NEED OF AGRICULTURE INNOVATION CENTER IN NEPAL

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Abstract

Agricultural innovation is the process whereby individuals or organizations bring new or existing products, processes, or ways of organization into use for the first time in a specific context in order to increase effectiveness, competitiveness, resilience to shocks, or environmental sustainability and thereby contribute to food security and nutrition, economic development, or sustainable natural resource management. The innovation systems concept is attractive not only because it offers a holistic explanation of how knowledge is produced, diffused, and used, but also because it emphasizes the actors and processes that have become increasingly important in agricultural development. The establishment of an Agriculture Innovation Center (AIC) at a different university can have several benefits. It will enhance research capacity, attract private sector investment, and foster collaboration among stakeholders. It is also expected that the AIC will contribute to the development of sustainable agriculture practices that enhance productivity, conserve natural resources, and improve livelihoods. It can provide a platform for students, researchers, and entrepreneurs to collaborate, experiment, and prototype new ideas and translate them into commercial products and services. AIC can have a broader mandate that includes commercialization, entrepreneurship, and industry collaboration. This could lead to the development

of new technologies and business models that can improve the productivity, sustainability, and profitability of the agricultural sector.

Keywords: Agriculture, Incubates, Innovation, Technology, University

1. Background

The agriculture sector in Nepal is providing employment to around 65 percent of the population and contributing to 23.95 percent of the country's GDP (Statistical Information on Nepalese Agriculture, 2020/21). The country has a vast potential for agricultural production due to its favorable topography, climate, and soil types. However, the agricultural sector in Nepal is facing several challenges, including low productivity, a lack of necessary agricultural planning, a lack of modern technologies, inadequate infrastructure, reliable markets, and the adverse effects of climate change. To address these challenges, there is a need for an innovative approach to agriculture that integrates technology, research, and entrepreneurship. This approach demands a need to establish an agriculture research and innovation center in Nepal that will focus on developing new technologies, conducting research, exploring and modernizing local and indigenous technologies, and providing training to farmers and other stakeholders. The center will play a crucial role in promoting sustainable agriculture, enhancing productivity, and improving the livelihoods of farmers. The Agriculture Innovation Center (AIC) under different universities will promote innovation, technology adoption, and sustainability, leading to increased agricultural productivity, profitability, and environmental sustainability. It is expected that the AIC will contribute to the development of sustainable agriculture practices that enhance productivity, conserve natural resources, and improve livelihoods. The successful implementation of the AIC will require a sustained effort from all stakeholders, and it is hoped that the AICwill serve as a model for innovation and development in agriculture in Nepal.

2. Importance of the Agriculture Innovation Center

Agriculture Innovation Centers (AIC) play a crucial role in promoting agricultural development and sustainability. Here are some of the key reasons why AICs are important:

• Increase Agricultural Productivity: AIC can provide training and extension services to farmers to improve their productivity through the adoption of modern technologies, such as precision farming, the use of bio-fertilizers, bio-pesticides, and other smart agriculture technologies.

• Food Security: It can help in achieving food security by promoting sustainable agriculture practices and increasing agricultural productivity, which can lead to improved access to food for communities.

• Sustainable Agricultural Practices: AIC promotes sustainable agriculture by introducing farmers to environmentally friendly farming methods, such as organic farming, conservation agriculture, and integrated pest management. This helps to preserve the natural resources and biodiversity of the province.

• Promotion of Indigenous Technology: AIC can act as a platform to showcase and promote indigenous technology related to agriculture. This can include traditional farming practices, local seed varieties, and innovative techniques developed by farmers.

• Collaborative Agricultural Research: AIC can act as a hub for agricultural research, where researchers can collaborate with farmers and other stakeholders to identify and address research gaps and challenges in the sector.

• Rural Development: AIC can play a critical role in the development of rural areas by providing training and support to smallholder farmers, helping them to improve their income and livelihoods.

• Urban Agriculture: An agriculture innovation center can play an important role in promoting urban agriculture, which involves growing food in cities and urban areas. This can help increase access to fresh, healthy food for urban residents.
• Explore innovative ideas: These ideas help to address emerging challenges and opportunities in agriculture and ensure that farmers have access to the latest innovations.

