

# **Mushrooming Entrepreneurship in Sri Lanka**

**Sangeeth Prasad Fernando**

**Virajith Kuruppu**

**Norica Aiome**

**G.A.I.P. Kumara**

Research Report No: 252



December 2022

Hector Kobbekaduwa Agrarian Research and Training Institute  
No.114, Wijerama Mawatha,  
Colombo 07

Department of Agribusiness Management  
Faculty of Agriculture & Plantation Management  
Wayamba University of Sri Lanka

Department of Agriculture  
Peradeniya

2022, Hector Kobbekaduwa Agrarian Research and Training Institute

First Published: 2022

ISBN: 978-624-5973-32-3

Hector Kobbekaduwa Agrarian Research and Training Institute  
114, Wijerama Mawatha, Colombo 07  
Sri Lanka

Final typesetting and lay-out by : Niluka Priyadarshani de Silva

Cover page design by : Udeni Karunarathna

Tel. Phone : +94 11 2696981  
+94 11 2696437

Fax : +94 11 2692423

Email : [librarian@harti.gov.lk](mailto:librarian@harti.gov.lk)

Web page : [www.harti.gov.lk](http://www.harti.gov.lk)

## FOREWORD

When the question of commercial agriculture crops up inevitably, it seems, the discourse is dragged to economies of scale. And so we contend with laws and regulations that inhibit land markets. The underlying assumption is that profitability is all about size. As such the arguments tend to swirl around the potential for large agri enterprises which, as history has shown, throws up a few powerful brands/companies that end up controlling prices and holding both producer and consumer to ransom.

In contrast the so-called small farmer or anyone engaged in 'tiny-agriculture' was assumed to be about consumption and little else. In other words, 'not for the market.' Markets, however, have existed long before the word was used as a synonym of sorts of a capitalist order. People grew, they consumed, they also sold or exchanged.

Of late though, especially with 45 years of the much-celebrated and equally rubbish 'open economy' cash-in-hand has been the name of the game. People grow, they consume some and sell a lot more. They have accepted or else been forced to accept the vulnerabilities engendered by innumerable intangibles. It does not necessarily result in inevitable resignation and docile acceptance of a system made of and which also produces terms of exchange slanted against those who just don't have the capital or are just not advantageously situated in the overall political economy to acquire the much desired economies of scale. People live, they contest, they come through. Sure, even in aggregate, the small agricultural entrepreneurs cannot lay claim to a handsome slice of the goodies that are associated with those who have made it good. Nevertheless, there's virtue in reading the terrain well, sowing the right seeds, tossing in the right inputs in the right quantities, metaphorically speaking. Wealth can be generated and wealth-generation can be sustained. Things can mushroom, so to speak.

Speaking of mushrooms, as we must give the nature of this study, it is an industry, a home-grown one, literally, that has taken off of late. In purely economic terms it is a doable enterprise given that primary production does not involve capital intensive machinery and requires minimum space. The benefits are many, either as a supplement to household income or even as the principal cash-earner, mushrooms are relatively 'easy.' They offer insurance of a kind as well against crop-failure due to climatic conditions or what could be called in the context of the current global economic crisis exacerbated by erroneous policy decisions locally as 'input-failure.'

Despite all this and as this study reveals, mushrooms are marginal in the agricultural and agri-enterprise discourses in Sri Lanka. There is a need to take measures to support mushroom growers/entrepreneurs and to provide incentives for the growth of the industry in the country. Right now, there's a lacuna in the literature on what's actually happening on the ground; the nature of the behavioural profile of the farmer-entrepreneurs, the patterns of distribution and potentials for value-addition. This study addresses this and provides an excellent basis for further exploration.

The examination of the industry over 6 districts has generated valuable information about levels of entrepreneurship, vital when considering measures of developing it further, especially considering excellent potential to enhance exports. As of now, the study reveals, whatever networking and support that exists has grown organically with little or no support from state institutions. The room for advancement is obvious. Economies of scale, if that's the magical marker of success, can be achieved, but in ways that do not impoverish and enhance dependency. One can have the mushrooms and sell it too. Not an unenviable thought in trying times.

**Dr. G.G. Bandula**  
**Director/CEO**

## **ACKNOWLEDGEMENTS**

We express our sincere gratitude to Dr. G.G. Bandula, Director, Hector Kobbekaduwa Agrarian Research and Training Institute (HARTI) for his enormous support in publishing this report. We are much thankful to Mr. Malinda Seneviratne, Former Director of HARTI for his excellent guidance and supervision throughout the conduct of this research study. We also thank Ms. Renuka Weerakkody, Additional Director (Cover-up), HARTI for encouraging us to bring out this report. In particular, we extend appreciation to Mr. Prasanna Wijesinghe, Head of the Data Management Division, HARTI for providing support, guidance and encouragement to conduct the study and for the valuable comments to improve the report.

We are grateful to the external reviewers Dr. L.P. Rupasena, Senior Lecturer, Faculty of Agriculture, Rajarata University of Sri Lanka and Dr. Frank Niranjan, Former Deputy Director (Research), Sri Lanka Council for Agricultural Research Policy for their valuable comments, guidance, encouragement, suggestions and advice to improve the quality of the final draft of the report. The research team highly appreciates mushroom societies and cooperatives, mushroom collectors and processors, Regional Agricultural Research and Development Centre-Makandura, Ratmalana Mushroom Development and Training Centre, Sri Lanka Export Development Board-Colombo, NGOs related to the promotion of mushroom cultivation and processing (Ex: SAEMAUL), other technical/training institutes related to mushroom cultivation and processing (Ex: Peoples Livelihood Development Foundation) for sharing their experiences and offering their valuable time to provide information during the field survey. Moreover, we extend our appreciation to all key informants representing the above stakeholders for responding to our queries. Contribution of all mushroom producers who took time to answer for the questionnaires and share their experiences at the survey is also deeply appreciated.

Further, thanks are also due for Ms. Priyantha Liyanage, Statistical Assistant of HARTI and Investigators Ms. L.D.S.D. Silva, Ms. H.A.H.J. Hapuarachchi, Ms. R.L.N.T. Rajapaksha, Ms. A.G.K. Kumari and Mr. Kasun Binendra for the great support extended during the survey. We are also thankful to Ms. Sharmini Kusum Kumara and Ms. Suharshi Perera for the expert editorial assistance and Mr. S.A.C.U. Senanayake, for proof reading the report. Further, we deeply thankful to Ms. Chandrika Dahanayake, Assistant Registrar (Programme) and her staff, Ms. Thushari Wedage (Accountant) and her staff for providing administrative facilitation throughout the study. Also, we wish to convey our sincere gratitude for Mr. W.H.A. Shantha, Present Head of the Information and Communication Division and his staff, Dr. N.P.G. Samantha, Former Head of the Information and Communication Division, Ms. Samantha Geethani, Management Assistant of the Data Management Division, all the Office Aides in the Data Management Division and Food Systems Division, Publication Unit and Printing Unit for the valuable contribution rendered to implement the activities of the research and publish this research report. We also thank our friends and others who have been helping and encouraging us through the study.

### **Research Team**

## EXECUTIVE SUMMARY

Mushroom has great potential as a source of nutrition, an economical and a climate-resilient crop that can promote farm-entrepreneurship through value-addition. However, a robust action plan is lacking in converting the crop into a diversified agribusiness venture among producers and processors. Hence the study aims at assessing the entrepreneurial behaviour of mushroom farmers and emerging agribusiness opportunities to uplift the mushroom industry, thereby reinforcing income generation and food security in Sri Lanka. The foci of the study were: identifying the factors that affect the entrepreneurial behaviour of farmer entrepreneurs, constructing an entrepreneurial behaviour profile of farmer-entrepreneurs, assessing the present situation of production and economy of the mushroom industry and exploring current and emerging agribusiness opportunities in the value addition process to enhance entrepreneurship capacity of farmer-entrepreneurs.

The study employed a descriptive survey design that blends quantitative and qualitative data. The study was conducted in two phases from August to December 2021 in Ratnapura, Kalutara, Colombo, Kurunegala, Kegalle and Kandy districts. In the face of the Covid 19 pandemic, questionnaires were used to elicit information from 289 mushroom producers via telephone in the initial phase. Additionally, another sub-sample of 100 interviewees were interviewed in-person for the second phase. Mixed reactions of both non-probability and probability sampling techniques namely snowball sampling and stratified random sampling were adopted to select farm households for the study. Also, key informant interviews and focus group discussions were conducted to evaluate the possible path forward. Both primary and secondary data were analyzed using descriptive and inferential statistics.

