Journal of Learning for Development – JL4D
ISSN: 2311-1550
2021, Vol. 8, No. 2, pp. 398-411

Achieving Community Development through an Agricultural Extension Programme: Technology Dissemination for Mushroom Farmers

Nilantha De Silva and Mahinda Wijeratne

University of Ruhuna, Sri Lanka

Abstract: Mushroom production is a small-scale business unit in rural areas. The Life Long Learning for Farmers (L3F) Programme aims to enhance the socio-economic conditions for them, increasing their access to and use of knowledge and technology. This study evaluates the outcomes of the L3F Programme at the community level. Data were collected through a pre-tested questionnaire survey. The sample consisted of 30 L3F farmers. Farmers' achievement was assessed by the Farmer Performance Index (FPI). Results indicate that mushroom farmers have scaled up their production; have improved their productivity; designed new experiments to minimise the impact of pests and diseases; focused on environmental sustainability and scientific mushroom production; and improved the quality of packaging. The mobile app Bimmal Govi, blended with Information and Communication Technology, helped them to move with the latest technological advancements. The L3F Programme has increased the standards of mushroom production, helping the farmers become promising entrepreneurs.

Keywords: agricultural extension, L3F Programme, mushroom, community development.

Introduction

Sri Lanka needs to increase its food production by 50% during the next few decades to meet the food demand of the rapidly increasing population (Marambe, 2018). Therefore, it is vital to increase both agricultural and labour productivity in Sri Lanka following various methods such as increasing the population involved in agriculture, minimizing the labour drainage from the agriculture sector into the service sector, increasing the availability of productive lands within the country, etc. (Collier & Dercon, 2014). Furthermore, it is important to develop strategies to empower small-scale farmers by providing sufficient resources and opening different ventures regarding commercialised agriculture. Then, the small-scale farmers would receive the opportunity to interact with large-scale farmers and develop hybrid enterprises creating important value chains (Collier & Dercon, 2014). The main challenge in this regard is reducing the imbalance between small-scale and large-scale farmers, whose main focus is to enhance agricultural productivity, while the small-scale farmers' focus is on sustainable livelihoods in the rural community (Pretty et al, 2011). Many of the small-scale farmers lack knowledge of modern technologies, efficient and effective use of inputs and proper management practices (Piesse & Thirtle, 2010). Therefore, it is important to educate the farmers about improved farming practices, effective and efficient land utilization, improved pest and disease management, best management practices, methods of increasing harvest, etc., through well-established agricultural research and extension networks in collaboration with respective governments and non-governmental institutions (Bozeman, 2000).

Transferring technology to the small-scale farmers in developing countries is vital since agriculture is the livelihood of the majority of the rural community; and the growth of the agriculture sector marks the social and economic development of developing countries in achieving national goals, including food security, employment and poverty eradication (Chebbi, 2010). Agricultural extension has three dimensions: improving the production and profitability of farmers and empowering the rural community through improving agricultural development tasks providing formal and non-formal agriculture-related education (Zwane, 2012). Empowering the local farming community is the most appropriate strategy to attain rural development. In this regard, agricultural extension can play a tremendous role through strengthening the human resource capacity of farmer organizations and enhancing their access to useful extension services, savings or credit (Thabet et al, 2015). Further, agricultural extension can develop farmers' capacity for innovation and link them with research institutions, private institutions, product markets, and non-governmental organizations, etc. (Poncet et al, 2010). If the national funds allocated for agricultural extension are inadequate, farmers could be introduced to regional and global donor agencies who are interested in delivering farmer-centred, demand-driven, performance-oriented, and participatory extension services (Nairobi Declaration on Agriculture Extension and Advisory Services, 2011).

More than 70% of the Sri Lankan population resides in rural areas of the country whose main source of income is agriculture-related activities (Thilakaratna & Pathirana, 2018). Among the agricultural products in Sri Lanka, mushrooms have been considered as a food source to meet the human protein requirement, and so mushroom farming has become popular as an agribusiness (Ferdousi et al, 2019). However, it has been revealed that many of the mushroom farmers restrict their cultivation mainly to Oyster (*Pleurotus ostreatus*) and Abalone (*Pleurotus cystidiosus*) mushrooms, while some of them left mushroom cultivation due to various circumstances related to production and marketing (Thilakaratna & Pathirana, 2018). Realizing that mushroom farming largely comprised scattered units of small-scale production, the Life Long Learning for Farmers (L3F) Programme was commenced with the prime objective of empowering the small-scale mushroom farmers in the Southern Province in collaboration with the Department of Agricultural Economics, Faculty of Agriculture, University of Ruhuna, Sri Lanka and Commonwealth of Learning, Canada (Wijeratne & De Silva, 2014). This is an agricultural extension programme to enhance the socio-economic conditions of the clientele via the dissemination of knowledge/technology generated in universities and elsewhere. Furthermore, it accumulates the existing local knowledge and outcomes of the farmers' experimentation. The L3F Programme has utilised an array of agricultural extension techniques such as farmer discussions, demonstrations, participatory farmer training/ workshops, field visits, printed educational materials, best farmer award competitions, and an interactive voice mail system (Wijeratne & De Silva, 2010; Wijeratne & De Silva, 2014). Therefore, it is important to assess the impact of the L3F Programme to identify the progress attained by the mushroom farmers through the extension efforts provided by the programme. Hence, this study was conducted to evaluate the outcomes of the L3F Programme at the community level.

