Tamás, J.; Huzsvai, L. Seasonal predictability of weather and crop yield in regions of Central European continental climate. *Comput. Electron. Agric.* **2020**, *173*, 105400. [CrossRef]
11. Pradhan, K.C.; Mukherjee, S. Examining Technical Efficiency in Indian Agricultural Production Using Production Frontier Model. *South Asia Eco. J.* **2018**, *19*, 22–42. [CrossRef]
12. Soshte, R. A Study on Development of Agricultural Sector in India. *Think India J.* **2019**, *22*, 1–5.
13. *Agriculture in India: Information about Indian Agriculture Importance*; Agriculture and Allied Industries Report; Indian Brand Equity Foundation: New Delhi, India, 2022.
14. Lichtfouse, E.; Navarrete, M.; Debaeke, P.; Souchère, V.; Alberola, C.; Ménassieu, J. Agronomy for sustainable agriculture. A review. *Agron. Sustain. Dev.* **2009**, *29*, 1–6. [CrossRef]
15. Constance, D.H. Sustainable agriculture in the United States: A critical examination of a contested process. *Sustainability* **2010**, *2*, 48–72. [CrossRef]
16. Dabholkar, S.A. *Plenty for All*, 3rd ed.; Farmers Problems and Solutions in India: Problems in India; Mehta Publishing House: Pune, India, 2011.
17. Ceballos, F.; Kannan, S.; Kramer, B. Impacts of a national lockdown on smallholder farmers' income and food security: Empirical evidence from two states in India. *World Dev.* **2020**, *136*, 105069. [CrossRef]
18. Groot, A.E.; Bolt, J.S.; Jat, H.S.; Jat, M.L.; Kumar, M.; Agarwal, T.; Blok, V. Business models of SMEs as a mechanism for scaling climate smart technologies: The case of Punjab, India. *J. Clean. Prod.* **2019**, *210*, 1109–1119. [CrossRef]
19. Velu, C. A systems perspective on business model evolution: The case of an agricultural information service provider in India. *Long Range Plan.* **2017**, *50*, 603–620. [CrossRef]
20. Sengupta, T.; Narayanamurthy, G.; Hota, P.K.; Sarker, T.; Dey, S. Conditional acceptance of digitized business model innovation at the BoP: A stakeholder analysis of eKutir in India. *Tech. Soci. Change* **2021**, *170*, 120857. [CrossRef]
21. Sumberg, J.; Giller, K.E. What is 'conventional' agriculture? *Glob. Food Secur.* **2022**, *32*, 100617. [CrossRef]
22. Sarkar, B.; Icar, S.; Kumar, U.; Sarma, K. Traditional Agricultural Tools used by Tribal Farmers in Eastern India. *Res. J. Agric. Sci.* **2015**, *6*, 215–219.
23. Linder, J.C.; Cantrell, S. Five business-model myths that hold companies back. *Strategy Leadersh.* **2001**, *29*, 13–18. [CrossRef]
24. Velten, S.; Leventon, J.; Jager, N.; Newig, J. What is sustainable agriculture? A systematic review. *Sustainability* **2015**, *7*, 7833–7865. [CrossRef]

25. Hernandez-Aguilera, J.N.; Gómez, M.I.; Rodewald, A.D.; Rueda, X.; Anunu, C.; Bennett, R.; van Es, H.M. Quality as a Driver of Sustainable Agricultural Value Chains: The Case of the Relationship Coffee Model. *Busi. Strate. Environ.* **2018**, *27*, 179–198. [CrossRef]
26. Di Vaio, A.; Boccia, F.; Landriani, L.; Palladino, R. Artificial intelligence in the agri-food system: Rethinking sustainable business models in the COVID-19 scenario. *Sustainability* **2020**, *12*, 4851. [CrossRef]
27. Cederholm Björklund, J. Barriers to Sustainable Business Model Innovation in Swedish Agriculture. *J. Entrep. Manag. Innov.* **2018**, *14*, 65–90. [CrossRef]
28. Ioannis, M.; George, M.; Socrates, M. A community-based Agro-Food Hub model for sustainable farming. *Sustainability* **2019**, *11*, 1017. [CrossRef]