The study clearly illustrates that the mushroom industry is an ideal agribusiness venture that can economically empower people. Compared to other crops, its input cost is minimal. The study has revealed that the market demand for mushrooms is soaring day by day as they can be bought at a lower price than other food items. However, majority of the farmers in the sample (73.4%) show less entrepreneurial behaviour and the yield they produce has also reduced. Farmers with high entrepreneurial behaviour produce 2,600 kg/ year and farmers with low entrepreneurial behaviour produce 1,840 kg/year. Also, farmers with high entrepreneurial behaviour earn an average profit of Rs. 19,556/= per 1000 grow bags of mushroom cultivation per month, while for farmers showing low entrepreneurial behaviour it is Rs. 13,367/=. Lack of supervision and the less entrepreneurial behaviour of the mushroom producers have distanced farmers from the cultivation. Absence of a solid linkage to connect all actors and no state intervention are prominent issues. A public-private-partnership with state intervention would be promising. Innovation should be promoted and facilitated by providing regular technical and specialized agricultural support services by setting up forming farmer commodity associations to address farmer grievances and issues.

# CONTENTS

|   | Page No |
|---|---------|
| FOREWORD .....  | I       |
| ACKNOWLEDGEMENTS.....   | III     |
| EXECUTIVE SUMMARY .....   | IV      |
| CONTENTS .....  | V       |
| LIST OF TABLES .....  | VIII    |
| LIST OF FIGURES .....   | IX      |
| LIST OF Annexures .....   | IX      |
| LIST OF ABBREVIATIONS.....  | X       |
| <br>  |         |
| CHAPTER ONE .....   | 1       |
| Introduction .....  | 1       |
| 1.1 Background of the Study.....  | 1       |
| 1.2 Research Problem and Justification.....                                 | 1       |
| 1.3 Significance of the Study.....  | 2       |
| 1.4 Research Questions .....  | 3       |
| 1.5 Overall Objective.....  | 3       |
| 1.5.1 Specific Objectives .....   | 3       |
| 1.6 Organization of the Report .....  | 3       |
| <br>  |         |
| CHAPTER TWO .....   | 5       |
| Literature Review .....   | 5       |
| 2.1 Introduction .....  | 5       |
| 2.2 Entrepreneurship .....  | 5       |
| 2.3 Role of Entrepreneurship in Agribusiness Development.....               | 5       |
| 2.4 Socio-economic Factors and Entrepreneurial Behaviour .....              | 6       |
| 2.5 Overview of Mushroom .....  | 8       |
| 2.5.1 Nutritional Value of Mushroom .....                                   | 8       |
| 2.5.2 `Agribusiness Opportunities in Mushroom Industry.....                 | 9       |
| 2.5.3 Production and Marketing of Mushroom Industry in Sri Lanka.....       | 9       |
| 2.6 Summary of Literature Review .....                                      | 12      |
| <br>  |         |
| CHAPTER THREE.....  | 13      |
| Research Methods.....   | 13      |
| 3.1 Introduction .....  | 13      |
| 3.2 Research Approach and Design .....                                      | 13      |
| 3.3 Conceptual Framework.....   | 14      |
| 3.4 Selection of Study Location.....  | 16      |
| 3.5 Sample Selection and Sampling Techniques.....                           | 16      |
| 3.6 Data Collection.....  | 19      |
| 3.6.1 Instrument for Data Collection .....                                  | 19      |
| 3.6.2 Validation of the Questionnaire.....                                  | 20      |
| 3.6.3 Methods of Data Collection .....                                      | 21      |
| 3.7 Data Analysis.....  | 21      |
| 3.7.1 Model to Assess the Factors Affecting Entrepreneurial Behaviour ..... | 22      |
| 3.7.2 Entrepreneurial Behaviour Index (EBI).....                            | 24      |
| 3.8 Chapter Summary .....   | 25      |

|  |        |
|--|--------|
| CHAPTER FOUR.....  | 27     |
| Factors Affecting the Entrepreneurial Behaviour of Mushroom Farmers .....                            | 27     |
| 4.1 Introduction .....   | 27     |
| 4.2 Demographic Profile of the Respondents.....  | 27     |
| 4.3 Reliability Analysis.....  | 32     |
| 4.4 Logistic Regression Analysis.....  | 32     |
| 4.5 Chapter Summary .....  | 34     |
| <br>CHAPTER FIVE .....   | <br>35 |
| Entrepreneurial Behaviour Profile of Farmer-entrepreneurs .....                                      | 35     |
| 5.1 Introduction .....   | 35     |
| 5.2 Entrepreneurial Behaviour and Components.....  | 35     |
| 5.3 Chapter Summary .....  | 39     |
| <br>CHAPTER SIX .....  | <br>41 |
| Production of Mushroom .....   | 41     |
| 6.1 Introduction .....   | 41     |
| 6.2 Mushroom Housing .....   | 41     |
| 6.3 Mushroom Grow Bags .....   | 42     |
| 6.4 Pest and Diseases on Mushroom Cultivation .....  | 43     |
| 6.5 Varieties of Mushroom Cultivated.....  | 45     |
| 6.6 Number of Mushroom Growbags/Pots Cultivated per Cycle from each Variety ..                       | 46     |
| 6.7 Duration of a Production Cycle (in Months) of Different Mushroom Varieties ....                  | 46     |
| 6.8 Number of Production Cycles Cultivated per Year by the Farmers.....                              | 48     |
| 6.9 Production of Mushroom per Growbag/Pot (g) by different Mushroom Varieties .....                 | 49     |
| 6.10 Mushroom Yield Produced (kg) by Different Mushroom Varieties in One Production Cycle .....      | 49     |
| 6.11 Total Annual Mushroom Production (kg) in Different Mushroom Varieties.....                      | 50     |
| 6.12 Distribution of Total Annual Production of Mushroom (kg).....                                   | 51     |
| 6.12.1 Distribution of Total Annual Production (kg) across Entrepreneurial Behaviour Levels .....    | 51     |
| 6.12.2 Distribution of Total Annual Production (kg) across Districts.....                            | 52     |
| 6.13 Chapter Summary .....   | 53     |
| <br>CHAPTER SEVEN.....   | <br>55 |
| The Economy of Mushroom Cultivation.....   | 55     |
| 7.1 Introduction .....   | 55     |
| 7.2 Distribution of Income and Expenditure of Mushroom across Entrepreneurial Behaviour Levels ..... | 55     |
| 7.2.1 Income and Expenditure Component of Mushroom across Entrepreneurial Behaviour .....            | 55     |
| 7.3 Chapter Summary .....  | 57     |
| <br>CHAPTER EIGHT .....  | <br>59 |
| Current and Emerging Agribusiness Opportunities.....   | 59     |
| 8.1 Introduction .....   | 59     |
| 8.2 Mushroom Imports and Exports.....  | 59     |
| 8.3 Mushroom Marketing.....  | 63     |
| 8.4 Mushroom Societies .....   | 65     |



|                                    |   |    |
|------------------------------------|---|----|
| 8.5                                | Mushroom Growers who Won Their Lives through Mushrooming.....               | 67 |
| 8.6                                | Constraints Faced by Mushroom Farmers.....                                  | 68 |
| 8.7                                | Farmers’ Suggestions to Overcome the Constraints in Mushroom Industry ..... | 70 |
| 8.8                                | SWOT Analysis for the Industry .....  | 71 |
| 8.9                                | Chapter Summary .....   | 73 |
| CHAPTER NINE .....                 |   | 75 |
| Conclusion and Recommendation..... |   | 75 |
| 9.1                                | Conclusion.....   | 75 |
| 9.2                                | Recommendations .....   | 77 |
| REFERENCES .....                   |   | 80 |
| ANNEXURES .....                    |   | 85 |

