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Invited Paper

Potential of mushroom technology as a social enterprise - The way forward

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ABSTRACT

Mushroom cultivation began in India in 1952. Since then this industry has been oscillating between the myths of earning millions overnight and the ground realities of growing a non-conventional crop. The concept, which branched off as a lesser-known shoot of mycology, has taken unusually long to establish itself in India. Although mushroom science has the inherent subjective capability of a great impact on nutrition, agricultural waste management and environment cleansing; yet has been immensely underexploited in India. Social entrepreneurship is a novel movement gaining momentum around the world. It is a novel concept of modern business model which can find sustainable solutions to social, economic and environmental issues. It is a concept which believes in engaging in profitable commercial activities for mutual social and community gain. It works on the principle "Together we win", hence community takes precedence over individuals. Social enterprises have a strong character of creating jobs and making a socially just and inclusive business model. This is the ultimate objective of any scientific organization or scientific technology more so of public institutions like ICAR. Mushroom technology can be a very successful social enterprise in the Indian context where agricultural crop residues to the tune of 98 million tons/annum is burnt, where millions of youth are unemployed, where there is rampant undernourishment and ever increasing threat of climate change. A majority (53%) of social enterprises in India are focussed on skill development, followed by 30% on education, 28% in agriculture-related activities, 26% in financial and clean energy, 22% in healthcare, 17% on farm livelihood, 16% food & nutrition and 14% sanitation & water. There is a need to initiate mushroom technology based social enterprise which can reduce air pollution by using crop residues to grow mushrooms rather than burn, can create employment in rural unskilled sector, can help in enhancing nutrition, bring diversity to food plate and empower women. Although sporadic examples are available in India, there is a need to increase the number of such enterprises, integrate it with government programs and develop a model in partnership with public institutions who are the technology generators.

Keywords: Mushroom farming, social enterprises, community development, recycling

Mushrooms play a very important role in eco-friendly recycling of agricultural wastes. This process leads to the production of highly nutritious and medicinal mushrooms which can be easily grown by anyone at home or scale up to industrial production (Chang and Miles, 2004). India produces about 98 million tons of surplus agro wastes per annum. Even if 10% of this waste is used for mushroom cultivation, India can produce 5 million tons of mushrooms, giving year round employment for 2 million people, can provide 98,400 tons of quality protein per annum apart from other health enhancing nutrients and can give back about 6 million tons of organic manure back to the eco-system. In a country like India where

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agricultural crop residues to the tune of 98 million tons/ annum is burnt, where millions of youth are unemployed, where there is rampant under nourishment and ever increasing threat of climate change; mushroom technology can be used as a social enterprise tool for sustainable development (Pandey and Kumaran, 2018).

What is social enterprise?

Social enterprise is an organisation or business set up to tackle social, economic or environmental issues. Driven primarily by social and/or environmental motives, they engage in trading or commercial activities to pursue these objectives and produce social and community gain. Profits or surpluses generated by the enterprise are reinvested to further their social objectives. Ownership of the enterprise is within a community, or amongst people with a shared interest. Globally, social enterprise and impact investment are creating hybrid markets and new forms of entrepreneurship, innovation, and capital. Supporting this emerging sector will deliver: improved social, environmental and economic outcomes; increased innovation in community and public service provision; creation of jobs and training opportunities, especially for young people and women in rural areas. Communities develop their own solutions, leading to resilient local economies and greater engagement between the business and community sectors. Government and philanthropic bodies having greater flexibility to target spending and encourage more private capital into areas where there is a need for new solutions. Derive most of their income from trade, not donations or grants. Use the majority (at least 50%) of their profits to work towards their social mission

How mushroom technology fits into the social enterprise model

Mushroom technology with its multifaceted character has the potential of becoming a successful social enterprise especially in the Indian context due to the following reasons.

a. Multidimensional tool

Mushroom production process involves numerous activities like spawn production, substrate production, crop production, packaging and processing, value addition, Marketing. Each of these activities has the potential to become a standalone commercial unit. When these individual units are integrated and networked, it can become a social enterprise which will be more sustainable as compared to individual units.

