3

Role of ABI for Entrepreneurship Development in Value Addition Sector

Manoj P Samuel, George Ninan and Ravishankar C N

Introduction

Compared to the previous decades, the scope and power of intellectual property rights (IPRs) in agriculture and biotechnology has grown substantially and their international reach has expanded. The IP regime has set up the stage for healthy competition among research centres and industries for developing and seeking novel technologies. However, compared to developed countries, once the technology is created, not much attention is paid in the developing nations on their commercial, policy, environmental, ethical and societal implications. Hence, better techniques are needed for their management, to create policy and educate professionals to commercialize and govern them. Due to the critical role of technology in a competitive environment, strategic technology management is important for farmers and agri-enterprises too. The translation of nascent technologies into new products/ services and their commercialization requires some amount of hand-holding, mentoring and incubation support.

The mission of agri-business incubation is improving the well-being of the poor through the creation of competitive agri-business enterprises by technology development and commercialization. Agri-Business incubation is defined as a process which focuses on nurturing innovative early-stage enterprises that have high growth potential to become competitive agribusinesses by serving, adding value or linking to farm producers.

The major objectives of agri-business incubation initiatives are

- To foster the innovation through creation, development of agri-businesses to benefit the farming community
- To facilitate agro-technology commercialization by promoting and supporting agribusiness ventures.

- To promote successful agribusiness ventures in order to benefit the famers through new markets, products and services

The commercialization including dissemination, transfer and marketing of technology has been evolving as a major pillar that supports the R&D systems. The commercialization process is linked to various activities in the technology management pipeline like protection, valuation, incubation, test marketing, technical and economic feasibility studies, showcasing, licensing and marketing of the technology. Incubation process helps to nascent technology to fully evolve into a business product or service which can compete in real world environment. In a globalized economy, technology licensing and transfer of technology are important factors in strategic alliances and international joint ventures in order to maintain a competitive edge in a market economy.

IPR and its management

Currently, the term 'intellectual property' is reserved for types of property that result from creations of the human mind, the intellect. The most accepted definition is the one advocated by the World Intellectual Property Organization (WIPO). The convention establishing the World Intellectual Property Organization defined the term 'intellectual property' as- "Literary artistic and scientific works; performances of performing artists, phonograms, and broadcasts; inventions in all fields of human endeavour; scientific discoveries; industrial designs; trade-marks, service marks, and commercial names and designations; protection against unfair competition; and all other rights resulting from intellectual activity in the industrial, scientific, literary or artistic fields."

A compilation of the major types of IP assets in agriculture R&D with their qualifying attributes under relevant legislations in India is presented in Table 1. The broad institutional mechanisms, legislative provisions and potential returns to the stakeholders of agri-value chain are also depicted. Considering special nature of use of bio-resources and traditional knowledge (TK) in agriculture, the various provisions and legal mechanisms for protection of these are also enumerated.

Business incubation in Agriculture

Agri-Business Incubators (ABI) open new entry points in the agricultural value chains, which in turn can use to access new markets. They afford leverage through these entry points to accelerate agricultural development and offer the unique potential to develop small and medium-sized enterprises (SME's) which can add value along these chains in ways which other development tools do not offer. There is no single "right way" to perform agribusiness incubation. Rather, the work of agribusiness incubation depends on the state of development of the

Table 1: Broad institutional mechanism (s), legislative provisions and potential returns to stakeholders with respect to IP and related forms of knowledge and resources

S. N.	IP	Legislation	Administration authority	Qualifying attributes	Possible field(s) of application in agricultural sector	Potential stakeholder (s) to benefit
1.	Patent	Patents Act, 1970	Controller General of Patents Designs and Trademarks (CGPDTM)/ Controller of Patents	Novel, non-obvious, capable of industrial application and not fall within the provisions of Section 3 and 4 of the Patents Act, 1970	Agricultural products, processes, value addition	Inventors, traders, economy
2	Design	Design Act, 2000	CGPDTM/Registrar of Designs	New or original; significantly distinguishable from known designs or combination of known designs	Agricultural machinery; post harvest technology products, packaging of processed food/inputs etc.	Industry including SMEs
3	Trademark	Trade Marks Act, 1999	CGPDTM/Registrar of Trademarks	Capable of distinguishing features of goods and services, capable of graphical representation, used or proposed to be used to identify goods/services	Goods and services in agri-business sector	Industry- products and service sector
4	Geographical indication	Geographical Indications (Registration and Protection) Act, 1999	CGPDTM/Registrar of Geographical Indications	Specific geographical origin, possessing qualities, reputation or characteristics that are essentially attributable to that place of origin	Goods, naturally occurring breeds/varieties of commercial value	Communities, traditional practitioners, knowledge holders
5	Copyright	Copyright Act, 1957	Director and Registrar of Copyright	Original expressions of ideas, creations	Software, databases, expert systems, books,	Creators of all works