Methods

The data were collected through a field survey which was executed during August-September in 2019. Two enumerators were employed in the field survey. The target population of the study was the mushroom farmers cultivating more than 500 mushroom culture bags who were registered in the L3F

Programme. There were 300 such farmers. Out of the target population, initially, 30 mushroom farmers were selected as the sample of the study However, one farmer had abandoned the cultivation at the time of the investigation. The enumerators visited the farmers individually and made observations on the mushroom shed and surroundings. The data were collected via a pre-structured questionnaire to investigate the components, including the construction of a mushroom shed, media preparation, daily maintenance, management of pests and disease, waste management, use of sustainable management practices, cost of production, harvesting and marketing, etc. The collected data were analyzed following the scoring method to evaluate the level of mushroom production managed by every farmer who participated in the field survey. Furthermore, the Farmer Performance Index (FPI) was developed to assess their performances in productivity. This technique was applied to assess the yield performance of the rice sector (Wijeratne & De Silva, 2002; Wijeratne & De Silva, 2003).

Results

Scale of Production

The production cycle of American Oyster mushrooms is confined to four months, including one month for mycelium development and a three-month harvesting period. During that period, one mushroom culture bag produces approximately 300-400 grams of fresh mushrooms. Therefore, the daily income of the mushroom farmers depends on the number of bags producing mushrooms on any particular day (because not all the bags produce mushrooms every day) and also the quantity of fresh mushrooms produced by each bag.

At the beginning of the L3F Programme, a baseline survey was conducted and the results revealed that the scale of production was restricted to less than 500 mushroom culture bags (Wijeratne & De Silva 2014). Therefore, it was expected to expand the scale of production at least up to 2000 mushroom culture bags with the intervention of the L3F Programme. Hence, at the inception, it was revealed that a farmer could earn a monthly profit of SLR (Sri Lankan Rupees) 20,000-25,000 (USD 100) which has been considered a reasonable economic gain to sustain a family. Table 1 depicts the scale of production of mushroom bags and 70% of the farmers have achieved the expected target of cultivating 2000 mushroom bags.

Table 1: Scale of American Oyster production

Number of Mushroom Culture Bags	Number of Farmers	Percentage of Farmers	Cumulative Percentage of Farmers
500-1000	11	38	38
1001-2000	9	32	70
2001-3000	1	3	73
3001-4000	2	7	80
4001-5000	2	7	87
5001-6000	3	10	97
>10000	1	3	100
Total	29	100	100

Achievement Distribution

The achievement distribution of the farmers was evaluated by the Farmer Performance Index (FPI). The location-specific yield was considered as 300g/per culture bag and this can be regarded as the average production of the area (Wijeratne & De Silva, 2014). The FPI is calculated as the farmer's actual yield/location-specific yield x 100. The optimal level is considered as 100%, meaning that a farmer has achieved a location-specific yield of 300g per mushroom bag. Application of this procedure locates every farmer on an achievement distribution curve (Figure 1). The level of achievement distribution of each farmer on the FPI provides a comparative measure to determine the ability of the farmers to accomplish the optimal economic level which plays an important role in identifying the target mushroom farmers for agricultural extension programmes in future. Therefore, agricultural extension programmes should be designed and executed in favour of the mushroom farmers who locate below the optimal economic level, in order to uplift their production and economic achievements. Figure 1 implies that 42% of the mushroom farmers locate below the optimum line of the achievement distribution. Hence, though they have reached the optimal scale of production, not all have obtained optimal productivity. Hence, it is essential to target the 42% of the farmers in the future agricultural extension programmes more intensively indeed.