b. Environment and agro waste management

Mushrooms play a very important role in eco-friendly recycling of agricultural wastes. This process leads to the production of highly nutritious and medicinal mushrooms which can be easily grown by anyone at home or scale up to industrial production. India produces about 98 million tons of surplus agro wastes per annum. The following table shows the estimated benefit of utilizing just 10% of agricultural wastes produced in the country for mushroom cultivation.

c. Nutrition

Mushrooms are highly nutritious vegetable with high protein, high fibre, excellent source of B- vitamins and only vegetarian source of vitamin D. They are excellent source of potassium, selenium and a very good source of bio-available iron. They have zero cholesterol and high in the antioxidant ergothioneine and lovastatin which makes it a recommended diet for cardiac health (Azeez *et al.,* 2020). Mushrooms have very low to negligible sodium which makes it the recommended food for hypertension. It is very low in sugar, low in carbohydrate, high in fibre and has glycemic index less than 3 which makes it an excellent food for the diabetics and for weight reduction. Although mushrooms are very well known for their

Table 1. Estimated mushroom production and other related benefits by using 10% of surplus crop residues burnt annually in India

Surplus crop residues burnt in the country per annum	98.4 million tons million tons per annum
10% of this crop residue	9.84 million tons per annum
Fresh oyster mushrooms produced through 9.84 million tons @50 % biological efficiency	4.92 million tons per annum
Employment generated @150 man days per ton production	738 million man days or 2.02 million people can be employed every year
Protein produced @ 4% of the fresh mushroom produced	196800 tons per annum
SMS available as organic manure @ 60% (minimum) of residue used	5.9 million tons per annum

culinary medicinal properties, their consumption in India is very limited due to short shelf life, irregular availability and high cost. People are not aware about the usage of dry mushrooms and the ways in which mushrooms can be fortified in everyday diet to enhance its flavor and nutrition and health enhancing properties. There is no mushroom fortified product available in the Indian market.

d. Rural employment

Flourishing rural areas are vital to regional and national development. Education, entrepreneurship, and physical and social infrastructure all play an important role in developing rural regions (Pandey and Veena, 2003). Skills are central to improving employability and livelihood opportunities, reducing poverty, enhancing productivity and promoting environmentally sustainable development. India's 56% population is engaged in agriculture. Approximately 2 million people per annum migrate from rural to urban areas, of which about 1 million may be job seekers. Mushroom technology has the potential to create jobs in the rural areas which can reduce the migration to urban areas.

e. Women empowerment

A sharp decline is being observed in the number of working women in rural areas. This is because of the dwindling number of jobs suitable for them. Women in rural areas, who are mostly burdened with responsibilities of running the home and taking care of the family, find it convenient to do part-time jobs near their homes. The most preferred form of employment would be farming related jobs. "However, the number of farming jobs has been shrinking, without a commensurate increase in other employment opportunities. Many researchers suggest that more than half of the decline in female labour force participation is due to the scarcity of suitable jobs at the local level. Mushroom technology being a women friendly soft technology can be a boon for rural women who can help by bringing additional income to the family without sacrificing their time for their family and children. When women take up mushroom cultivation, it has better chances of being used in the daily diet of their families which can also help in mitigating malnutrition.

f. Inclusive technology

Mushroom technology is a simple technology with repetitive activities suitable for trainable physically challenged people especially in the rural sector where they are deprived of any skill or economy opportunity for equal participation. Mushroom technology has activities which with few physical, social and infrastructural modifications can be made suitable for special people and help in their socio-economic and psychological growth.

Agricultural social enterprises in India

A majority (53%) of social enterprises in India are focussed on skill development, followed by 30% on

education, according to a study on Indian social enterprises released by the British Council. The other sectors where social enterprises are active include agriculture-related activities (28%), financial services (26%), clean energy (26%) and technology in healthcare (22%), on-farm livelihood (17%), food and nutrition (16%) and sanitation and water (14%). For far too long, private entities have looked down upon Indian agriculture as an opportunity-less arena, giving them no chips to introduce new products and services, customised specifically for the sector. However, the new crop of social enterprises are making bold moves, expressing their confidence in the farmers' capacity to respond positively given a chance. However, observers and development professionals do not see an immediate answer to the problems of small farmers in the current flood of expensive and complex technology and analytics. This is an important point, because 67 percent of farmland in India is held by small farmers. So a company looking to scale and tap nation-wide consumers has to look at developing solutions that the majority is willing to try.