S. N.	IP	Legislation	Administration authority	Qualifying attributes	Possible field(s) of application in agricultural sector	Potential stakeholder (s) to benefit
6	Integrated circuit design	Semiconductor Integrated Circuits Layout-Design Act, 2000	Registrar, Semiconductor Integrated Circuits Layout-Design Registry	Original; not commercially exploited anywhere in India or in a convention country; inherently distinctive; inherently capable of being distinguishable from any other registered layout-design	Automated machineries/ irrigation systems/ agri-processing	Electronic industry, traders, SMEs
7	Plant varieties	Protection of Plant Varieties and Farmers' Rights Act, 2001	Registrar, Protection of Plant Varieties and Farmers' Rights (PPV&FR) Authority/ Registry	New, distinct, stable and uniform	Seeds/ seedlings/ propagation materials	Plant breeders, farmers,industry
8	Biodiversity	Biological Diversity Act, 2002	Registrar, National Biodiversity Authority (NBA)	Biological resources, herbal remedies, associated traditional knowledge	Access and utilization of biological resources	Knowledge holders, farmers, communities, researchers, etc.
	Traditional knowledge	None	Secretary of the concerned Ministry(ies)	Traditional knowledge/ genetic resources	TK based products and processes	Knowledge holders in communities by sharing of accrued knowledge

agribusiness ecosystem and changes over time as that ecosystem matures and develops. In its earliest phases, incubators demonstrate the viability of new business models and look to create and capture additional value from primary agricultural products. In underdeveloped agricultural economies, incubators help by strengthening and facilitating linkages between enterprises and new commercial opportunities. They open new windows on technologies appropriate to agribusiness enterprises and help agricultural enterprises discover new, potentially more competitive ways of doing business. In subsequent phases of development, incubators operate as network facilitators: they link specialized service providers to agribusinesses and link separate agribusinesses to one another. Finally, in a more advanced state of business development, incubators operate as conduits for the exchange of technology, products, inputs and management methods across national borders.

Agri-business incubation and technology transfer in NARS

The National Agricultural Research System (NARS) in India employs about 4000 researchers in Indian Council of Agricultural Research (ICAR) and almost 15,000 academic faculty members in various State Agricultural Universities (SAUs). In view of changing circumstances and policies, the NARS has initiated steps to strengthen its IP portfolio management and encourage its researchers and academicians to develop and commercialize their innovations for the benefit of farming community. A more pragmatic system for business incubation and promoting start-up companies with respect to agricultural technologies have been evolved in recent times within the National Agricultural Research System (NARS). Generally, agricultural technologies are low-cost technologies and entrepreneurs are not much enthusiastic about it, considering the less purchasing power of the target market.

Since the implementation of the XI Five Year Plan (2007-12) of Government of India, the three-tier IP management mechanism has been established in Indian Council of Agricultural Research (ICAR) towards developing an institutional setup for commercialization of agriculture research products/technologies generated from public research institutions. Accordingly, Institute Technology Management Units (ITMUs) were established in its 95 institutes as a single-window mechanism to showcase the intellectual assets of the institute and pursue matters related to IP management and transfer/commercialization. Five Zonal Technology Management and Business Planning and Development (ZTM&BPD) units were established at the middle-tier, in synergy with the ITMUs, in their respective zones. 12 new BPD units have been initiated in 2013-14 to promote business incubation and technology commercialization. Subsequently, the National Agricultural Innovation Fund (NAIF) has been

schematized for the 12th Plan period (2012-17) by the Government of India and establishment of Agri-Business Incubation (ABI) Units in 27 Agricultural research institutes and promotion of Grass-root Innovations are the highlights of the scheme. Under the new initiative, sector wise Zonal Technology Management Centres (ZTMC) coordinate the technology incubation, protection and commercialization activities. Apart from these, Technology Business Incubators (TBI) supported by Department of Science & Technology (DST) has been set up in three NARS institutions and incubation and innovation centres are established at different State Agricultural Universities. Support and services needed by bigger firms and investors for technology transfer as well as for incubation and funding can be addressed through the new flexible business innovation-incubation centres like AgrInnovate India and Technology Business Incubator under the NARS itself (Fig. 1).