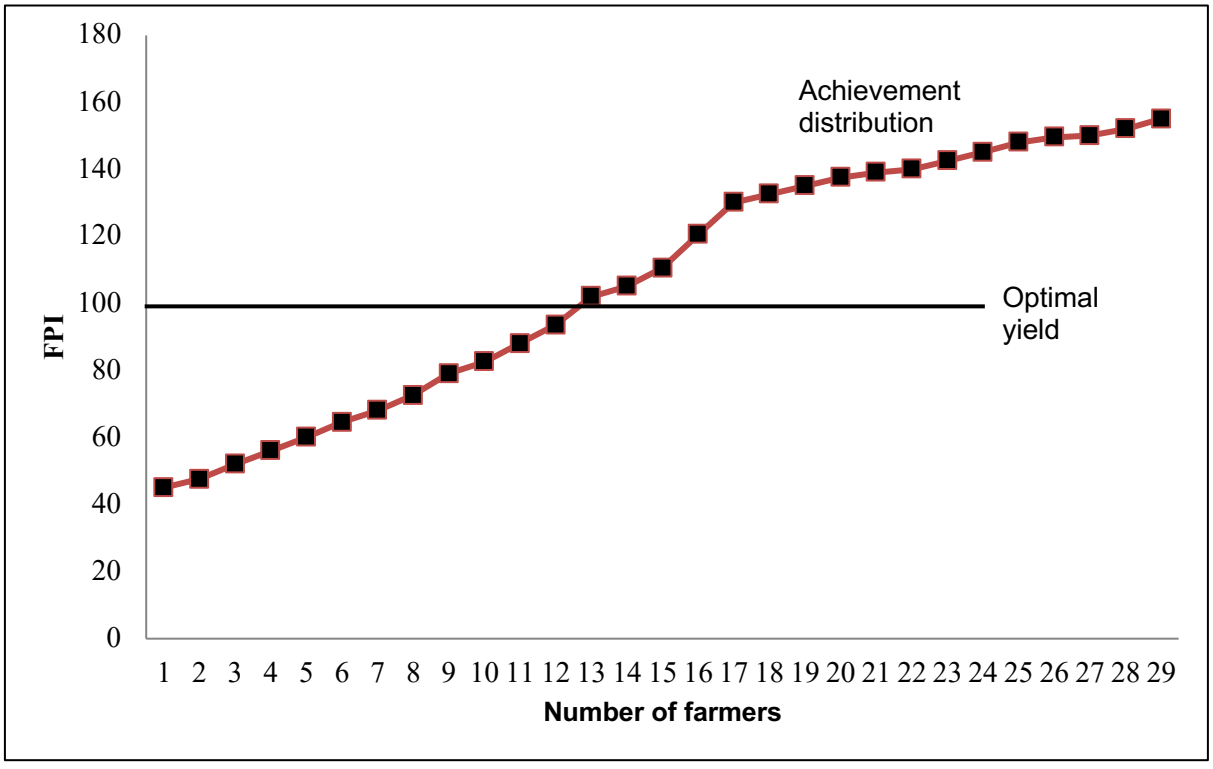

Figure 1: Achievement distribution of the mushroom farmers

Mushroom Seed Production

While moving towards sustainable mushroom production, the major problem encountered by the mushroom farmers was finding good quality seeds. Having identified this obstacle, the L3F Programme trained ten mushroom farmers on mushroom seed production. The farmers were provided with both theoretical and practical knowledge including the use of laminar flow. Having obtained knowledge from the training programme, the "Ekamuthu" Mushroom Farmers' Association in Kamburupitiya commenced the production of American Oyster mushroom seeds at Vidatha Center, Mapalana, which has been noted as a successful endeavour. The "Ekamuthu" Mushroom Farmers' Association sells the mushroom seeds to its members as well as to outsiders and earns a considerable monthly income. Later they scaled up the seed production business by producing mushroom seeds of other varieties such as Makandura White.

Cost of Production

The unit cost of a mushroom bag is vital for the calculation of income and profit as well as for increasing the scale of production. According to the farmers' records, the unit cost of a mushroom culture bag up to sterilization with the inclusion of maintenance cost was calculated as SLR 30. Also, it was recorded that the cost of labelling, packaging and marketing was SLR 10, so the total cost of a mushroom bag was SLR 40.

Generally, the farm gate price of a mushroom packet weighted 150 grams is SLR 50. As mentioned earlier, one mushroom bag produces 300 grams of fresh mushroom which indicates that two mushroom packets can be produced from one mushroom bag. Hence, the total income received from one mushroom bag is SLR 100 (SLR 50 x 2). Therefore, the profit obtained from one mushroom bag was calculated as SLR 60. Accordingly, if a mushroom farmer produces 2,000 mushroom bags during the production cycle of four months, the profit will be SLR 120,000 (SLR 60 x 2000). Therefore, the monthly profit earned by a mushroom farmer will be SLR 30,000 (SLR 120,000/4) (USD 150-200)[1] which can be considered as a reasonable monthly income to sustain a family.