## LIST OF TABLES

|  | Page No |
|--|---------|
| Table 3.1: Distribution of the Selected Sample for the Initial Phase .....                           | 18      |
| Table 3.2: Distribution of the Sample Selected for the Second Phase .....                            | 18      |
| Table 3.3: The Criteria for Understanding the Mean Scores of Satisfaction Level .....                | 22      |
| Table 3.4: Variables Applied in the Binary Logistic Regression Analysis.....                         | 23      |
| Table 3.5: Analysis Summary .....  | 26      |
| Table 4.1: Level of Entrepreneurship by Gender .....   | 28      |
| Table 4.2: Level of Entrepreneurship by District.....  | 31      |
| Table 5.1: Level of Entrepreneurial Behaviour of Respondents .....                                   | 36      |
| Table 6.1: Varieties of Mushroom Cultivated .....  | 45      |
| Table 6.2: Number of Growbags Cultivated per Cycle from each Mushroom Variety .....                  | 46      |
| Table 6.3: Duration of a Production Cycle (in Months) of Different Mushroom Varieties...             | 47      |
| Table 6.4: Number of Production Cycles Cultivated per Year by the Farmers .....                      | 48      |
| Table 6.5: Production of Mushroom per Growbag/Pot (g) by Different Mushroom Varieties.....           | 49      |
| Table 6.6: Mushroom Yield Produced (kg) by Different Mushroom Varieties in One Production Cycle..... | 50      |
| Table 6.7: Total Annual Mushroom Production (kg) by Different Mushroom Varieties.....                | 51      |
| Table 6.8: Total Annual Production of Mushroom (kg) across Entrepreneurial Behaviour Levels.....     | 51      |
| Table 6.9: Total Annual Mushroom Production (kg) across Districts.....                               | 52      |
| Table 6.10: Pairwise Comparisons of Total Annual Mushroom Production (kg) across Districts.....      | 53      |
| Table 7.1: Income and Expenditure Component of Mushroom across Entrepreneurial Behaviour Levels..... | 56      |
| Table 8.1: Constraints Faced by Mushroom Farmers .....   | 70      |
| Table 8.2: Suggestions from Farmers' End to Overcome the Issues in Mushroom Industry 71              |         |
| Table 8.3: SWOT Analysis for the Mushroom Industry in Sri Lanka.....                                 | 72      |

## LIST OF FIGURES

|   | Page No |
|---|---------|
| Figure 3.1: Conceptual Framework of Entrepreneurial Behaviour of Mushroom Farmers ... | 14      |
| Figure 3.2: Study Area .....  | 16      |
| Figure 4.1: Age Distribution across Entrepreneurial Behaviour.....                    | 28      |
| Figure 4.2: Educational Distribution across Entrepreneurial Behaviour .....           | 29      |
| Figure 4.3: Primary Occupation across Entrepreneurial Behaviour .....                 | 30      |
| Figure 4.4: Primary Intention of Farming across Entrepreneurial Behaviour .....       | 30      |
| Figure 4.5: Monthly Household Income across Entrepreneurial Behaviour .....           | 31      |
| Figure 8.1: Mushroom Exports by Quantity from 2016 to 2018.....                       | 60      |
| Figure 8.2: Mushroom Exports by Value from 2016 to 2018.....                          | 60      |
| Figure 8.3: Import & Export of Mushroom by Quantities from 2016-2021 November .....   | 61      |
| Figure 8.4: Import & Export Values of Mushroom from 2016-2021 November .....          | 62      |

## LIST OF Annexures

|   | Page No |
|---|---------|
| Annexure 01: Likert Items Relevant to the Eight Components which Result in the Entrepreneurial Behaviour..... | 85      |
| Annexure 02: Reliability Analysis for the Component of Entrepreneurial Behaviour.....                         | 88      |
| Annexure 03: Omnibus Tests of Model Coefficients of Logistic Regression .....                                 | 88      |
| Annexure 04: Hosmer and Lemeshow Test of Logistic Regression .....  | 89      |
| Annexure 05: Model Summary of Logistic Regression .....   | 89      |
| Annexure 06: Classification Table of Logistic Regression .....  | 90      |
| Annexure 07: Variables in the Equation in Logistic Regression.....  | 91      |
| Annexure 08: Mushroom Export Quantities and Values by Export Destinations .....                               | 93      |

## LIST OF ABBREVIATIONS

|       |   |  |
|-------|---|--|
| ANOVA | - | Analysis of Variance                       |
| DAD   | - | Department Agrarian Development            |
| DOA   | - | Department of Agriculture                  |
| EBI   | - | Entrepreneurial Behaviour Index            |
| EDB   | - | Export Development Board                   |
| FGDs  | - | Focus Group Discussions                    |
| KIIs  | - | Key Informant Interviews                   |
| LKR   | - | Sri Lankan Rupee                           |
| NGOs  | - | Non-Governmental Organizations             |
| PLDF  | - | People's Livelihood Development Foundation |
| PPP   | - | Public Private Partnership                 |
| SPSS  | - | Statistical Package for Social Science     |

# CHAPTER ONE

## Introduction

### 1.1 Background of the Study

Traditionally, agriculture is perceived as a less attractive and innovative venture with limited dynamics. However, over the past decades this has changed drastically with the growing demand for food around the globe. Hence, agriculture has become one of the potent sources of rural economy, food security, economic growth and development. This could be achieved through farmer-entrepreneurship as a change agent in the agro-food value chain (Dias et al., 2019). Thus, many of the national as well as international organizations focus more on farm-entrepreneurship as a strategic development intervention (Sandika and Kulasinghe, 2010). The number of entrepreneurs determines the success of each society and economy in any country. Therefore, many developed and developing countries focus on supporting entrepreneurship (Naude et al., 2011). One such approach is to promote the mushroom industry locally (Zhang et al., 2014).

Mushroom is simply a fruit body of fungi and often referred to as “Vegan Meat” which contains high nutrient and energy levels with its unique taste (Thilakarathne and Sivashankar, 2018). Mushroom cultivation is a popular and profitable agribusiness venture in many developing countries since the presence of abundant agricultural waste (straw, sawdust and other agricultural waste), excellent source of protein and energy providing support to reduce malnutrition, alternative solution for unemployment and job creation, less usage of high capital intensive machinery for primary production, window of opportunities for various level of value additions, limited land requirement for the cultivation and minimizing the climatic risk in agriculture (Jahan and Singh, 2019; Gamage and Ohga, 2018; Wakchaure, 2017). When attention is directed to Sri Lanka, commercial scale mushroom cultivation was initiated in 1985 with the aid of United Nations Development Programme (Thilakarathna and Pathirana, 2018). But, the development of the industry over the years is insignificant despite having a favourable potential, as a diversified agribusiness venture among producers and processors (Gamage and Ohga, 2018).

### 1.2 Research Problem and Justification

Due to economic, social and nutritional value of mushrooms, many Sri Lankan entrepreneurs who are looking for new agribusinesses turn to the mushroom industry. But due to various problems related to production and sales, a declining trend of farmers engaged in mushroom cultivation is observed (Thilakarathna and Pathirana, 2018). It is evident from the facts: 47% of the people engaged in mushroom cultivation in 2017 abandoned it by 2018, as per a study conducted on mushroom production in Kuruwita area. The main reason for this regression is the lack of entrepreneurial and managerial skills of the mushroom entrepreneurs in Sri Lanka (Gnaneswaran and

Wijegunasekara, 1999). Other than that, a lack of knowledge in mushroom cultivation and disease management, lack of financial assistance, technological barriers, difficulties in finding a proper local market and difficulties in producing value-added mushroom products have also contributed (Gamage and Ohga, 2018; Thilakaratna and Pathirana, 2018; Wijeratne and De Silva, 2014; Gnaneswaran and Wijegunasekara, 1999). This is well proved by the research of 'Prospects and Challenges of Mushroom Production in Kuruwita, Sri Lanka' conducted by Thilakaratna and Pathirana in 2018. Farmers have cited the need for additional training on disease management, packaging, and storing methods and financial support to expand their business.

Also, the mushroom industry in Sri Lanka is still growing with only a few value-added products available in the market and at present mushrooming is a cottage industry has the potential to grow into a much larger industry (Gamage and Ohga, 2018; Thilakarathne et al., 2018; Wijeratne and De Silva, 2014). Hence, identification and promotion of mushroom farm entrepreneurship in such areas are vital to aid the agricultural system in Sri Lanka (Dias et al., 2019).

The Government believes that the agricultural sector should capitalize more on the opportunities related to diversifying the production structure of food crops and moving towards high-value agriculture and promoting agricultural exports (Ministry of Agriculture, 2018). Furthermore, weak progress of farmer-entrepreneurs on establishment of processing and value adding business ventures is identified as a priority research area (Sri Lanka Council for Agricultural Research Policy, 2017). Promoting youth agricultural entrepreneurship and facilitating entrepreneurship development is also identified under people-centric economy as key strategies in the Vistas of Prosperity and Splendor (Ministry of Finance, 2020). These structural changes may accelerate poverty reduction and rural development. Moreover, this yields more direct and indirect employment opportunities for women and youth in rural agricultural communities. Apart from that, this creates an avenue for alternative income generation while protecting small scale farm families from possible financial risks. This could also be a strategy to cope and adapt to climatic change. Diversification and stable income enhance food security in the country as well. It is evident that sustainability of the agro-food sector could be achieved through providing real opportunities for farmers rather than providing mere subsidy schemes. Therefore, mushroom is an ideal crop that needs to be reconsidered for value addition process by promoting farm-entrepreneurship and also as a means to enhance rural agricultural development and food security in Sri Lanka.