• Environmental Sustanability: AIC can promote sustainable agriculture practices that are environmentally friendly, such as conservation agriculture, organic farming, and agro-forestry.

• Improved Market Access: AIC can provide farmers with market information and linkages to buyers and processors, helping to improve their access to markets and increase their income.

• Agricultural entrepreneurship (AIC) can play a crucial role in promoting agricultural entrepreneurship by providing a supportive environment and resources to farmers and agribusinesses in various ways. It can be done by providing ways out to funding and investment, offering training and mentorship, facilitating partnerships and collaborations, and providing support, resources, and networking opportunities.

3. Why AIC Under University

Establishing an Agriculture Innovation Center (AIC) at different universities can have several benefits. Here are a few reasons:

• The universities can bring specialized expertise and knowledge to the AIC that might not be available at other research institutes.

• By having a center within a university, there is also an opportunity to work more closely with faculty and students who are researching related topics.

• AIC can serve as a hub for education and training on new agricultural practices and technologies. At the university, there will be an opportunity to work with students who are studying agriculture and train them in the latest techniques and technologies. This can help ensure that the next generation of farmers and agricultural professionals are up-to-date on the latest developments in the field.

• AIC can also serve as a hub for partnerships and collaborations between different organizations working in agriculture. There will be an opportunity to bring together researchers, government agencies, and private sector actors to work together on common goals. This can lead to more coordinated and effective efforts to address challenges in agriculture.

• AIC can have a broader mandate that includes commercialization, entrepreneurship, and industry collaboration. This could lead to the development of new technologies and business models that can improve the productivity, sustainability, and profitability of the agricultural sector.

• AIC can leverage the university's academic and research resources, which can provide a unique advantage in developing new technologies and solutions that meet the needs of the industry. It can also provide a platform for students, researchers, and entrepreneurs to collaborate, experiment, prototype new ideas, and translate them into commercial products and services.

• AIC may create many job opportunities for youth in the agriculture sector by offering educational programs and promoting the importance of agriculture as a viable career option.

4. Innovation Definition and Concept

Agricultural innovation is the process whereby individuals or organizations bring new or existing products, processes, or ways of organization into use for the first time in a specific context in order to increase effectiveness, competativeness, resilience to shocks, or environmental sustainability and thereby contribute to food security and nutrition, economic development, or sustainable natural resource management (https://www.fao.org). In the agricultural context, many changes have heightened the need to examine how innovation occurs in the agricultural sector, which increasingly include: 1) driven by markets; 2) dynamic and unpredictable aspects of the production, trade, and consumption environment for agriculture and agricultural products; 3) generated, diffused, and applied knowledge, information, and technology through the private sector; 4) exponential growth in information and communications technology; 5) a changing knowledge structure in the agricultural sector in many countries; and 6) agricultural development in a globalized setting (World Bank, 2006). The innovation systems concept is thus attractive not only because it offers a holistic explanation of how knowledge is produced, diffused, and used, but also because it emphasizes the actors and processes that have become increasingly important in agricultural development

The Evolution of the Agricultural Innovation Systems Concept

An evolution has taken place in the framework of agricultural innovation systems since the 1970s, beginning with the national agricultural research system (NARS), followed by the agricultural knowledge and information system (AKIS), and finally the agricultural innovation system approach (AIS). A comparison of these frameworks is presented in Table 1.

Table 1. Defining features of NARS and AKIS frameworks in relation to AIS

1. Models of Innovation Centre

a. In- House Incubatees with requirement of Lab facilities (The incubatees will be physically incubate at university AIC, provided with lab and office space)

b. In- House Incubatees without requirement of Lab facilities (The incubatees can utilize the office space for their computational research work such as software development)

c. In- House Student Incubatees with requirement of Lab facilities (Students with innovative ideas will pay subsidized incubation charges and will provide the laboratory facilitates)

d. External Registrant Incubatees (The incubatees can register for virtual incubation and mentorship support will be provided by Agri Innovation Center- University)

2. Technologies Access for Entrepreneurs/Farmers from AIC

2.1. Crop Improvement: Among the technologies, biotechnology and marker assisted plant breeding for crop improvement technologies will have access to the innovators, scientists and entrepreneurs. Apart from this, RNA interference, next generation sequencing and nanotechnology have become new promising techniques for improving crop production according to future need.