Figure 2 reflects the cost, income and profit earned by a mushroom farmer by varying the number of mushroom bags. It implies that farmers could earn SLR 120,000 for the cultivation of 2,000 mushroom bags for the entire cropping period.

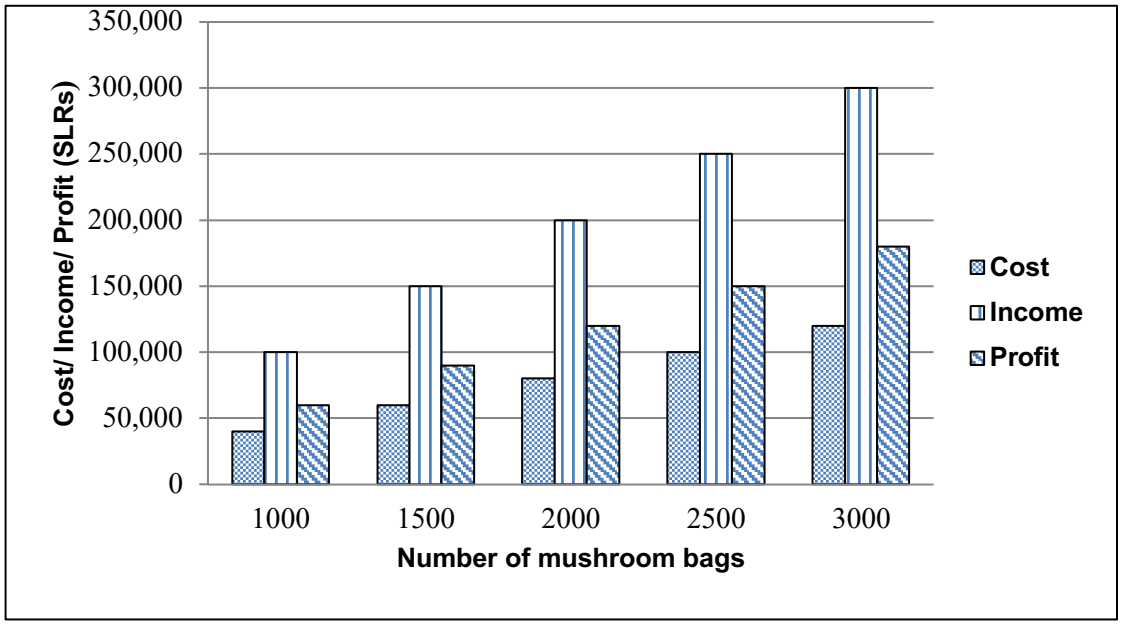

Figure 2: Variation of cost, income and profit according to the scale of production

Farmer Experimentation

Successful agricultural extension programmes accelerate farmers' strengths in innovative capacities and sharing innovative knowledge among farmers (Hagmann et al, 1999). But agricultural research and extension has generally failed to recognise the capacities and improve the participation of the farmers (Chambers et al, 1993). Furthermore, there is often reluctance to appropriate the richness and validity of the indigenous knowledge of rural people (Chambers, 1983). The farmer-to-farmer extension keeps farmers at the central point of the knowledge creation and dissemination process. Furthermore, comprehensive local knowledge encourages the innovative farmers to communicate with fellow farmers to spread the innovations rapidly at a lower cost (Tripp et al, 2005). In this scenario, the L3F Programme contributed to enhancing farmers' application of local knowledge to combat their problems. Another Sri Lankan study reported that farmers have obtained higher yields by growing mushrooms on both sides of the culture bag (Wijeratne & De Silva, 2014). After obtaining the basic hands-on experience about mushroom production from the L3F Programme, farmers undertook their experimentation in the aspects of minimizing pest attacks, increasing yield and increasing seed germination, etc. which has been able to attain successful outcomes. The summary of the experimentations undertaken by the farmers is mentioned in Table 2.