### **1.3 Significance of the Study**

Climatic change threatens the traditional crop production resulting in more fluctuation in production and income generation. Most of the farmers do not have a proper alternative income generation source thus, are easily prone to financial risk. Lack of opportunities in income generation drag small scale farmers into the vicious cycle of poverty. Therefore, farmers no longer see agriculture as a viable industry. The focus is on survival rather than ideas on farm family growth and profit maximization

through diversified agribusiness ventures. Sri Lanka is gradually losing its momentum in the agriculture sector compared to its other South Asian counterparts. These issues have serious consequences not only on the sector's development but also on national food security. Lack of opportunities in the sector push the new generation away from agriculture. Therefore, Sri Lanka needs a systematic approach to change this situation and head towards development. This is where the stimulus of farm-entrepreneurship is essential for developing countries like Sri Lanka. Proper entrepreneurial skills may aid these farmers to connect with emerging agribusiness opportunities in national and global value chains creating a window of opportunities for the Sri Lankan agriculture sector.

#### **1.4 Research Questions**

- i. What are the underlying factors which affect the entrepreneurial behaviour of farmer-entrepreneurs?
- ii. What is the level of entrepreneurship among mushroom farmers?
- iii. What is the present situation of production and economy of mushroom industry?
- iv. Can Sri Lanka enhance the entrepreneurial capacity of mushroom farmers and how it should be done?
- v. What are the emerging agribusiness ventures related to the mushroom industry?
- vi. Are there any possibilities to adopt value addition within the industry?
- vii. What are the strengths, weaknesses, opportunities, and threats in the mushroom industry?

#### **1.5 Overall Objective**

To assess the entrepreneurial behaviour of mushroom farmers and emerging agribusiness opportunities to uplift the mushroom industry and thereby reinforce income generation and food security in Sri Lanka.

##### **1.5.1 Specific Objectives**

- i. To assess the factors affecting the entrepreneurial behaviour of farmer entrepreneurs.
- ii. To construct an entrepreneurial behaviour profile of farmer-entrepreneurs.
- iii. To assess the present situation of production and economy of the mushroom industry.
- iv. To explore current and emerging agribusiness opportunities to enhance the entrepreneurship capacity of farmer-entrepreneurs.

#### **1.6 Organization of the Report**

The report is organized as follows: The first chapter presents the introduction to the research. The second chapter reviews the literature on entrepreneurship, role of

entrepreneurship in agribusiness development, socio-economic factors and entrepreneurial behaviour, nutritional value of mushroom, agribusiness opportunities in mushroom industry, and production and marketing of mushroom industry in Sri Lanka. Chapter three presents the research methods including research approach and design, conceptual framework, selection of study location, sample of the population, sample selection & sampling techniques, instrument for data collection, validation of the questionnaire, methods of data collection and the data analysis. Chapter four, five, six, seven and eight respectively outlines the factors affect the entrepreneurial behaviour of mushroom farmers, entrepreneurial behaviour profile of farmer-entrepreneurs, production of mushroom, the economy of mushroom cultivation, and current and emerging agribusiness opportunities in the mushroom industry. Finally, chapter nine relates the conclusion and recommendations of the study in order to going forward.



## **CHAPTER TWO**

### **Literature Review**

#### **2.1 Introduction**

This chapter discusses entrepreneurship, role of entrepreneurship in agribusiness development, socio-economic factors and entrepreneurial behaviour, nutritional value of mushroom, agribusiness opportunities in mushroom industry, and production and marketing of mushroom industry in Sri Lanka. Those themes will explicitly discuss the research questions in order to achieve the objectives.

#### **2.2 Entrepreneurship**

Entrepreneurship is the activity of setting up a business or businesses, taking on financial risks in the hope of profit. It is a form of behaviour which paves the way for growth and development. Concept of entrepreneurship is not limited to certain areas or fields and more importantly it does not have a clear cut boundary. Hence, there are many definitions and interpretations regarding entrepreneurship (Rusu et al., 2012). Entrepreneurship is identified as a key input and a catalyst for economic growth and development. Hisrich and Peters (1989), defined entrepreneurship as “the process of creating something different, with value, by allotting the necessary time and effort, presupposing the taking of financial, social and physical risk, and obtaining monetary rewards and personal satisfaction”. Entrepreneur is the agent who engages in such processes. Another simpler version is that entrepreneurship is concerned with why, when and how individuals identify and exploit opportunities (Shane and Venkataraman, 2000). Throughout history, ways and means of entrepreneurial thinking have evolved with unpredictable twists and developments. Entrepreneurship mainly depends on opportunity seeking and the degree of risk taking (Rusu et al., 2012). Entrepreneurship also involves an economic function, as a bearer of uncertainty, as a distributor of resources or as an innovator. It also refers to inherent characteristics, creation of new organizations or the role of an owner or manager (Karlsson, et al., 2004).

#### **2.3 Role of Entrepreneurship in Agribusiness Development**

Farm-entrepreneurship can be divided into two parts namely: on-farm diversification (activities as part of the existing farm) and off-farm diversification (new business ventures outside regular farming). It is not only large scale farmers but small-scale farmers who can become entrepreneurs (Karlsson et al., 2004). Even though the majority of farmers tend to do on-farm diversification, off-farm diversification is also profitable, as long as farmers possess the qualities of innovativeness and forward-looking. Farmers need to be able to identify opportunities and seize them. Farmer-entrepreneurs recognize that new opportunities are found in the market and profits are made in the market therefore farm production decisions should be based on what

the market needs, not what farmers think. To identify the entrepreneurial behaviour of farmers, it is important to study the ladder of intention and reasons for farming. Farmers have four reasons to farm: farming exclusively for home consumption, farming primarily for home consumption marketing surplus, farming primarily for the market with some home consumption and farming exclusively for the market (Kahan, 2012).

Farmers who belong to the first step of the ladder, rarely demonstrate entrepreneurial intention and often these farmers are struggling with basic survival of themselves and their families. Second stage farmers could showcase better entrepreneurial behaviour through changing their resource mix. Such farmers are viewed as ‘pre-entrepreneurs’ as well. They require more support to move into an independent position. The third stage farmers do understand the importance and value of farming. These farmers are limited by access to finance, labour market, capacity development programmes and market information. Embracing risk is a vital factor to decide expansion of the farm business. Farmers in the fourth stage are fully market oriented. Those farmers are interested in the profit not the food production. Farmers in this level require greater farm management skills and entrepreneurial skills (Rusu et al., 2012). Farmers belonging to the second, third and fourth stages of the ladder demonstrate greater entrepreneurial intention as a result of market orientation. Thus, farmers in different stages require different strategies in order to enhance entrepreneurial skills.

Agribusiness is a broad and wide sector which comprises input, production and processing/manufacturing. The success of each part depends upon the proper functioning of the other two. Both public and private sectors should equally contribute to maintain the sustainability of the agribusiness sector. Davis and Goldberg, 1957, defines the agribusiness as the “the sum of all operations involved in manufacture and distribution of farm supplies, production operations on the farm, and the storage, processing and distribution of farm commodities.” Over the years the agribusiness system has evolved from individual markets to more complex chains and networks. The role of entrepreneurship plays a vital part in the modern agribusiness system (Zylbersztajn, 2016). Inherent uncertainty as well as a window of opportunities in the agriculture sector boosts farm-entrepreneurship. This is important to strengthen poverty alleviation and rural development in developing countries. Expansion of agribusiness systems within an economy opens up novel ways to earn and sustain hence, this has been further boosted by entrepreneurship. Therefore, farm-entrepreneurship is of utmost importance in the development of the agribusiness system within a country.