2.2. Bio-Fertilizers: The center will have technologies to produce different types of bio-fertilizers (Bacterial Biofertilizers: Rhizobium, Azospirilium, Azotobacter, Phosphobacteria; Fungal Biofertilizers: Mycorhiza; Algal Biofertilizers: Blue Green Algae and Azolla) and also will be access to the concerned stakeholders.

2.3. Bio-Pesticide: Biopesticides are the biological agents used to control the pest population. It includes the use of botanicals, microbial pathogens such as fungi, bacteria, viruses and natural enemies of pests such as parasitoids, predators and nematodes.

2.4. Bio-Fuel: Bio-fuels produced from bio-mass resources through eco-friendly approaches are getting attention worldwide from researchers and scientists. At present, various gaseous and liquid bio-fuels (biodiesel, ethanol, methanol, methane and bio- oil) are produced from biomasses. These bio-fuels have shown great potential for future energy supply and to achieve energy security sustainably. It is essential to convert biomass in bio-fuels by developing novel technology to increase bio-fuel production to fulfill the current and future energy demand within the country.

2.5. Bio-Energy: The FAO defines bio- energy as all energy derived from bio-fuels, which are fuels derived from biomass (that is, matter of biological origin). These bio-fuels can be subdivided into three types, solid, liquid, and gas and by origin, forest, agriculture, and municipal waste. The basic bio-energy process involves the translation of organic material into an end product, including biogas, which can then be used to produce energy.

2.6. Plant Breeding and Seed Production:

Breeding and seed production are closely tied to questions about ownership of and access to plant genetic resources, affecting farmers' ability to build up capacities to respond to disturbances. There is a strong link between formal plant breeding and seed supply.

2.7. Tissue Culture, Hydroponics and Aeroponics:

2.7.1. Tissue culture is seen as an important technology in Nepal for the production of disease-free, high quality planting material and the rapid production of many uniform plants.

2.7.2. Hydroponics is the technique of growing plants without soil. The plants can be grown in a nutrient-rich solution, or in a disease-free substance such as sand, gravel or coconut fiber, watered with nutrient solution.

2.7.3. or misting the roots with hydroponic solutions, which are suspended in the air. It does not use soil or aggregate medium. In aeroponics plant roots are suspended in a dark enclosure, while a nutrient- dense solution is sprayed on the roots at certain intervals.

2.7.4. Greenhouse: It provides a controlled and favorable environment for crop to grow high yield in all the seasons and saves crop excessive cold in winters, from heat in summers and from rain in monsoon seasons.

3. Value Addition in Food and Food Products Value addition is a technique which should be readily used in today's generation. It does not only help in nutrient enhancement but also in reducing the post production losses. Through innovation, cheaper and more efficient technologies will be developed, while new or modified products will be introduced to adjust to changes in consumer preferences, improve shelf life, reduce postharvest losses and enhance product quality and safety.

4. Agricultural Implements and Mechanization Due to unavailability of attractive employment opportunity in the country, the majority of young people are going abroad in search of jobs. Hence agriculture has become job of old people and that of women farmers in the village. In this context the agriculture innovation center should need to develop appropriate agricultural mechanization technologies in PPP model.

5. Nanotechnology in Agriculture Nanotechnology offers generous visions for the development agricultural sector through advanced applications and the probability of products and increases crops production volume to feed the ever increasing population. Promising results generated from the innovation center will be applied in the areas of nano nutrients, implement crop productivity, protect plants (herbicides and pesticide), nano-packing and Nano sensors.

6. Storage and Marketing Losses of agricultural produce are a major problem in the post-harvest chain. They can be caused by a wide variety of factors, ranging from growing conditions to handling at the retail level. Not only are losses clearly a waste of food, but they also represent a similar waste of human effort, farm inputs, livelihoods, investments, and scarce resources such as water. Hence, there is a need for efficient storage, & marketing of agricultural produce to reduce losses and improve the lives of farmers. Agricultural markets in Nepal are

underdeveloped and imperfect, and lack both horizontal as well as vertical integration. The supply chains for agricultural commodities are long and dominated by a number of intermediaries, leading to a considerable price spread from their point of production to end-consumption. In such situation the research innovation will recommend a crucial feedback with an innovative technology for policymakers, federal and provincial government and other stake holders to strengthen the national market for agricultural commodities.