Table 2: Use of local knowledge in experimentation

Farmer Experimentation using Local Knowledge	Number of Farmers	Outcome
Vaporise Kohomba (*Azadirachta indica*) Oil + Thinner and use Sulfur fume as a mite repellent	6	Controlled mite attacks
Spray chopped Garlic (*Allium sativum*) + Kochchi (*Capsicum frutescens*) mixture	2	Reduced pest attacks
Increase the amount of rice bran and reduce the amount of green gram in the preparation of culture media	1	Increased yield
Spray Sulfur liquid	1	Reduced pest attacks
Use *Thriposha/Samaposha* for the media instead of green gram	7	Increased yield
Use *gandapana* (*Lantana camara*) leaves	3	Controlled pest attacks
Use Ipli Ipli (*Leucaena leucocephala*)	1	Controlled pest attacks
Add additional 100 grams of *gypsum* per 10 kgs of sawdust	1	Increased yield
Use whit-in instead of calcium carbonate	1	Increased yield
Use dolomite instead of calcium carbonate	1	Increased yield
Open holes around the bag and open a small hole after taking the first harvest	1	Increased yield
Sterilise chamber and rack system	1	Controlled pest attacks
Use automated water spray	1	Reduced heat inside the shed
Use a gas flame around the opening of the bag	1	Prevented pest attacks
Spray a blended mixture of Garlic (*Allium sativum*) + Soap + Kohomba (*Azadirachta indica*)	2	Controlled pest attacks
Paste grease on yellow colour sheets and hang in the shed	1	Controlled pest attacks

As mentioned above, innovative farmers engaged in experimentation to find feasible practical solutions for the problems encountered. This showed that farmers are rich in local knowledge and applied such knowledge without outside intervention. The L3F Programme tends to disseminate such local knowledge through the participatory interactive sessions.

Technological Advancements

Earlier, almost all the activities related to mushroom production had to be done by the farmers themselves. Some activities demanded a very high labour input (e.g., filling the bags). However, with the interventions and rapid advancements in technology during the last decade, many private companies entered the mushroom industry to provide materials, equipment, and services. As a result, mushroom farmers obtained the opportunity to save labour and time. Table 3 depicts the materials and services available for the mushroom farmers which make their work much more convenient.

Table 3: Technological advancements in the mushroom industry

Material/Service	Implications for the Farmers
Polypropylene bags (250 gauge)	Farmers can purchase the bags at a cost of SLR 4 per each that saves their time and labour
Caps to seal the culture bags	Farmers can seal the mushroom bags properly
Sprinklers	Control the amount of water sprayed to mushroom bags that save their time and labour
Humidity fires	Maintain the humidity within the shed appropriately
Machine for bag filling	Farmers can reduce the labour cost and the time spent for manual filling
Electric sterilising (steam)	The large quantity of bags can be sterilised at once that saves their labour and time
Production of quality seeds	Farmers can cultivate good quality mushrooms
High-quality printing, packaging, and labelling	Farmers could obtain such services to attract consumers, and also include relevant information.

Environment Sustainability

Disposal of mushroom bags after the production period of four months has created an array of environmental problems as the Polypropylene bags are non-degradable. Realizing the environmental problems encountered by mushroom production, the L3F Programme executed interactive awareness sessions to provide knowledge to the mushroom farmers on proper methods of disposing of mushroom bags, such as separating the polythene cover from the media, disposing the media away from the mushroom shed, using the media to make compost, using media as a fertiliser for other crops, burying the media and polythene covers, etc. Interestingly, almost all the farmers have started to practise such methods of disposal of mushroom bags and continue mushroom production in an environmentally-friendly manner.

Scientific Mushroom Production

Intending to enhance farmers' existing knowledge on scientific mushroom production, the L3F Programme executed an array of extension activities including demonstrations, visiting sessions, participatory training workshops, cross visits, an interactive voice mail system (Mobitel sim 8820), cyber extension, CD-ROMs, print media, etc. All such efforts were focused on providing knowledge on aspects of mushroom shed construction, media preparation, daily maintenance, control of pests and diseases, and harvesting and marketing. The extent of applying the knowledge on scientific mushroom production by the farmers was assessed and analysed using the scoring procedure. The results are mentioned in Table 4.

Table 4: Application of knowledge on scientific mushroom production

Knowledge Element	Category of Score	Number of Farmers	Percentage	Cumulative Percentage
Construction of Mushroom Shed	0-3	3	10	10
	4-7	8	28	38
	8-12	18	62	100
Preparation of the Culture Media	0-2	1	3	3
	3-5	1	3	6
	6-8	27	94	100
Seed Inoculation	0-2	0	0	0
	3-5	2	7	7
	6-9	27	93	100
Pest Control	0-4	1	3	3
	5-9	22	76	79
	10-13	6	21	100
Use of ICT	0-2	8	28	28
	3-5	20	69	97
	6-7	1	3	100
Risk Management	0-4	18	62	62
	5-9	11	38	100
	10-13	0	0	100