29. Yin, R. *Case Study Research: Design and Methods*, 2nd ed.; Sage Publishing: Thousand Oaks, CA, USA, 1994.
30. Yin, R. *Applications of Case Study Research*; Sage Publishing: Newbury Park, CA, USA, 1993.
31. Stake, R. *The Art of Case Research*; Sage Publishing: Newbury Park, CA, USA, 1995.
32. Narayanan, S. *Organic Farming in India: Relevance, Problems and Constraints*; Open Government data (OGD) Platform India; Department of Economic Analysis and Research, National Bank for Agriculture and Rural Development: Mumbai, India, 2005.
33. Varshney, D.; Kumar, A.; Mishra, A.K.; Rashid, S.; Joshi, P.K. India's COVID-19 social assistance package and its impact on the agriculture sector. *Agric. Syst.* **2021**, *189*, 103049. [CrossRef]
34. Denzin, N. *The Research Act*; Prentice Hall: Englewood Cliffs, NJ, USA, 1984.
35. David, M.; Upton, V.; Fuller, A. The ITC eChoupal Initiative. *Harv. Bus. Rev.* **2004**, *9*, 1–20.
36. Anuj, G.; Philip, M.; Parker, I.T.C. *E-Choupal (B), Revolutionizing Agriculture In India by Propagating Technology*; INSEAD The Business School for the World: Paris, France, 2016.
37. Bello, W.B. Problems and Prospect of Organic Farming in Developing Countries. *Ethiop. J. Environ. Stud. Manag.* **2008**, *1*, 36–43. [CrossRef]
38. Kumar, J.; Pradhan, M.; Singh, N. Sustainable organic farming in Sikkim: An inclusive perspective. *Lect. Notes Electr. Eng.* **2018**, *435*, 367–378.
39. Paul, J. Four New Strategies To Grow the Organic Agriculture Sector. *Agrofor* **2018**, *2*, 122. [CrossRef]
40. Feuerbacher, A.; Luckmann, J.; Boysen, O.; Zikeli, S.; Grethe, H. Is Bhutan destined for 100% organic? Assessing the economy-wide effects of a large-scale conversion policy. *PLoS ONE* **2018**, *13*, e0199025. [CrossRef] [PubMed]
41. Kumar, A.; Babu, S.; Singh, R.; Saha, S.; EL, M.B.; Devi, R.L.; Mishra, V.K. Integrated Organic Farming System (IOFS): An Holistic Approach for Food, Nutrition and Livelihood Security of Marginal and Small Farmers in Terraces Land of Sikkim Himalayas. *Agricolation* **2022**, *1*, 122.
42. Meek, D.; Anderson, C.R. Scale and the politics of the organic transition in Sikkim, India. *Agroecol. Sustain. Food Syst.* **2020**, *44*, 653–672. [CrossRef]
43. Gurung, R. Sikkim's Organic mission: Role of farmer producer organisations. *Indian J. Hill Farming* **2020**, 139–144.
44. Singh Verma, J.; Sharma, P. Potential of Organic Farming to Mitigate Climate Change and Increase Small Farmers' Welfare. *A J. HIPA Shimla* **2019**, *6*, 139–156.
45. Sharma, C.R. Perspectives of Organic Farming in Sikkim: A Descriptive Approach. *Int. J. Rese. Public Rev.* **2021**, *1210*, 7421.
46. Census Organization of India. *Villages and Towns in Gobichettipalayam Taluka of Erode*; Census Organization of India: Tamil Nadu, India, 2015.
47. Liang, K.; Yang, T.; Zhang, S.; Zhang, J.; Luo, M.; Fu, L.; Zhao, B. Effects of intercropping rice and water spinach on net yields and pest control: An experiment in southern China. *Int. J. Agric. Sustain.* **2016**, *59*, 1–18. [CrossRef]