One such company is Ecozen, which has launched a solar-powered micro cold storage that the company claims to be affordable and portable. With this facility available locally, a farmer can sell his produce at better prices by keeping for himself greater room to hold the produce. Similarly, a very promising EM3 Agri Services is trying to close an apparent gap in the demand for heavy farm machinery like tractors by providing it on a pay-per-use basis. It is a fact that most farmers in India are financially incapable of buying heavy farm machines, and this could be a real boon for them. Hence, the fact remains that farm-focused social enterprises need to understand the real challenges faced by farmers in the country if they are to attain any significant success and these solutions do not lie solely in technology. This is evident from the performance of so many procurement startups like Parvata foods and Safe Harvest. By directly marketing the produce to urban retail points, these companies target a major problem for farmers - unfair market prices, and as a plus, encourage them to adopt healthier farming practices.

The recent innovation in farming has also shown that the solutions may not at all be about bringing in a new product or business model. Instead, using public policy to build on existing ideas so as to make them work effectively can also bring about radical change.

Agro-waste based social enterprises

During the recent past there has been strong views pertaining to utilization of agro wastes for profitable trade/business. Mushroom technology can play a very vital role as it utilizes agro-waste as the primary substrate for growing mushrooms. The spent substrate after mushroom harvest can be used either as animal feed, compost or raw material for bio-fuel production. The agro-waste based social enterprises can help in enhancement of income at every level in rural India.

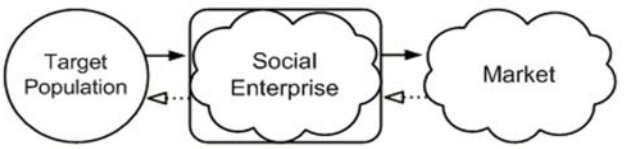
Social entrepreneurship models

a. Entrepreneur support model

This model supports the target population or "clients," self-employed individuals or firms by providing small working capital loan. Microfinance institutions, small and medium enterprise (SME) and business development service (BDS) programs use the entrepreneur support model. Microfinance institutions that provide small working capital loans to low income women who invest the capital in productive activities or small-scale production then sell their products in the open marketplace to enhance their income. Women SHGs can utilize small loans to produce mushroom value added products in this model.

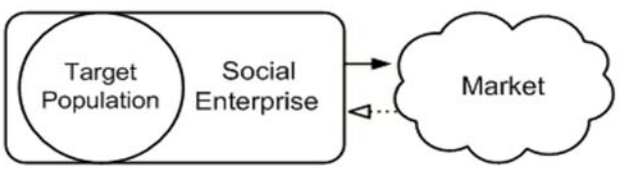
b. Market intermediary model

This model facilitates its target population or "clients," small producers (individuals, firm or cooperatives), to access markets by adding value to client-made products. Product development; production and marketing assistance; and credit fall under this model. Mushroom culinary social enterprises who can buy fresh mushrooms from small scale mushroom farmers or women SHGs and use in their culinary business or production of mushroom value added products to sold in urban markets.



c. Employment model

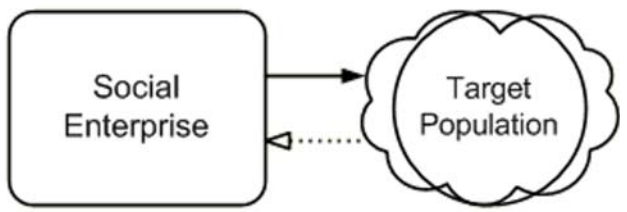
This model of social enterprise provides employment opportunities and job training to its target populations or "clients," people with high barriers to employment such as disabled, homeless, at-risk youth, and ex-offenders. The organization operates an enterprise employing its clients, and sells its products or services in the open market. The type of business is predicated on the appropriateness of jobs it creates for its clients, regarding skills development, and consistency with clients' capabilities and limitations, as well as its commercial viability. Food and Agriculture organization (FAO) developed a training module for the physically handicap in oyster mushroom cultivation in Thailand. Tata's model school 'SWASTHA' in Coorg where children with special needs have been trained in mushroom cultivation who grow mushrooms and sell to the local staff and market.