According to Table 4, 62% of the farmers have achieved a maximum score for construction of a scientific mushroom shed, while 94% exhibited correct preparation of mushroom culture media. In the production process, seed inoculation is a significant task. Ninety-three percent of the farmers are regarded as good practitioners in this regard. The mushroom farmers frequently encounter pest and disease problems and, in many instances, they abandoned cultivation. Even though the L3F Programme focused on these aspects, still farmers have not adopted the correct pest control measures satisfactorily. To increase the extension coverage, the L3F Programme, in collaboration with Mobitel PLC, developed the Interactive Voice Response (IVR) system. This facilitated incorporation of ICT and enhanced Open and Distance Learning (ODL) for the extension programme. The IVR system embedded a two-minute voice recording on mushroom cultivation. There are about 100 such messages, and farmers can access the system through Mobitel sim 8820. First, this facility was restricted to the registered farmers of L3F Programme but, by popular request, it was extended nationwide. There were more than 5,000 clients distributed throughout the country (Wijeratne & De Silva, 2014). The outcomes are documented in Wijeratne & De Silva (2011). However, even though ICT was encouraged with the mobile phone intervention, farmers showed only moderate usability. Non-

accessibility and reluctance to use smartphones could be stated as limitations. The applications of risk management practices are not apparent.

Market Information

Although there is a significant demand for fresh mushrooms in both urban markets and supermarkets, most of the farmers restrict their sales only to the surrounding retail markets because the mushroom farmers do not follow standard methods of packaging and labelling to meet the requirements demanded by customers. Thilakaratna and Pathirana (2018) mentioned that the main challenge faced by the mushroom farmers was the problems encountered in marketing. Realizing this fact, the L3F Programme organised training programmes to educate mushroom farmers regarding the use of proper packaging materials with adequate quality, preparation of attractive labels, size of the packet, and durability of the packet. Furthermore, farmers were educated about the information that should be mentioned on the label such as trade name, weight, price, date of manufacture and date of expiry to meet the legal requirements. Acquiring knowledge from the training programmes, mushroom farmers have started to use high-quality packaging materials, with attractive and eye-catching labels which state the necessary information on them.

Sustainable Management Practices and Risk Management

The study investigated the application of sustainable management practices during the production cycle, and the risk management procedure applied to combat fluctuating climatic factors and price. The investigated sustainable management practices included the environmentally friendly activities practised by the mushroom farmers such as the use of integrated pest management practices, control of the use of raw materials, use of culture media as manure, use of sprinkler irrigation systems, etc.

It was revealed that the mushroom farmers did not show much concern about following sustainable management practices throughout the process of mushroom production. Hence, any future extension agenda should focus on those aspects.

The application of prevention techniques as remedial measures to climate change and price sensitivity was also investigated. The sustainable management practices applied to minimise the impact of high temperature were spraying water manually or sprinkling water two to three times per day inside the mushroom shed, keeping a thin layer of water on the floor of the mushroom shed, and laying wet gunny bags on the floor. During the two years prior to writing, farmers did not encounter a significant price fluctuation. Therefore, no significant action was taken to change the daily mushroom production or the preparation of value-added mushroom products. The farm-gate price remained as SLR 50 per a 150g packet of American Oyster mushrooms and the retail price of some varied from SLR 60 to SLR 70.

Recent Innovations of the L3F Programme

Technology Dissemination Centres

The L3F Programme, in collaboration with the Ministry of Telecommunication and Digital Infrastructure, established cyber extension centres in eleven locations across the Southern Province intending to provide extension input through Open and Distance Learning (ODL). The cyber dissemination centres were established at Agricultural Service Centers (ASCs) where the Agriculture

Instructors (AIs) perform their official duties. There are three centres in Galle District, located in Labuduwa, Walahanduwa and Koggala. The centres in Matara District are located in Akuressa, Kamburupitiya, Mapalana, Godagama, Kekanadura, Hakmana, while the centres in Hambantota District are located in Katuwana and Weeraketiya.

Mobile App Development

The L3F Programme has developed a mobile app, namely, "Bimmal Govipola App", which can be installed on smartphones through Google Play Store. This app provides benefits to mushroom farmers, consumers and input suppliers of the mushroom industry. Through this mobile app, the mushroom farmers get the opportunity to mention and update information about their daily mushroom production including type and quantity, location of the farm/mushroom shed, type and quantity of inputs used. Therefore, the buyers receive the opportunity to contact the mushroom farmers directly without any intermediaries. Also, the input suppliers receive the opportunity to contact the relevant mushroom farmers directly and sell the inputs to them without exerting much effort.