The requirement of incubation support by the bigger firms may also be met by these institutional innovations. Provisions were also made to protect the interest of farming community to a larger extent. The established mechanism helps to answer the questions, which may arise from the society on the righteousness and ethical issues of commercializing the public funded research outputs.

The Agribusiness Incubator Program under NARS seeks to provide business consulting services to agriculture-related businesses and helps to develop a strategic business plan. The new initiatives by the Govt. of India as well as ICAR have encouraged start-up companies in agriculture, especially by attracting

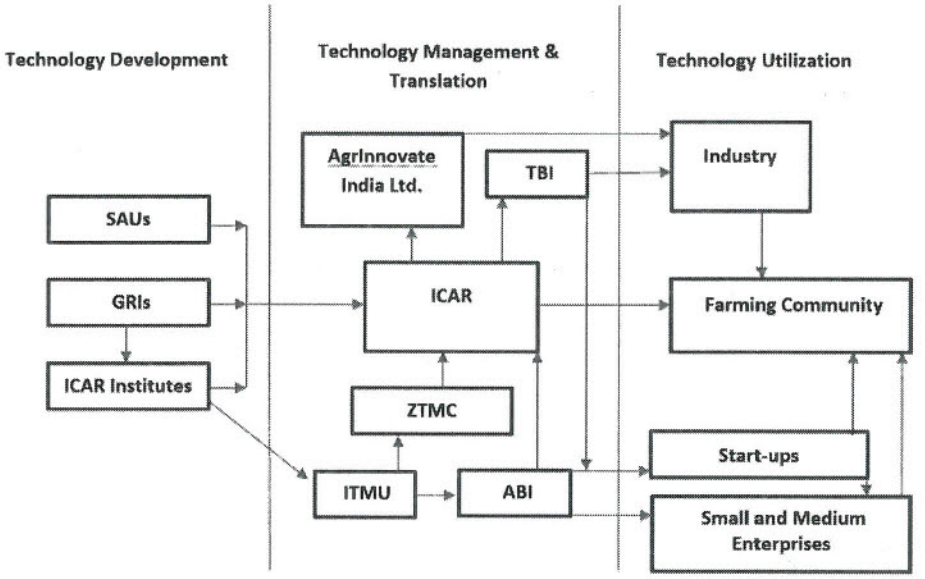

Fig. 1: Institutional framework for Tech transfer and commercialization

rural youth to agri-entrepreneurship. Apart from guidance and consultancy services, the new initiatives also assist in making venture capital funds available to the start-ups. The local communities can also be involved in developing business ideas and entities with respect to agriculture.

Potential institutional innovations for strengthening Agri-Incubation and commercialization capacity of NARS in India

A novel approach should be designed to encourage start-up companies in agriculture, especially by attracting rural youth to agri-entrepreneurship. Apart from guidance and consultancy services, the new initiative should also assist in making venture capital funds available to the start-ups. The local communities can also be involved in developing business ideas and entities with respect to agriculture.

The development processes in the suggestive framework (Fig.2) for the Agriculture Business Incubation (ABI) involve scouting of the technology, assessment and valuation. The technology management services focus on the protection of the developed technologies having a commercial value. The technology generation cycle is the phase where product prototype developed out of the technology innovation undergoes continuous transformation leading into the final product development. The process such as innovation process; technology generation process; and agriculture business incubation are individual entities but complete a cycle of a business. Combining all these processes in a framework, a holistic approach for fostering innovation and incubation eco-system has been envisaged. Through this framework, the role of the individuals or public and private players at various levels and at various places are defined in the process of innovation of various technologies and products.