Physically and mentally disabled farmers on mushroom production and enterprise development. Pilot training activities were implemented at the Training Centre of the Department of Labor and Social Welfare, in Urbon Ratchatani province. About 40% of the ex-trainees are full-time successful mushroom entrepreneurs at village level; some have become trainers of disabled and non-disabled farmers themselves. Income gained by disabled mushroom producers and their families from daily sales at local markets varies from 5 to 10 US dollar equivalents per day. About 30% of the ex trainees are temporary/ seasonal mushroom producers, being also engaged in other agricultural activities. Various other resources persons at this meeting will present other successful FAO experiences in capacity building for local resources decentralization.

d. Fee-for-service model

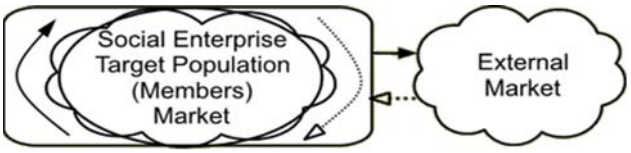
This model commercializes its social services, and then sells them directly to the target populations or "clients," individuals, firms, communities, or to a third party. In mushrooms this role can be played by KVKs. For e.g. Kvks can provide mushroom spawn and training services, sterilization services, RTF bag services, packaging and dehydration services by charging a small fee and facilitating rural growers.



e. Cooperative model

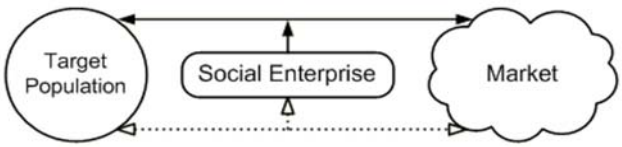
The cooperative model of social enterprise provides direct benefit to its target population or "clients," cooperative members, through member services: market information, technical assistance/ extension services, collective bargaining power, economies of bulk purchase, access to products and

services, access to external markets for member-produced products and services, etc. The cooperative membership is often comprised of small-scale producers in the same product group or a community with common needs—i.e. access to capital or healthcare. Cooperative members are the primary stakeholders in the cooperative, reaping benefits of income, employment, or services, as well as investing in the cooperative with their own resources of time, money, products, labor, etc. AMUL is a classical example for this model of social enterprise. Formation of Mushroom Farmer producers companies which can facilitate through spawn, substrate production, production and marketing of fresh, dehydrated and value added products, facilitate cold chain marketing etc.



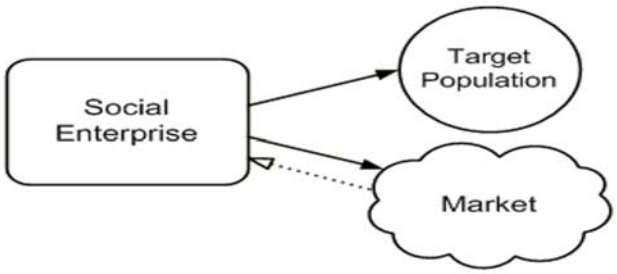
f. Market linkage model

The market linkage model facilitates trade relationships between the target population or "clients," small producers, local firms and cooperatives, and the external market. It functions as a broker connecting buyers to producers and vice versa, and charging fees for this service. Unlike the market intermediary model, this type of social enterprise does not sell or market clients' products; rather it connects clients to markets. Facilitation through connecting for export market for dried/ fresh mushroom, mushroom products, RTF bags, etc



g. Service subsidization model

The service subsidization model of social enterprise sells products or services to an external market and uses the income it generates to fund its social programs. The service subsidization model is usually integrated: business activities and social programs overlap, sharing costs, assets, operations, income and often program attributes. Although the service subsidization model is employed primarily as a financing mechanism—the business mandate is separate from its social mission—the business activities may enlarge or enhance the organization's mission. Mushroom social enterprise in collaboration with NGOs brings about mutual benefit of cost, asset, and space sharing for the enterprise and employment and income for the NGO through the sale of mushrooms/mushroom products / RTF bags produced in NGO premises.