#### **2.4 Socio-economic Factors and Entrepreneurial Behaviour**

Behaviour is the way in which one acts or conducts or responses oneself, especially towards something or someone (Uher, 2016). However, entrepreneurial behaviour of farm management is termed as the changes in knowledge, skills and attitudes of farmers towards farming and allied activities. It is not necessarily doing new things but also doing things in a new way that have been already done, but with different results

(Anthony et al., 2014). Entrepreneurial behaviour can be measured in many ways. Most popular method is to use a mixture of qualitative factors which are attributed with entrepreneurship. Planning ability, embracing risk, leadership or management ability, cosmo-politeness, knowledge on farming and allied activities, ability to implement decisions, farm innovativeness, achievement orientations and market orientation are some factors which determines farm-entrepreneurship (Wanole et al., 2018; Bhendarkar et al., 2017; Chitsa, 2014). Degree of these attributes construct the farmer-entrepreneur.

Past studies have identified many socio-economic factors which affect entrepreneurial behaviour (Bhendarkar et al., 2017; Chitsa, 2014; Archana, 2013). Studies have shown that various factors such as age, gender, education, land holding, annual income, farming experience, participation in extension and economic motivation influence entrepreneurial behaviour. Gender is a base to assign certain roles and behaviour to men and women in the society. Gender also affects the decision making power in farming activities. Household head's gender is therefore significant in accessing resources and success in farming. Age is another factor that determines the degree of entrepreneurship in farming. It is evident that younger farmers are leaving farming since they are technically constrained and are attracted to other industrial activities. However, on the other hand older farmers possess hands-on experience related to farming thus creating tacit knowledge which is hard to transfer. Better human capital resources play a significant role in entrepreneurship thus, education and training is much needed to enhance entrepreneurial behaviour. Availability of own land for farming reduces the risk hence, farmers tend to experiment more. Household income and number of income sources are other crucial factors which enhance entrepreneurial capacity in farm management. Factors such as family size and more importantly number of dependents within the family determine the household economy thus, affect in different ways. In some cases, family labour greatly aids farming. If farmers possess self-processing capability it boosts novel products and processes.

Not only the micro level factors but, macro level factors also have an effect on the entrepreneurial capabilities (Kahan, 2012). In general, these factors are termed as the entrepreneurial environment which is beyond the control of farmers. Favourable policies enhance production and processing capabilities. Policy frameworks need to focus more on research and development and infrastructure development rather than imposing measures to control free flow markets (Wankhade et al., 2013). Simultaneously it may aid in the emergence and development of market structures in a country. Farmers could seek more opportunities by having access to wider business networks in both the public and private sector. Novel technological advancement may increase the efficiency and effectiveness of farm management thus, creating a window of opportunities in farm-entrepreneurship development.

## 2.5 Overview of Mushroom

### 2.5.1 Nutritional Value of Mushroom

The cultivation of edible mushrooms has become an attractive economic alternative over the past few years around the world mainly due to increase in its demand and market value (Cho et al., 2006; Chiu and Moore, 2001). The mushroom is a delicious food consumed by children and also elders throughout the world. It is also called, 'the future vegetable which is a guarantee for food insecurity, malnutrition problem and has medicinal value' (Getachew, 2016). At present, demand for mushrooms has increased as mushrooms satisfy the needs of health-conscious consumers. It is a desirable alternative food, especially for vegetarians (United States International Trade Commission, 2010).

According to Manikandan, 2011, mushrooms are considered to be a complete, healthy food and suitable for all age groups, from children to aged people. Mushrooms comprise about eighty to ninety percent of water, and eight to ten percent of fiber. Mushrooms are rich in protein, dietary fiber, vitamins and minerals. In addition to these, it is an admirable source of vitamins especially C and B (Folic acid, Thiamine, Riboflavin and Niacin). Minerals such as potassium, sodium and phosphorus are higher in the fruit bodies of the mushroom. It also contains other essential minerals (Cu, Zn, Mg) in traces but is deficient in iron and calcium. The nutritional value of mushrooms is affected by several factors such as species, stage of development and environmental conditions. Further, the digestible carbohydrate profile of mushrooms includes starches, pentose, hexoses, disaccharides, amino sugars, sugar alcohols and sugar acids. The total carbohydrate content in mushrooms varied from 26-82% on a dry weight basis in different mushrooms. The crude fiber composition of the mushroom consists of partially digestible polysaccharides and chitin. Mushrooms have been shown to encourage immune function; boost health; lower the risk of cancer; inhibit tumor growth; help balancing blood sugar; ward off viruses, bacteria, and fungi; reduce inflammation; and support the body's detoxification mechanisms. Increasing recognition of mushrooms in complementing conventional medicines is also well known for fighting for many diseases.

According to Baraza et al., (2007) and Barros et al., (2008), mushrooms are low in fat and simple carbohydrates. And they are rich in digestible protein, high molecular weight polysaccharides among other nutritional constituents and good source of fiber. Further, mushrooms contain unsaturated fatty acids, which constitute over 70% of the total content of fatty acids, contain essential fatty acids, and are low in calories, and high in vegetable proteins, minerals and vitamins. Also, mushrooms are a rich source of secondary metabolites which may be essential for nutraceuticals, pharmacological and medicinal applications. According to Dembitsky et al., (2010), 'some mushrooms have therapeutic activity which is useful in preventing diseases such as hypertension, hypercholesterolemia, atherosclerosis and cancer'. Which shows that mushrooms are highly nutritious food.

### 2.5.2 `Agribusiness Opportunities in Mushroom Industry

Global mushroom production has steadily increased from 0.3 million tons to 3.4 million tons from 1965 to 2015 (Singh et al., 2017). World leading mushroom producing countries are China, United States, Netherlands, Poland and Spain. Among these countries, China itself produces nearly 70% of the total production. Apart from China, other Asian countries such as Japan, India, Indonesia, Vietnam and Korea are also producing mushrooms (Food and Agriculture Organization of the United Nations, 2020). Further, the global demand for readymade or ready-to-make food products makes it an even more popular food source. High moisture level of mushroom acts as a barrier to store it for more than 24 hours. Therefore, producers and processors tend to move towards novel agribusiness ventures through value addition. Value can be added to the mushrooms at various levels, right from grading to the readymade snacks or the main-course items (Wakchaure, 2017). Hence, mushroom cultivation is a popular agribusiness venture.

In India, mushroom soup powder, biscuits, nuggets, ketch-up, candy, pickle, chips and ready-to-serve mushroom curry are popular agribusiness ventures initiated under farm-entrepreneurship. Further, mushrooms are utilized to produce jam, cake, idli, bread, pizza, macaroni, pasta and noodles (Wakchaure, 2017). Mushrooms are traded worldwide in the processed forms like frozen, canned, pickled and dried which increases shelf-life and market value. It was reported that market structure for mushrooms in many South Asian countries are unstructured (Jahan and Singh, 2019). Thus, production and processing of mushrooms is bound to a limited scope. This is where farm-entrepreneurship should focus on. The value addition is not very popular among small scale producers in Sri Lanka due to low production capacity and high demand for fresh mushrooms in the local markets. However, still mushroom producers in Sri Lanka have opportunities to go for higher production and value addition to their product. It allows supply to the demand throughout the year while giving a surplus price to value added products (Gamage and Ohga, 2018). Economic potential of mushroom cultivation has been demonstrated in China in 1989 when mushroom cultivation was popularized to help people in poverty stricken areas. Furthermore, Oyster mushroom production targeted for small scale farmers in Kisumu and Busia, Kenya was promoted as a poverty reduction tool (Vostrovsky and Jablonska, 2007).

### 2.5.3 Production and Marketing of Mushroom Industry in Sri Lanka

According to a study carried out by Thilakarathne and Sivasankar in 2018 on Mushroom Value Chain Analysis in Kegalle District of Sri Lanka, there were mainly four mushroom varieties namely American oyster (*Pleurotus ostreatus*), Bhutan oyster (*Pleurotus eous*), Abalone (*Pleurotus cystidiosus*), and Button mushroom (*Agaricus bisporus*) cultivated commercially in Sri Lanka. In addition, Makandura white (MK-White; *Calocybe* sp.) was a variety introduced recently, and it is not popular with the mushroom producers due to various reasons like lack of knowledge about the variety, etc. However, according to many studies, Sri Lanka mainly relies on American oyster

(*Pleurotus ostreatus*) (Thilakarathna and Pathirana, 2018; Gamage and Ohga, 2018). Sri Lanka exported US\$ 229,765 worth of mushrooms in 2014 (Sri Lanka EDB, 2016). The study of Thilakarathne and Sivasankar (2018) further illustrated that although there were many substrates that were Tested and proven to suitable such as straw and bagasse, all the producers responded used sawdust as their substrate because of its easy availability. All the other substrates were available abundantly only in seasons. But sawdust was available all around the year. There were only a few who bought sawdust from intermediaries; almost all the producers bought sawdust from the sawmill directly. But the supply of sawdust was getting scarcer as the many sawdust suppliers had started making furniture out of sawdust of rubber and other light wood, which is used in mushroom cultivation. Due to the consistency of the demand from the furniture manufacturers, sawmill owners tended to give the sawdust to the furniture factories. Therefore, then, the mushroom farmers had to buy sawdust in larger quantities. Earlier they used to buy sawdust as they needed and in the exact quantity, they required. Moreover, according to a study conducted by Rajapakse et al., (2007), the substrate called paddy straw and sugar cane bagasse are equally good substrates as the traditionally used saw dust media for oyster mushroom cultivation in Sri Lanka. In the year 1990, Hami conducted a study using different types of sawdust used in oyster mushroom cultivation. Accordingly, wood powder from mango, lunumidella and mahogany plants has been identified as the most suitable wood powder substrate for oyster mushroom cultivation. He has confirmed that the wood powder of these plants is softer than the wood powder of plants that have a hard texture, so it allows the spawn to produce better yields. Also, Joseph et al., (1998) have shown that rubber wood saw dust-an ideal substrate for the mushroom cultivation.