The nodal centre, which can act as a networking platform of technology managers in SAUs and ICAR institutes in line of a registered society will be helpful in networking relations and exchange of ideas and information related to IP management in agriculture. Further, it can be extended by incorporating other areas of scientific organizations, institute of technologies, engineering colleges, law and business schools and traditional universities. Such a platform can be linked to similar organizations in other countries like Association of University Technology Managers (AUTM) in USA in order to explore the possibility of global technology transfer and commercialization. This initiative will also aid in updating with recent trends in IP regime, new changes in IP laws in a national and international perspective. The platform can also be extended to private companies to foster public-private partnerships.

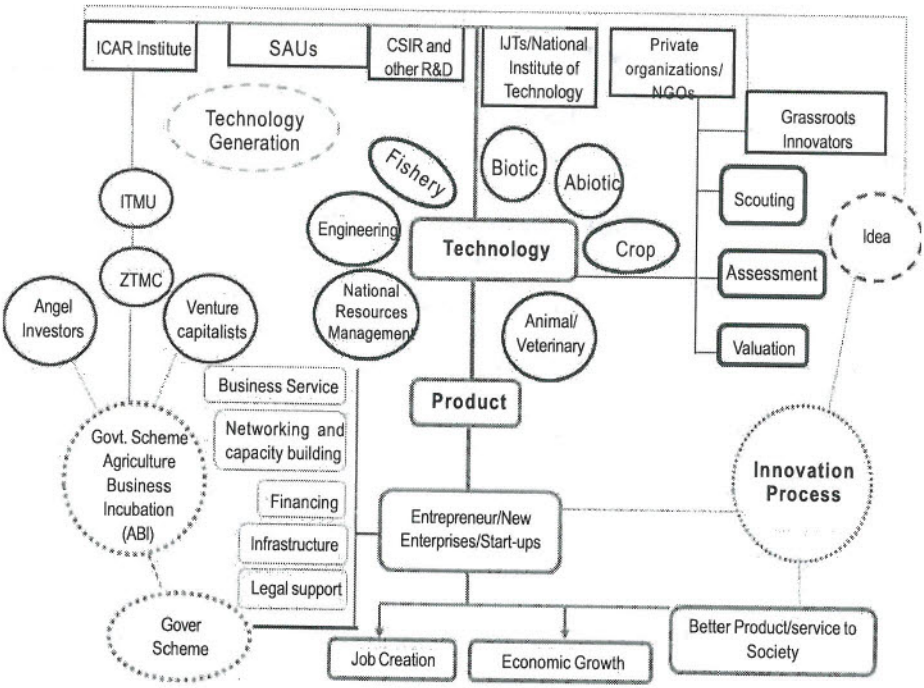

Fig. 2: Conceptualized framework for agri-innovation-incubation process

The nodal centre can bridge the gap between research institutes, industry, society, and the Government. It can play a proactive role in framing technology transfer and commercialization policy in coordination with Central and State Governments, related agencies, business houses and other players in the industry. Nodal centre can be mooted in all research councils/organizations like CSIR, ICAR, ICMR etc. and all can be pooled together to form a National level umbrella consortium under Government of India. The Consortia is envisaged to facilitate the convergence and effective deliverance of all schemes with respect to innovation, incubation and commercialization and provide necessary information to the Government and policy makers and also can play an advisory role.

Agricultural technology management and IPR- emerging opportunities and challenges

Intellectual property rights could play a significant role in encouraging innovation, product development and technical change. Developing countries like India tends to have IPR systems that favour information diffusion through low-cost imitation of foreign products and technologies. This policy stance suggests that prospects for domestic invention and innovation are insufficiently developed to warrant protection. However, an inadequate IPR system could stifle technical change even at low levels of economic development. This is because much

invention and product innovation are aimed at local markets and could benefit from domestic protection of patents, utility models, and trade secrets. Moreover, IPR systems could help reward creativity and risk-taking among new enterprises and entrepreneurs. Countries that retain weak standards could remain dependent on technologically inefficient firms that rely on counterfeiting and imitation. It is therefore necessary that a development oriented country like India must have strong IPR legislation and policies and strive to create awareness among industry, academia, students, farmers and public on the IP regime and precautions to be taken to protect their intellectual assets. India is rich in its indigenous technical knowledge and therefore, the avenues to cash upon the traditional wisdom should be opened to the grass root innovators and farmers. A general awareness of the global scenario and clear understanding of the modalities under the IPR is inevitable to the above mentioned stakeholders and it can be cultivated only through educational programmes at the degree level and above especially to the students of agriculture, law, engineering and management.