Business Planning

Many of the farmers involved in the mushroom industry do not possess adequate knowledge about financial literacy, and business planning which has become the main barrier for them in obtaining credit. Therefore, the L3F Programme organised workshops for mushroom farmers scattered in the Galle, Matara and Hambantota Districts to educate them on the preparation of business plans from which they were able to gain adequate knowledge. The L3F programme linked the mushroom farmers with several banks including Bank of Ceylon, Peoples Bank and Ruhuna Development Bank. The farmers obtained loans to improve their mushroom production after providing the business plans prepared for their enterprise. Furthermore, several books such as *Mushroom cultivation as an enterprise* (Wijeratne & De Silva, 2012) and *Business planning for small scale entrepreneurs* (De Silva et al, 2019) were designed for farmers and distributed to enhance farmers' knowledge on entrepreneurship.

Best Farmer Award

The L3F Programme made awards to the best mushroom entrepreneurs to empower small-scale mushroom farmers and to encourage them to become successful entrepreneurs in the mushroom industry. The Best Mushroom Entrepreneur Award Ceremony has been held twice so far. In the first award competition (2011), only the mushroom farmers from "Ekamuthu Mushroom Society" in Kamburupitiya, Matara were considered. Later, as the activities of the L3F Programme were expanded to all three Districts in Southern Province, mushroom farmers from the entire Southern Province were selected for the second Best Farmers Award competition (2019). The assessment of the mushroom farmers, and their mushroom production process were evaluated systematically using a pre-structured questionnaire. The most highlighted feature of the second Best Mushroom Entrepreneur Award was that the three winners were awarded the technology of automating the mushroom shed that was provided with the collaboration of Dialog Axiata PLC and the L3F programme. This technology is a new intervention which automatically controls the humidity within the shed and also minimises the spread of pests and diseases.

Conclusion

Through the extension activities implemented by the L3F Programme, the mushroom farmers have been able to increase both the scale and productivity of mushroom production and achieve the expected outcomes. Seventy per cent of the farmers were able to increase the scale of production up to 2,000 bags. However, according to the Farmer Performance Index (FPI), 42 per cent of the farmers were still below optimal productivity. Hence, it is clearly important to include such farmers as the target clientele for future extension programmes. Furthermore, mushroom farmers were able to invent their experiments to minimise the impact of pests and diseases as well as increasing the yield using the local knowledge. The farmers also benefited from the technological advancements of the mushroom industry. As a result, they were able to reduce the cost of production through labour- and time-saving. The farmers have made efforts to comply with scientific mushroom production and environmental sustainability. The mobile phone intervention, through the Interactive Voice Response (IVR) system, has shown a moderate success as the farmers are not much geared toward this intervention. The mushroom farmers were also able to increase the quality of packaging and label preparation which let them enhance the capacity of marketing. The L3F Programme introduced a new intervention, the Bimmal Goiv App, to the mushroom farmers, blended with Information and Communication Technology, which helped them to move with the latest technological advancements. In all, it can be concluded that through the knowledge/technology transfer endeavours of the L3F Programme, the mushroom farming community benefitted to a significant extent, and established reasonable social-economic standards.

Acknowledgement: The authors wish to thank the Commonwealth of Learning (COL) of Canada for providing financial assistance to the L3F Programme of University of Ruhuna, Sri Lanka. This agricultural extension programme won the Commonwealth Award for Outreach and Community Relations.

References

Bozeman, B. (2000). Technology transfer and public policy: A review of research and theory. *Research Policy*, 29, 627-655.

Chambers, R. (1983). *Rural development: Putting the last first.* Longman Scientific and Technical, Longman Group. 246.

Chambers, R., Pacey, A., & Thrupp, L. A. (1993). *Farmer first*, *Farmer innovation and agricultural research.* Interactive Technology Publications.

Chebbi, H. E. (2010). Agriculture and economic growth in Tunisia. *China Agricultural Economic Review*, 2, 63-78.

Collier, P., & Dercon, S. (2014). African agriculture in 50 years: Smallholders in a rapidly changing world? *World Development*, 63, 92-101.

De Silva, N., Wijeratne, M., & Hasini, K.K.L. (2019). *Business planning for small scale entrepreneurs.* Neat Graphics.

Ferdousi, J., Riyadh, Z. A., Hossain, M. I., Saha, S. R., & Zakaria, M. (2019). Mushroom production benefits, status, challenges and opportunities in Bangladesh: A review. *Annual Research and Review in Biology*, *34*(6), 1-13.