11. Facilities in Agriculture Innovation Center

11.1. Start-Up Incubation and Promoting Student Entrepreneurship

The incubation process allows students to preserve capital and gain external support to accelerate their innovation work. Incubation support includes providing technological facilities and advices, initial growth funds, network and linkages, co-working spaces, lab facilities, mentoring and advisory support.

11.2. Licensing of University Technologies

The University Technology Licensing provides widespread, convenient, and efficient access to valuable inventions owned by the university relating to particular technologies, products, and solutions that enable new leading-edge products to be brought to market.

11.3. Financial Support through Different Sources

The innovation center will search different sources of financial assistance the sources are financial support by (1) Ministries/ Departments/Organizations (2) financial institutions (3) financial corporation's etc.

11.4. Market Linkages/ Intra- Incubatee Linkages/ Interface Meets

Through market linkages smallholders can attract larger buyers, access larger markets, negotiate stronger prices, and reduce transaction costs to enhance economies of scale. Intra – Incubatee linkages has created positive effect in ideas for product development; information about market trends; how to manage company; information about potential colleagues/personnel, customers, suppliers, and investors. Interface meetings has enabled entrepreneur and groups of entrepreneurs to engage, negotiate and voice their concerns on service delivery different levels of officials and

service providers, both sides (service provider and recipient) to come together, identify the reasons for poor services and find solutions for the problems.

11.5. Patent Services for Innovative Process and Products

Businesses rely on innovation to keep pace with their competitors, and one of the best ways to gain an advantage is protecting innovations by using patents. With a patent, a business can secure their inventions from their competitors for a set length of time. With a patent, an inventor or small business knows there is a good chance that they will get a return on the time, effort and money they invested in developing a technology.

11.6. Sales Promotional

Activities (TV channels, Newspapers, Magazines, Participation in National events and Agri- Expos).

11.7. Access to Seminars/Conferences/ Workshops/Interface

Meetings Participants at seminars/conferences/ workshops/interface meetings may share their thoughts and ideas to get a fresh perspective on the subject. It is possible that listening to other people's ideas can aid innovators in coming up with fresh ideas for their works.

11.8. In-House Space for Start-Ups

Provide collaboration: By launching a start- up development program, the entrepreneurs provide start-ups with a platform for collaboration Work on an attractive image: Achieve higher attractiveness by offering start-ups access to the customer base, business angels and others contacts. Offer outstanding support: By providing office space, technical infrastructure, mentorship, strong support and the possibility to work on leading-edge technologies, the entrepreneurs offer start-ups what they need in the conception phase.

11.9. Access to Food Packaging Laboratory

The innovation center will have an access of food packaging laboratory to the innovators and entrepreneurs. The goal of food packaging is to contain food in a cost-effective way that satisfies industry requirements and consumer desires, maintains food safety, and minimizes environmental impact. Packaging also provides information to the consumer. For example, package labeling satisfies legal requirements for product identification, nutritional value, ingredient declaration, net weight, manufacturer information, product expire date and pricing.

11.10. Post-Harvest Facilities on Payment Basis

The Post-Harvest Loss Innovation Lab will work to reduce post-harvest loss and food waste of various crops (grains, oilseeds, legumes, vegetables, fruits and seeds) and related processed products. The Lab enables innovators and entrepreneurs, cooperatives, agribusinesses, NGOs, and other stakeholder partners on payment basis. 12.

Conclusion

In Nepal, where agriculture is a significant contributor to the economy and a source of livelihood for a large portion of the population, agriculture innovation centers within universities are instrumental in addressing the challenges faced by farmers, improving agricultural productivity, and promoting sustainable farming practices. They contribute to food security, poverty reduction, and overall economic development in the country. Agriculture innovation centers also serve as catalysts for progress in the agricultural sector. They promote research, knowledge dissemination, technology transfer, and sustainable practices, ultimately contributing to economic development, food security, and environmental sustainability.

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