Inventive firms in developed economies tend to orient their research programmes toward products and technologies for which they expect a large global demand and that may be protected by IPR. This means that a disproportionately small amount of global R&D is focused on the needs of developing economies with low income and weak IPR protection. The efforts to strengthen IP protection in developing countries like India could induce greater R&D aimed at meeting the particular needs of the country. The evidences suggest that IPR protection could generate more international economic activity and greater indigenous innovation, but such effects would be conditional on circumstances. These circumstances vary widely across countries and the positive impacts of IPR should be stronger in countries with appropriate complementary endowments and policies. Countries face the challenge of ensuring that their new policy regimes become pro-active mechanisms for promoting beneficial technical change, innovation, and consumer gains. Educating all stake holders along with policy makers on the dynamic environment of the IPR regime is a vital pre-requisite for conceiving and enforcing strong IP legislations. Apart from encouraging their innovativeness and accelerating returns for re-investments, the stakeholders should also be taught to extract profit from their innovations on traditional or modern technologies using the means provided under IPR by commercializing them through licensing or similar agreements on an international arena.

The lack of formal IP education makes future agriculture professionals incompetent in the face of global business and technological challenges and therefore, a well-structured and comprehensive academic programme in IP and technology management should be included as part of curriculum at the

university level. The future global economies will largely be governed by climate change/GHG emission approach, carbon trading, environmental issues and sustainable livelihood based food and water policies. Hence, IPR and technology management educational programmes should also be directed towards these issues and related socio-economic factors. The factors such as changes in global and local businesses, dynamics of supply and value chain systems, advances in technology management protocols, change in preference of consumers and industry should be considered while formulating education policies with respect to IPR in agriculture.

Business incubation initiatives in fish processing sector

Fisheries sector with its important role played in the socio-economic development of the country has become a powerful income and employment generator, and stimulates the growth of a number of subsidiary small, medium and large scale industries. In order to translate the research results arising from the field of fisheries and other agricultural sectors, ICAR have set up an innovation based Business Incubation Centre (BIC) at the ICAR-Central Institute of Fisheries Technology (CIFT), Cochin (Fig.3). BIC is managed by Zonal Technology Management – Business Planning and Development (ZTM-BPD) Unit and aims at establishment of food business enterprises through IPR enabled ICAR technologies.

BIC supports operations on business projects as a measure of enhancing the foundation for new technology based industries and establishing a knowledge-based economy. It focuses on finding new ways of doing business in fisheries and allied agricultural fields by finding doors to unexplored markets. The Centre helps prospective entrepreneurs, by providing pro-active and value-added business support in terms of technical consultancy, infrastructure facility, experts' guidance and training to develop technology based business ideas and establish sustainable enterprises. It acts as a platform for the speedy commercialization of the ICAR technologies, through an interfacing and networking mechanism between research institutions, industries and financial institutions. The Incubator at ICAR-CIFT differs from traditional Business Incubators as it is tailored specifically for technology based industries and is operational at an area with a high concentration of fish production. This industry-specific incubator also allows new firms to tap into local knowledge and business networks that are already in place. BIC offers their services to industries not only in Cochin, but also all over India through virtual incubation. Beyond promoting business growth, the Centre is also trying to bring its benefits to all the fisheries communities in India.

This unique Business Incubator is now known as a "One Stop Shop", where entrepreneurs can receive pro-active, value-added support in terms of technical consultancy, and access to critical tools such as entrepreneur ready technologies, vast infrastructure and other resources that may otherwise be unaffordable, inaccessible or unknown. With the aim of transforming the incubator into a symbol of entrepreneurship and innovation, the ZTM-BPD Unit has created an environment for accessing timely scientific and technical assistance and support required for establishment of technology based business ventures. The activities of the ZTM-BPD Unit focuses on finding creative and innovative ways for linking public sector resources and private sector initiatives within and across regional and national boundaries for promoting economic growth. The Centre uses the right expertise in relevant fields to identify and analyse the constraints and barriers hindering the growth of a business, and devise appropriate strategies. It explores the various structures and strategies to help small enterprises to grow and ensure a promising future in the global market. It fosters corporate and community collaborative efforts, while nurturing positive government-research-business relationships.