Another issue pointed out by Thilakarathne and Sivasankar (2018) was that there were fewer spawn producers in the Kegalle district that are registered in the Department of Agriculture, and the spawn producers had to be found with directions from the farmers and agriculture instructors. Accordingly, mushroom producers bought the required mushroom seed from the department of agriculture sales outlet in Gannoruwa and from the Mushroom development center in Ratmalana, which is not located in the Kegalle district.

Mushroom cultivation requires a substrate and supplements for the growth of the fungi. The main supplements used for the cultivation are  $MgSO_4$ ,  $CaCO_3$ , Rice bran, and Green gram flour (Rajarithnam et al., 1988). Also, as a supplement, some farmers had gotten used to apply the food called “Samaposa” which is prepared from maize, rice, and soybean. Anyhow, most mushroom producers use all the other supplements, except “Samaposa”. They omit it from the mixture in the belief that there is no benefit to the harvest from that though it amounts to a higher cost of the mixture (Thilakarathne and Sivasankar, 2018).

According to Thilakarathne and Sivasankar (2018), to harvest a well-matured mushroom, a producer has to go through many steps. Accordingly, after the spawn is inserted into the mushroom media bags, the bags are kept in a dark room which is

called an incubation chamber to facilitate mycelia growth. After the mycelia are covered all over the bags, the bags are kept in a well-lighted grow house until the fruiting stage. There the producer will be able to harvest the mushroom. Many factors have to be in favourable condition for the mushroom to be grown in good health. Environmental factors like relative humidity, temperature, CO<sub>2</sub> concentration, and lighting condition has to be controlled so that the fungi can grow to the optimum level utilizing the media. They further stressed that the majority of the mushroom producers kept their season for two to three months and others got harvested until three to five months.

According to the study carried out by Thilakarathne and Sivasankar in 2018 on Mushroom Value Chain Analysis in Kegalle district, the decision making on the price of packet of the mushroom is mainly determined by the traders. Therefore, there might be significant power by the traders over the mushroom value chain. And most of the traders have one to five suppliers of the mushroom. There was an informal agreement between the traders and the producers to buy certain amount of harvest from a particular supplier. This has been built-up over long-time business relationship. Average purchasing price of fresh mushroom kilograms by traders was LKR 257.5. And LKR 286.5 was the average selling price by the traders.

They showed that problems encountered in marketing were the biggest challenge faced by the majority of farmers in Kegalle district in 2018. According to them, this problem can be minimized by providing direct transport facilities to the island wide supermarket, local traders, intermediaries, regional wholesalers, local restaurants or becoming organized with farmer cooperatives with the government involvement. Further, returned packs could be used to make value added products such as dried, pickled or fried mushrooms to increase the shelf life of mushrooms for domestic consumption. Also, the study revealed that farmers need additional trainings on disease management, packaging and storing methods and also need support in terms of finance to expand their business. The study expressed the significance of empowering the mushroom production in Sri Lanka as small and medium entrepreneurs because it aids the rural farmers to improve their livelihood. Moreover, they suggested to provide high quality seeds continuously to all the farmers to obtain high quality yield at a reasonable price by targeting the foreign market as well. Additionally, to achieve this target, availability of better and low cost substrates, approaches of maintaining hygienic conditions in the culturing sheds, effective disease controlling techniques, introduction of new varieties of edible mushroom to the farmers were essential. Finally, they have quoted that the research and development aspects relevant to above issues need to be promoted to have a sustainable mushroom cultivation in Sri Lanka.

Further, technological improvements of mushroom cultivation in Sri Lanka is not satisfactory when compared to other countries South Asian countries like Bangladesh, Pakistan and India (Gamage and Ohga, 2018). Despite growth in the industry through mushroom growing programmes introduced in the rural areas as self-employment generation by many government and non-government poverty alleviation

programmes, value addition is still in its infant stages in Sri Lanka (Thilakaratna and Pathirana, 2018).

Socio economic research on the mushroom industry in Sri Lanka is limited compared to other crops cultivated (Karunaratna et al., 2017; Thilakaratna and Pathirana, 2018). So, the mushroom farmers have little knowledge about what are the consumer preferences in their products and how they can increase the profit by engaging in more value-added activities for their products.

## **2.6 Summary of Literature Review**

This review includes concepts and empirical studies. With the aid of this chapter, knowledge gaps, findings and conclusions of previous studies were covered to cater for analyzing the objectives and methodological review and analysis is discussed under the next chapter of research methods.