Model in co-ordination with R&D and public institution

Public R&D institutions like ICAR labs, AICRP centres, KVKs, State horticulture departments, Agriculture/horticulture universities can play a very pro active role to take forward mushroom technology as a social enterprise. This can be done through generating locally suitable technologies; providing quality spawn; scientific training; providing market linkage; working with health and nutrition department policy makers to include mushrooms in mid day meals; working with Rural development ministry policy makers to include mushroom technology in MANREGA program especially for women; linkage

with skill development ministry to impart scientific mushroom cultivation training

Single window based agricultural waste management model

The single window availability of agricultural wastes can be very effective in agricultural waste management of the entire country. This can be taken up as a start up model or a network model involving all villages. This will facilitate availability of agricultural wastes wherever required instead of being burnt due to non availability of such facilitation centers. Fig. 1 is a conceptual model in this direction.

Net outcome of the above model

Efficient collection, storage and availability of biomass raw material for various economic activities like mushroom cultivation, compost preparation, bio-fuel, etc; employment generation for landless and marginal farmers and unemployed youth through collection and transportation of the biomass; drastic reduction in environmental pollution which happens due to burning of such biomass wastes; villages will become clean (swatch gram); single window availability of large amount of raw materials for biomass based activities; sale of agricultural biomass like paddy straw etc can bring in regular additional income to the farmer; creation of self employment in villages through mushroom cultivation and betterment of quality of mid-day meals of the village school through incorporation of mushrooms produced in the village itself; villages can have central composting yards to make their own compost in a scientific manner; surplus biomass not utilized at village/taluk level can be transported to district level warehouses; Availability of biomass through a single window system for agricultural/industrial enterprises in peri-urban and urban areas; Availability of nutritious and healthy food (mushrooms), employment, betterment of environment, energy, manure through efficient management of agricultural and forestry biomass

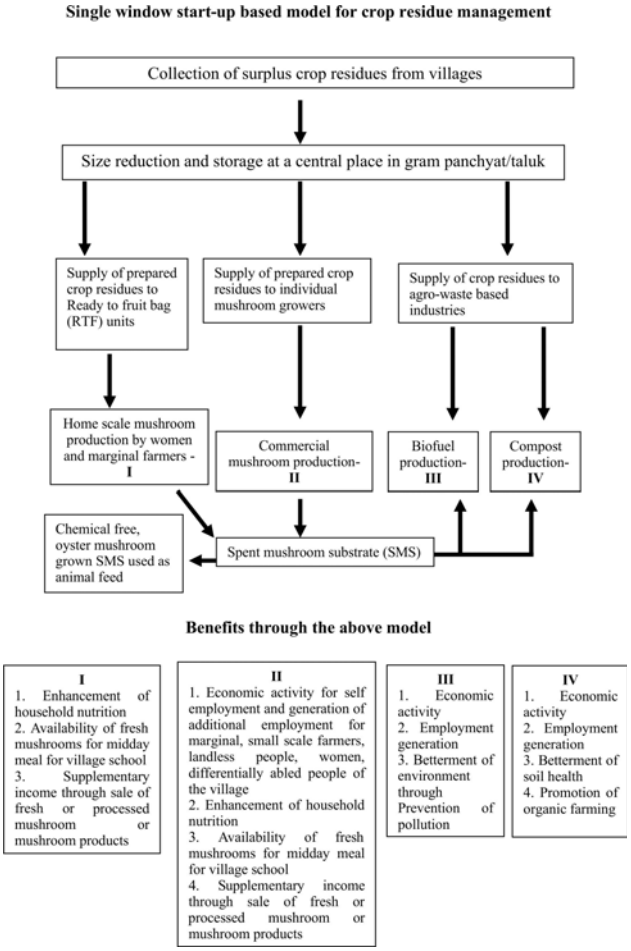


Fig. 1.