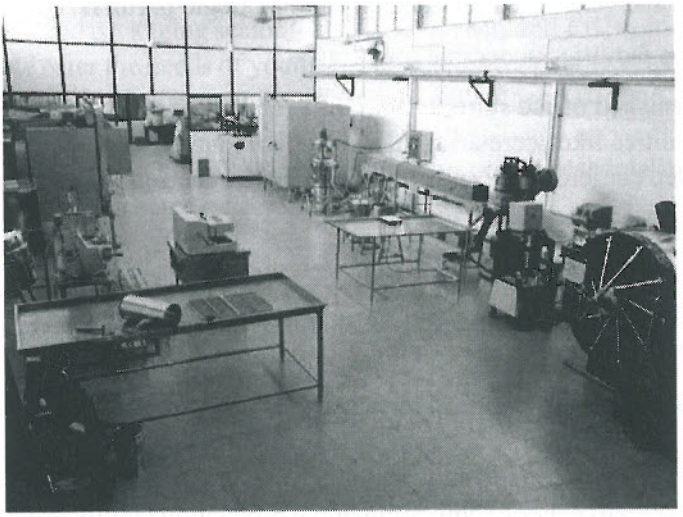

Fig. 3: Pilot Plant at CIFT for Business Incubation

Process of incubation

The Centre regularly conducts industry interface and technology promotional programmes for sensitization of entrepreneurs and to identify interested potential candidates for physical and virtual incubation. The clients at BIC get the privilege of meeting scientists, business manager and business associates directly, to discuss and finalise the strategies to be adopted to take the business forward. It is also the peer-to-peer relationships that develop within the incubator, that

ensures the delivery of basic services such as how to actually incorporate a business; what are the legal issues; how to take intellectual property protection; how to do basic accounting and cash flow; how to do business presentations etc.

The residency period for direct incubatees is normally for two years, extendable by another year in special cases, depending on the progress of incubation. As the business venture becomes mature enough, the concessions and the facilities provided to the incubatee companies will be gradually withdrawn. Each incubatee of the unit will have to pay to the Institute a charge for utilization of space, at a rate concessional to the benchmark rate which is the prevailing market rent realizable. Incubatee mentoring will continue in virtual mode after graduation, on need basis.

Services and facilities offered by ICAR-CIFT business incubator

The Centre through its business support services provides links to supporting industries; upgrade technical/managerial skills; provide scientific/technical know-how; assist in market analysis, brand creation and initial test marketing; protect IP assets; and find potential investors and strategic partners.

Incubation facilities under one roof are:

- Furnished office suites within the premises of ICAR-CIFT, with shared facilities like secretarial assistance, computing, copying, conferencing, video conferencing, and broad band internet and communication services.
- Pilot level production lines
- Culinary facility
- Access to modern laboratory facilities for product testing and quality control
- Access to well-equipped physical and digital libraries

Pilot level production lines

A state-of-the-art generic semi-commercial production facility is made available to incubating entrepreneurs for developing value added products from fish. BIC provides access to these facilities along with support of manpower, and assists the entrepreneurs in production and testing of new product formulations. For the tenants, the pilot plant is an ideal testing arena to determine the commercial viability of new products. The plant also serves as a process lab, a place to see how processing equipment impacts food products under varying conditions. There are production lines for pre-processing, cooking, retort pouch processing, canning, sausage production, extruded products, chitin & chitosan

production, smoking, curing & drying, breading & battering and product packaging. By providing access to these resources, the Centre greatly reduces one of the major barriers to the commercialization of institute technologies by smaller firms - the high capital cost of intermediate or large scale process equipment.

Business services

The business oriented services offered by BIC include assistance in complying with business regulations and licensing procedures, financing, information services, marketing, and tailor-made services designed for the various tenant enterprises. Incubator clients can also gain special advantage in terms of tax savings through special regulations for Business Incubators. BIC also offers a wide variety of services, with the help of strong associations throughout the Business Incubation Network.