## **CHAPTER THREE**

### **Research Methods**

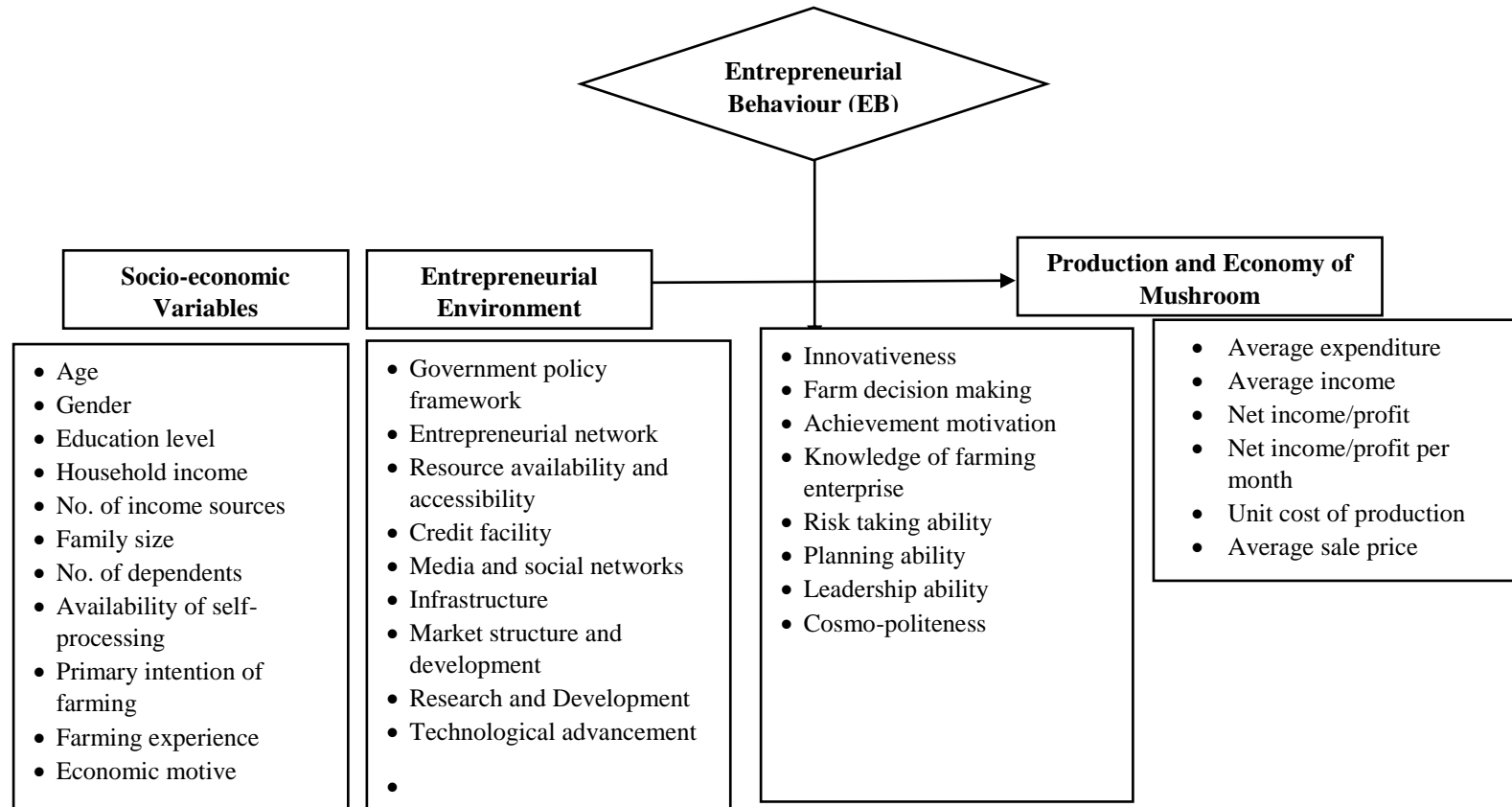
#### **3.1 Introduction**

This chapter gives an outline of research methods that were deployed in the study. Here, it describes information on the conceptual framework in a detailed manner to achieve the objectives of the research. The research approach and design that was chosen, conceptual framework, the geographical area where the study was conducted, sample of the population, sample selection and sampling techniques, data collection (instrument for data collection, validation of the questionnaire and methods of data collection) and data analysis techniques have been widely explored.

#### **3.2 Research Approach and Design**

A descriptive survey design that blends quantitative and qualitative data to unveil in-depth knowledge on a phenomenon was used (Mouton, 1996) and it serves best in answering the questions and the purposes of the study. Descriptive research is one in which a group of people or items is studied by collecting and analyzing data from only a few people or items considered to be representative of the entire group of people or items. That means, only a part of the population is studied, and findings from this are expected to be generalized to the entire population (Nworgu, 1991).

### 3.3 Conceptual Framework



Source: Authors' own compilation (2021)

**Figure 3.1: Conceptual Framework of Entrepreneurial Behaviour of Mushroom Farmers**

The conceptual framework shown in the above figure 3.1 explicitly describes the research design. At the outset, planning of a research is a conceptual framework that justifies the study and explains its structure. It provides essential support for the study components and also illustrates the context of the study for the reader. This framework explains how the study is conceived, what knowledge it will add regarding the topic, and how the elements of the study design align with the problem identified for the study.

The study adopted the descriptive design of social research to measure the entrepreneurial behaviour of mushroom farmers and thereby assessing the distribution of production, marketing, income and expenditure data of mushroom industry. Entrepreneurial behaviour is influenced by many intrinsic and broad extrinsic factors. This is also common in farmer-entrepreneurship. Accordingly, selected socio-economic variables are identified as independent variables which affect the dependent variables; production, marketing, income and expenditure data. Further, entrepreneurial behaviour and entrepreneurial environment is considered as the moderating variables which affect the relationship between independent and dependent variables.

Entrepreneurial behaviour is derived as a function of eight components through intense literature review. These eight components are considered as the essence to capture entrepreneurial behaviour of farm-entrepreneurship. It is important to understand not only one but all eight components which contribute to the behaviour of the entrepreneur. Innovativeness is a personal creativeness displayed by the farmer through trying new farming techniques and making improvements to existing farming methods. Farm decision making is the ability of farmers to select and execute the most efficient decision among a set of alternatives independently. Social value that emphasizes a desire for excellence in order for an individual to attain a sense of personal accomplishment is the achievement motivation. The level at which the farmer has mastered the necessary information and skills required for the profitable operation of the farming enterprise is considered as the knowledge of farming enterprise. The degree to which the farmer is oriented to embrace uncertainty in farming activities is called risk taking ability of the farmer. Planning ability is the way that the farmer carves the future direction of the farming venture by allocating sufficient resources to achieve goals and objectives of the venture. The degree to which an individual initiates and motives the action of others is the leadership ability. The degree to which the farmer is oriented outside his community and makes diversity in what he does is coined as Cosmo-politeness (Wanole et al., 2018; Bhendarkar, et al., 2017; Chitsa, 2014).

Apart from different independent variables, moderating variables also influence the relationship between independent and the dependent. As a whole this is termed as the entrepreneurial environment. Farmer-entrepreneur acts within this environment and his behaviour is also moderated by these broad aspects which are beyond his control. The main aspect is the government policy framework to support farmer-entrepreneurs. This includes different policy setups which link with many private and

public institutes and its activities. Then the infrastructure and resource availability. Further, market structures and its development over time moderates the relationship. Inter and intra network among other stakeholders also have an effect. Furthermore, research and development acts as another catalyst in farm-entrepreneurship.

### 3.4 Selection of Study Location

In general, mushroom growers are scattered around the island. However, the proposed study focused on Ratnapura, Kalutara, Colombo, Kurunegala, Kegalle and Kandy districts, from August to December 2021. These areas make a significant contribution towards the mushroom industry in Sri Lanka. Furthermore, developing and potential markets have been identified in these areas (Gamage and Ohga, 2018; Thilakarathna and Pathirana, 2018; Thilakarathne and Sivasankar, 2018). In addition, selection of these areas were verified through the initial discussions conducted with the Department of Agriculture.

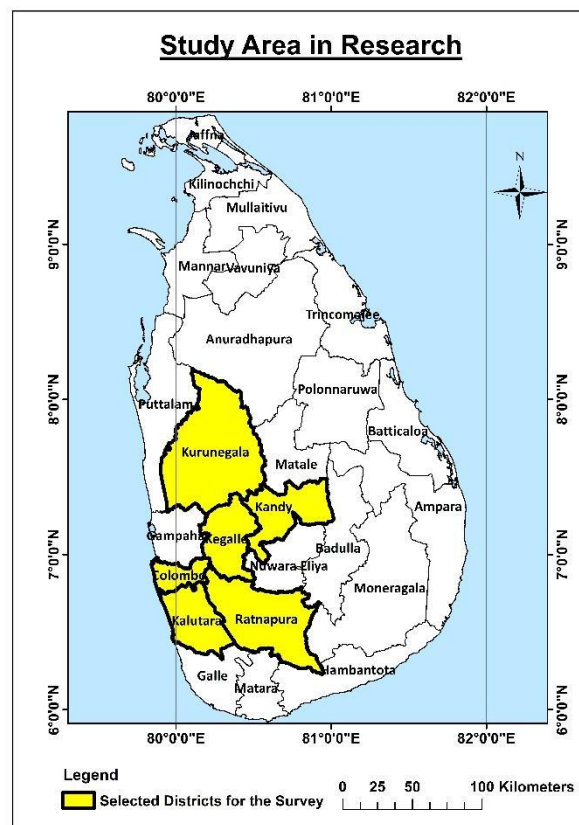


Figure 3.2: Study Area

### 3.5 Sample Selection and Sampling Techniques

For some studies, the population may be small enough to warrant the inclusion of all of them in the study. But a study may entail a large population which cannot all be studied. That portion of the population studied is called a sample of the population (Nworgu, 1991). The sample in this study was, therefore, a smaller group of small and

medium scale mushroom farmers (elements) drawn from an accessible population. The farm household was considered as the basic unit for data collection considering the economic situation of society. Farm household is defined as one person living alone or a small group of persons who share the same living accommodation, who pool some, or all, of their income and wealth and who consume certain types of goods and services collectively, mainly housing and food (Chitsa, 2014).

Calculation of exact sample size is an important part of research design. It is very important to understand that different study design need different method of sample size calculation and one formula cannot be used in all designs (Charan and Biswas, 2013).

There wasn't a continuously updated mushroom farmers' database in the country. However, a list of mushroom farm households maintained by the relevant institutes (government and private) which promote and develop mushroom cultivation in the districts could be found. Accordingly, a justifiable sampling frame was constructed relevant to the study area. But, the pilot studies showed that there were other mushroom farm households who were not in the above list. Therefore, the research team had to follow snowball sampling techniques prior to implementing the study to enrich the sampling frame. This technique has been proven by the researchers of Faugier and Sargeant (1997) and Spreen (1992).

Accordingly, the size of the sampling frame was 2890 and 10% of this was selected as the sample of the study by considering the time available and the budget. The margin of error and confidence level were used as 5.76% and 95% respectively. This means, in this case, there is a 95% chance that the real value is within  $\pm 5.76\%$  of the measured/surveyed value.