Finance for social enterprises

The major boost in social entrepreneurship was given by the Nobel Prize winner Dr. Mohammad Yunus when his brain-child Grameen bank became successful in helping people lift themselves out of poverty in rural Bangladesh by providing them with credit without requiring collateral. Yunus developed his revolutionary micro-credit system with the belief that it would be a cost-effective and scalable weapon to fight poverty. It was soon realized that profits can be made along with serving the society, provided you treat profits as a means and not the end result. The impact of such enterprise largely depend on its successful implementation to those that need it the most, those at the Bottom of the Pyramid. And of

Table 2. Availability of funds for social enterprise activities

Financing agency	Areas of support	Extent of support
Microfinance companies	For those at the bottom of the pyramid (BOP)	All rural sectors with poor people especially women
Acumen Fund http://acumen.org/	Primary focus on healthcare, housing, water, energy and agriculture	Companies invested : 12 Fund size: $40 million
VenturEast www.ventureast.net	Home health care, farm to fork concepts, agriculture	Companies invested : Over 50 (including 25 social enterprises)
		Fund size: $250 million
Song Soros Economic Development Fund, Omidyar Network https://www.omidyar.com	Sectors like education and training, agriculture and food, healthcare, financial services, basic utilities (waste, water, rural telecom, affordable housing, etc	Companies invested in: None Fund size: $17 million
Aavishkaar India Micro Venture Capital http://www.aavishkaar.in	Focus areas include Information and Communication Technologies and life sciences.	Total fund Rs 500 crore IIIF will provide funds directly in innovative enterprises, between RS. 20 lakh and Rs 5 crore
India inclusive innovation fund (IIIF) http://www.indiainnovationfund.in	Focus areas include Information and Communication Technologies and life sciences.	Total fund Rs 500 crore IIIF will provide funds directly in innovative enterprises, between RS. 20 lakh and Rs 5 crore
Samridhi fund http://samridhifund.com/	Investing in eight low income states of India in agriculture, livelihood, green technologies (Bihar, U.P, M.P, Rajasthan, Chhattisgarh, Orissa, Jharkhand, WB)	Investors are SIDBI, DFID (UK), LIC, UIIC

Table 3: List of social incubators in India

Agency	Functions
Un Ltd India	Financial and non-financial support, from inception to graduation of the a social
http://www.unltdindia.org	enterprise
Villgro http://villgro.org	Healthcare, education, agri-business and energy
Action for India http://actionforindia.org/	Water and sanitation facilities, improved agricultural practices, quality and affordable healthcare
Deshpande Foundation	In all sectors
RTBI – Rural Technology and Business Incubator http://www.rtbi.in/	Enterprises that are working towards rural and social inclusion -Information and Communication Technologies
Dasra	Sanitation, governance, adolescent girls
Upaya Social Ventures https://www.upayasv.org/	Focusing on skill development in all sectors
Ennovent http://www.ennovent.com/	Sanitation, energy, environment
Centre for Innovation, Incubation and	Energy, environment, agriculture, healthcare and affordable technology
Entrepreneurship (CIIE) http://www.ciie.co/	
Khosla Labs	Cloud technologies, mobile payments and Aadhaar
http://www.khoslalabs.com/	
Marico Innovation Foundation	Renewable energy, waste management, employability, livelihood and healthcare
http://www.maricoinnovationfoundation.org	
INVENT programme http://iitk.ac.in/invent/	Agriculture and food, healthcare and sanitation, education, energy, information technology

course a discussion about the BOP wouldn't be complete without mention of India; where hundreds of millions critically need a compelling movement in social entrepreneurship to improve their welfare. There is a natural predilection towards rural areas as 70% of the population lives in the hinterland. Recently, the rural scenario in the country has emerged as a lucrative option for the mainstream economy. Various organizations are viewing rural areas as potential markets, resulting in a gamut of innovative solutions within the social entrepreneurship space that focuses on and emerges from rural areas. Mushroom technology requiring agrowaste as the primary substrate, being labour intensive can be a highly successful social enterprise in which the rural areas with people with low income and skill can become the mushroom producers and can be linked to the markets in the urban areas by the enterprise.