Success stories of business incubation programme at ICAR-CIFT

The Central Institute of Fisheries Technology established a successful pathway in the areas of business incubation and igniting start-ups in food processing, value-addition and packaging sector. The ITMU, ZTMC and ABI units operating in the institute cater the needs of young entrepreneurs especially in micro-small and medium sectors. It also operates in tandem with other ABIs and ITMUs in the fisheries domain and offer mentoring and consultancy services. Some of the success stories of CIFT Business Incubation centre, especially in value addition sector are depicted below:

Chitin and chitosan

Chitosan is a natural product derived from the polysaccharide chitin. It consists of units of amino sugar D-glucosamine. Chitosan is not digestible and has the unique ability to attach itself to lipids or fats. There are no calories in chitosan and it traps the fat and prevents its absorption in the digestive tract. Matsyafed, (Kerala State Cooperative Federation for Fisheries Development Ltd.) in technical collaboration with Central Institute of Fisheries Technology, Cochin has developed CHITONE capsules, a natural chitosan product that can be used to counter obesity/overweight and high blood cholesterol level. The over-the-counter (OTC) chitone capsules hit the Indian markets during December 2009. A chitosan plant has been established by Matsyafed at Neendakara in Kollam District, Kerala for the commercial production of chitone. The plant has the capacity to produce 1.5 lakh capsules a day. The chitosan used for commercial production of chitone capsules is extracted from exoskeleton of fresh marine prawns, crabs and lobsters.

The technology was again commercialized to Uniloids Biosciences Pvt. Ltd. Hyderabad, who is specialized in the domain of bio fertilizers and respective chemicals. The company was given the technology know-how and training to convert the seafood process waste to chitin and chitosan using the scientific methods developed at CIFT. Uniloids Biosciences is a registered incubatee under the ZTM-BPD Unit, an Agribusiness Incubation Centre established at CIFT. The company is provided business support services through the ZTM-BPD Unit and technical support through the Fish Processing and Quality Assurance & Management Divisions at CIFT. Uniloids is successfully manufacturing, supplying and exporting chitin and chitosan to major market players in this field.

India's first integrated- zero waste agri-business venture, pioneered by CIFT incubatee

The Central Institute of Fisheries Technology (CIFT), Cochin under Indian Council of Agricultural Research (ICAR) has set a model for the public private partnership through the establishment of India's first inland fish processing facility in the village of Bhutana, District of Karnal, Haryana. Mr. Sultan Singh is the man behind the establishment of the "Sultan Singh's Fish Seed Farm", "Sultan Singh's Food Court" and the processing unit for the production of value added products from fish. Mr. Sultan Singh is a registered incubatee under ZTM-BPD Unit, South Zone. The processing unit at Karnal was set up in technical collaboration with the Fish Processing and Quality Assurance & Management division at CIFT, Cochin. He is the first incubatee from CIFT, to establish a successful business venture in the field of inland fisheries in India. Scientists from CIFT have provided technical guidance in setting up the zero waste fish processing unit and have imparted training in the production of fish based value added products. The plant is expected to improve the economic status of hundreds of families engaged in fish farming in the village ponds, and other entrepreneurs. The products like fish nuggets, burger, fingers, balls etc are being prepared and marketed under the brand name "Fish Bite". The Unit is designed in such a way that even the waste from fish processing would be converted into fish feed, thereby setting a fine example of zero waste agriculture.

Ready-to-cook fish product chain 'Meenootty'

Baigai Marine Foods, a Cochin based company, incubated at Business Incubation Centre (ZTM-BPD Unit), Central Institute of Fisheries Technology, Cochin, has hit Kerala market with an innovative concept of establishing a retail marketing network of chilled and packed fish products. The whole idea is to bring fish to the customer's doorsteps in a ready-to-cook form. The product line "Meenootty" attains great importance in today's daily life as the number of seafood consumers

in India is showing an increasing trend. This is mainly due to the recognition of the nutritional value of fish. But, as one kind of perishable and short shelf life goods, fishes are easy to deteriorate and the process is accelerated with increasing temperature owing to a number of factors such as microbial metabolism, oxidative reaction and enzymatic activity. Consequently, economic value and use value of fish is seriously affected. Baigai Marine Foods launched "Meenootty" by giving importance to the scientific interventions in quality assessment and packaging, and organised business model designed by ZTM-BPD Unit, CIFT. The product is processed and packed in par with the natural conditions preserving their nutritional qualities and freshness. The whole concept is to make available clean and fresh fish to every house, like milk products in the market.