Hagmann, J., Chuma, E., Murwira, K., & Connolly, M. (1999). Putting the process into practice: Operationalizing participatory extension. *Agricultural Research and Extension,* Network Paper No. 94.

Marambe, B. (2018). *Future of Sri Lanka and food security*. http://gamanicoreafoundation.lk/Future%20of%20Agriculture%20and%20Food%20Security%20Sri%20Lanka%201.pdf

Nairobi Declaration on Agricultural Extension and Advisory Services (2011). *Innovations in Extension and Advisory Services*. http://extensionconference2011.cta.int/sites/default/files/NairobiDeclaration30112011.pdf

Piesse, J., & Thirtle, C. (2010). Agricultural R&D, technology and productivity. *Philosophical Transactions of the Royal Society B*, 365, 3035-3047.

Poncet, J., Kuper, M., & Chiche, J. (2010). Wandering off the paths of planned innovation: The role of formal and informal intermediaries in a large-scale irrigation scheme in Morocco. *Agricultural Systems*, *103*(4), 171-179.

Pretty, J., Toulmin, C., & Williams, S. (2011). Sustainable intensification in African agriculture. *International Journal of Agricultural Sustainability*, 9, 5-24.

Thabet, B., Dhehibi, B., Kassam, S., & Aw-Hassan, A. (2015). Good intentions and hard realities: Achievements and challenges in agricultural extension systems in Tunisia. *International Journal of Agricultural Extension*, 3, 209-216.

Thilakaratna, W. S., & Pathirana, P. B. M. (2018). Prospects and challenges of mushroom production in Kuruwita, Sri Lanka: Comparative report on two consecutive years. *Journal of Dry Zone Agriculture*, *4*(1), 1-7.

Tripp, R., Wijeratne, M., & Piyadasa, V.H. (2005). What should we expect from Farm Field School? A Sri Lanka case study. *World Development, 33*(10), 1705-1720.

Wijeratne, M., & De Silva, N. (2002). Differences in farmer performance in two rice-growing areas in Sri Lanka. *International Rice Research Notes*, *27*(2), 42-43.

Wijeratne, M., & De Silva, N. (2003). Farmer categorization based on farmer performance index: Identifying the targets of agricultural extension. *International Rice Research Notes*, *28*(1), 72.

Wijeratne, M., & De Silva, N. (2010). Implications of intervention: Sri Lanka experience on lifelong learning for farmers. *The sixth plan — Commonwealth Forum for Open Learning, access and success in learning.* Indira Gandhi National Open University.

Wijeratne, M., & De Silva, N. (2011). Focus on marginalized groups: A Sri Lankan experience on empowering small scale mushroom producers. *Book of Abstracts, Annual conference of 25th Asian Association of Open Universities,* Wawasan University.

Wijeratne, M., & De Silva, N. (2012). *Mushroom production as an enterprise*. Neat Graphics.

Wijeratne, M., & De Silva, N. (2014). Agricultural extension in practice: A contribution to enhance small scale mushroom production. In M. Wijeratne & R. P. Mahaliyanaarachchi (Eds.), *Agricultural extension, recent interventions for development in Sri Lanka,* Sri Lanka Agricultural Extension Association, 159-171.

Zwane, E. M. (2012). Does extension have a role to play in rural development? *South African Journal in Agricultural Extension*, 40, 16-24.

Authors:

Nilantha De Silva is a Senior Academic attached to the Department of Agricultural Economics, Faculty of Agriculture, University of Ruhuna, Sri Lanka. She works as the Deputy Project Coordinator/Project Coordinator of Life-Long Learning for Farmers Project since 2008. The L3F project is one of the main outreach research projects of Ruhuna University, and mainly focuses on uplifting the living standard of mushroom farmers and scaling up the activities of organic farming. She has introduced many new initiatives to the farming community, especially to improve the knowledge of mushroom farmers. Email: nilanthade@agecon.ruh.ac.lk

Mahinda Wijeratne is an Emeritus Professor attached to the Department of Agricultural Economics, Faculty of Agriculture, University of Ruhuna, Sri Lanka. He was the key person to get this project to Ruhuna University and worked as the project coordinator from 2008 to 2017. During his tenure, he scaled up the project activities to the Southern province and worked to enhance the living standard of mushroom farmers. Email: mahindaw@agecon.ruh.ac.lk

Cite this paper as: De Silva, N., & Wijeratne, M. (2021). Achieving community development through an agricultural extension programme: Technology dissemination for mushroom farmers. *Journal of Learning for Development*, *8*(2), 398-411.

_____

[1]USD = SLR 160 - 180