Policy framework for social enterprise in India

India has seen a rapid expansion of social enterprise activity over the last decade. The ecosystem in India is relatively well developed with social enterprises active across all major sectors of the economy. In order to facilitate its engagement with government agencies in India on social enterprise, the British Council commissioned a short research study on the enabling environment for social enterprises in India, with a specific focus on the role that government could play in support of the sector. A very wide range of national and state-level policy and programmes influences social enterprise activity in India. The main points at which social enterprises are influenced are:

Examples of mushroom social enterprises - International

a. Mushrooms from coffee

Perma Fungi based in Brussels, is a good example of what we are talking about. They grow mushrooms using coffee grounds as a fertilizer. A cyclists collects around one-and-a-half tons of used coffee from restaurants every month. The company produces around three to four hundred kilos of fresh organic mushrooms, which are then sold in markets. They also make kits for growing mushrooms at home. Once production is complete, the coffee grounds are again re-used as a fertilizer, this time by farmers. Another interesting aspect of the project is that it creates local jobs for the low-skilled staff, who might otherwise have difficulty finding a job.

b. Hooba foods – A mushroom culinary social enterprise

Hooba, set up as a not-for-profit community interest company, has teamed up with the YMCA in Walker, Newcastle, to run a project working with ex-offenders to grow the oyster mushrooms using recycled coffee grounds collected from city centre cafes. Small-scale production is already underway, with the caps being sold by the YMCA to bring in money for the charity, while the mushroom stalks – which are usually discarded, despite being edible and nutritious – are used to make Hooba's food range.

Influencing policies	Requirements by stakeholders
Organisation registration	Legal status and definition
Sector-level policies, for example in health, education and water and sanitation.	Finance and access to investment
Finance and investment	Incubation and support
Incentives – taxation and subsidies	Access to markets, including access to government procurement opportunities
Programmes of support – in terms of skills development, access to markets and to finance, support to social innovation and programmes targeted at supporting disadvantaged groups	Support from the state and local (panchayat) level as well as from national government.

Examples of mushroom social enterprises - Indian models

c. Soumya Foods Pvt. Ltd

Ms. Divya Rawat who underwent mushroom training at DMR, Solan, is using mushroom cultivation as a way of curbing migration and providing livelihoods to people in Uttharakhand. This is also helping repopulate many 'ghost villages' in the state.

d. Mushroom start up Pluck fresh

Country's first Mushroom Start up company named "Pluckfresh" was launched on 24th Sept 2016 in Bengaluru. This company has been formed by Mr. Kevin Cherian who underwent Mushroom cultivation training at ICAR-IIHR and adopted the Ready to fruit (RTF) bag and the mushroom variety Arka-OM-1 (Pink oyster mushroom) released by ICAR-IIHR (The Hindu, 2013). ICAR-IIHR not only trained and transferred the two technologies but also guided him all throughout in his venture to demonstrate successfully this novel idea to financial institutions like Federal Bank and promoters like The Big Basket, a well known online marketing company. The initiation of RTF bag production as a Startup company is a beautiful example of using biological technologies as developmental tools for creating social entrepreneurship which can create business opportunities for clusters of individuals connected with it and bring about a wide impact on income and nutrition of numerous families. Such enterprises will help in making mushrooms a part of everyday meal which can have immense impact on enhancing household nutrition especially in rural areas. An indirect impact of such ventures will be in the creation of healthy pollution free environment through the recycling of Agricultural wastes which otherwise are burnt creating polluted environment, thus contributing to *"SWATCH BHARTH"*. This is an excellent example of how public sector research institutions who are technology generators can create socio-commercial entrepreneurship by networking with entrepreneurs, financial institutions and promoters which can lead to *"SAB KA SAATH SAB KA VIKAS"*.

CONCLUSION

The social enterprise model rather than pure conventional business model for mushroom will lead to win situation due to greater awareness about this crop, increase in the number of small scale region specific growers, increase in mushroom consumption hence in domestic market, create opportunity for value added processing industry and export market by making available the basic raw material –mushroom, create jobs especially in rural sector and for women, profitably utilize country's agro-waste and prevent air pollution, better nutrition and health through mushroom consumption.

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