Conclusion

In recent years, many institutional innovations and policy changes within the National Agricultural Research System have catalyzed agricultural technology commercialization and business incubation processes. To further increase Indian industrial competitiveness, new institutional innovations have to be encouraged for agri-business incubation and commercialization. Translating research into technologies and then to product and services requires a coordinated and concerted effort by all stakeholders including the Government, academia, research organization, industry, business houses and the public.

Though, there are many agencies, schemes and government departments in the country to act as support mechanisms for IP protection and subsequent commercialization, the benefits are not really get extended to the needy entrepreneurs, especially in case of small and medium scale agri-businesses. Hence, an effective umbrella structure should be conceived and established which ensures the deliverance of governmental schemes and financial grants to the appropriate agri-enterprises and start-ups.

The National level umbrella consortium can be mooted by the Govt. of India for coordinating and converging the individual initiatives to an integrated and focused effort. A technology transfer protocol for forward integration with the Government machinery, policy makers and other clients and the backward integration with the framers, research institutes, NGOs and other organizations such as IIMs, IITs and business houses have to be designed with clearly defined channels of communication and data flow.

Partnerships should be developed among the research producers, users, and funders both at nodal centre and consortia levels. The scope of public-private partnerships in agriculture and biotechnology in the areas of technology development, protection, transfer and commercialization has to be explored.

Apart from this, a concerted effort of all public institutions under various platforms in India such as Department of Science & Technology (DST), Council for Scientific and Industrial Research (CSIR), Department of Bio-technology (DBT), ICAR, Ministry of Micro, Small and Medium Enterprises etc. should be ensured for making sure of effective flow of information, timely consultancy services and speedy delivery mechanisms to the grass-root level agripreneurs. Effective communication, coordination and cooperation among the various nodal centres, umbrella consortium and the industry are inevitable for the successful implementation of the schemes.

References

Castle, D. *et al.* 2010. Knowledge Management and the Contextualisation of Intellectual Property Rights in Innovation Systems, *SCRIPTed*, 7(1). 32.

Dahlman, C. 2005. *India and the Knowledge Economy: Leveraging Strengths and Opportunities* (The World Bank, New York). Available at: https://openknowledge.worldbank.org/handle/10986/ 8565.

Darrell, M. W. 2012. Improving University Technology Transfer and Commercialization. *Issues in Technology Innovation, 20.* Center for Technology Innovations, Brookings. Available at: https://www.brookings.edu/wp-content/uploads/2016/06/DarrellUniversity-Tech-Transfer.pdf.

Fikkert, K. A. 2005. Netherlands- Judgment on Essentially Derived Varieties (EDVs) in the First Instance, *Plant Variety Protection*, 99. 11-12.

Geographical indications: Its evolving contours, *WTC Study Report*, (MVIRDC World Trade Centre, Mumbai and NMIMS University), 2009, http://www.iips.ac.in/main_book.pdf (12 September 2013).

Kochhar, S. 2008. Institution and Capacity Building for the Evolution of IPR Regime in India: Protection of Plant Varieties and Farmers Rights, *Journal of Intellectual Property Rights*, 13 (1). 51-56.

Making the Indian Higher Education System Future Ready: *Report of FICCI Higher Education Summit* (Federation of Indian Chambers of Commerce and Industry, New Delhi), 2009.

Manoj, P. S., R. Kalpana Sastry & R. Venkattakumar. 2014. Status and Prospects of IP Regime in India: Implications for Agricultural Education. *Journal of Intellectual Property Rights*, 19. pp.189-201.

Sastry, K. & A. Srivastava. 2013. *Indigenous Traditional Knowledge for Promotion of Sustainable Agriculture*, edited by V. S. Babu., K. Suman Chandra & S. M. Ilyas (NIRD, Hyderabad, India), pp.145-160.

United States Patent and Trademark Office 2010–2015 Strategic Plan. Available at: http://www.uspto.gov/about/stratplan/USPTO_2010-2015_Strategic_Plan.pdf

WIPO 2012. IP *Facts and Figures: WIPO Economics and Statistics Series* (World Intellectual Property Organization, Geneva), p. 7.