The study approached different data collection methods and two types of questionnaires (initial phase and second phase) so as to mitigate the issues that could arise and to succeed in the research due to the Covid-19 pandemic situation. Because, if every item/question was included in one questionnaire, it would have taken more time to complete and would have reduced the quality of the responses. Accordingly, as the main sample (initial phase), the data of 289 mushroom growers were collected through telephone interviews (due to the Covid-19 pandemic situation) from August to October in 2021 and stratified random sampling technique was used for this purpose. The distribution of the selected sample for the initial phase in each district is clearly described by the table below.

**Table 3.1: Distribution of the Selected Sample for the Initial Phase**

| <b>Respondents for the Initial Phase</b> |                       |                         |                   |
|--|-----------------------|-------------------------|-------------------|
| <b>District</b>                          | <b>Sampling Frame</b> | <b>Sample Frequency</b> | <b>Percentage</b> |
| Ratnapura                                | 730                   | 73                      | 25.3              |
| Kalutara                                 | 280                   | 28                      | 9.7               |
| Colombo                                  | 460                   | 46                      | 15.9              |
| Kurunegala                               | 440                   | 44                      | 15.2              |
| Kegalle                                  | 520                   | 52                      | 18.0              |
| Kandy                                    | 460                   | 46                      | 15.9              |
| <b>Total</b>                             | <b>2890</b>           | <b>289</b>              | <b>100.0</b>      |

In addition, data from the sub-sample of 173 interviewees {persons who were cultivating American Oyster (*Pleurotus ostreatus*) only} out of the 289 respondents in the initial phase survey was to interview as a face to face interview in the second phase survey from October to November in 2021, when there was a lull in the pandemic situation to obtain general practices, views, barriers, suggestions, income, and expenditure of mushroom industry. The reason for selecting the aforementioned subsample for the second phase of the survey was, many studies implemented earlier in Sri Lanka have proven that it was the majority cultivated type in Sri Lanka (Thilakaratna and Pathirana, 2018; Gamage and Ohga, 2018). But, due to limited time, researchers were able to cover only 100 out of the 173 interviewees who were cultivating American Oyster (*Pleurotus ostreatus*) only for the second phase survey within the study period. The Table 3.2 below clearly describes the distribution of the sample selected for the second phase in each district.

**Table 3.2: Distribution of the Sample Selected for the Second Phase**

| <b>Respondents who were Cultivating American Oyster Only</b> |   |  |                   |
|--|---|--|-------------------|
| <b>District</b>  | <b>Sample Size from the Initial Phase</b> | <b>Sample Taken for the Second Phase</b> | <b>Percentage</b> |
| Ratnapura  | 41  | 27                                       | 27.0              |
| Kalutara   | 24  | 24                                       | 24.0              |
| Colombo  | 34  | 18                                       | 18.0              |
| Kurunegala   | 12  | 12                                       | 12.0              |
| Kegalle  | 31  | 8  | 8.0               |
| Kandy  | 31  | 11                                       | 11.0              |
| <b>Total</b>   | <b>173</b>                                | <b>100</b>                               | <b>100.0</b>      |

In addition, purposive sampling was adopted to select key informant interviews and focus group discussions for the study in order to ensure the information richness. Hence, key informants who hold special and expert knowledge/ insights about the phenomenon of the study were selected carefully.

Also, key informant interviews were conducted for 51 key persons including farmer organizations, societies and cooperative, collectors/assemblers and processors, Regional Agricultural Research and Development Centre-Makandura, Ratmalana Mushroom Development and Training Centre, Sri Lanka Export Development Board-Colombo, Non-Governmental Organizations (NGOs) related to the promotion of mushroom cultivation and processing (SAEMAUL), other technical/training institutes related to mushroom cultivation and processing {'Peoples Livelihood Development Foundation (PLDF)' Institute} to explore the present situation of mushroom industry in Sri Lanka. This enabled a variety of settings, situations and participants, including negative cases or extreme cases to obtain a richer data base (Moser and Korstjens, 2017).

There were six main focus group discussion in each district from November to December in 2021 with the participation of different parties (around 8 parties) including farmer organizations, societies and cooperative, collectors/ assemblers and processors, government institutions {Department of Agriculture (DOA) and Department Agrarian Development (DAD)}, non-governmental organizations (NGOs), supermarket chains and mushroom vendors to gather the data on marketing, income, expenditure and current situation on Mushroom Industry in Sri Lanka and evaluate the possible path forward.

### **3.6 Data Collection**

#### **3.6.1 Instrument for Data Collection**

Both primary and secondary data was gathered for the study to ensure the richness of the data for the purpose of achieving the specific objectives. Primary data was generated through pre-Tested structured questionnaire surveys, Key Informant Interviews (KIIs), Focus Group Discussions (FGDs), Observations and Case Study analysis. Secondary data was gathered through secondary data sources such as relevant national and international journal articles, newspapers, periodicals, reports (i.e. Sri Lanka Export Development Board, Department of Customs) and any other reliable and related documents (research reports, journals and books).

The pre-Tested questionnaires chosen as data collection instruments in the survey and consisted mostly of closed-ended questions and a few open-ended questions, as these provide more diverse detail. The initial phase questionnaire consisted of sections A and B. Section A aimed at gaining socio economic information of mushroom farm households, production details of the currently cultivating mushroom varieties, challenges, barriers, opportunities or any other. The section B aimed at determining the entrepreneurial behaviour that was derived as a function of eight components through intense literature review. There were 32 questions/Likert items (Annexure 01) relevant to the eight components, ranging from "strongly disagree" (SD), through "disagree" (D), "Neutral" (N), "Agree" (A) to "strongly agree" (SA). Respondents were then asked to respond to their degree of agreement with the statements contained in the instrument. The second phase questionnaire used for in-person interviews

consisted of constraints of mushroom cultivation, source of inputs, mushroom farmers' knowledge on different practices of mushroom cultivation, the coping mechanisms used to mitigate pest and disease and marketing, income & expenditure. Here, one thing revealed in the investigation of the basic facts is that various mushroom growers share their knowledge through social media and no government or private intervention has taken place for that. Therefore, a Facebook page called 'Asirimath Bimal Wagawa (අසිරිමත් බිම්මල් වගාව)' was created to capture the different issues, suggestions, and potentials in the mushroom industry and to reach the objectives of the study very effectively. This provided a platform for mushroom entrepreneurs as well as those who are new to mushroom cultivation to generate knowledge. In parallel to this study, three documentary programmes using successful mushroom entrepreneurs living in Morontuduwa, Olaboduwa in Kalutara district, and Kahathuduwa in Colombo district have already been released on YouTube. Also, the quantity and values of mushrooms for import and export from 2016 to 2021 was gathered from the department of customs to explore the patterns of international trade and opportunities that lie within it.

**Link for the Facebook page:**

[https://www.facebook.com/pages/?category=your\\_pages&ref=bookmarks](https://www.facebook.com/pages/?category=your_pages&ref=bookmarks)

**Links for three documentary programmes:**

[https://www.youtube.com/watch?v=g3s\\_anbvWJ4](https://www.youtube.com/watch?v=g3s_anbvWJ4)

[https://www.youtube.com/watch?v=5XBc8JFD\\_5c](https://www.youtube.com/watch?v=5XBc8JFD_5c)

<https://www.youtube.com/watch?v=E1SiuOLTGnY>

### **3.6.2 Validation of the Questionnaire**

The questionnaires designed for the study were subjected to a validation process for face and content validity. According to McBurney (1994), face validity is the idea that a Test should appear superficially to Test what it is supposed to Test and content validity is the notion that a Test should sample the range of behaviour represented by the theoretical concept being Tested.

In the validation process of this study, the questionnaires were given to some technical experts to ascertain the appropriateness and adequacy of them. Accordingly, rephrasing of some questions was done to clarify the questions and more appropriate alternative response choices were added to the closed-ended questions to provide for meaningful data analysis (Burns and Grove 1997).

Having validated the two questionnaires, pre-Test was carried out on them using 29 respondents from telephone interviews and 10 respondents from face to face interviews. This was done to see how the respondent would react to the questionnaires, whether the items/questions were clear enough and easily understood, whether there was the need to include more items/questions in certain



areas, whether there were some items/questions to which they would not like to respond and to determine the workability of the proposed method of data analysis for the study. From the pre-Test, the researchers were able to understand the ambiguity of some items/questions and so had to modify it to the level of the questionnaires.

### **3.6.3 Methods of Data Collection**

After pre-Testing and all necessary modifications, the questionnaires were administered directly to the chosen sample for the study. Due to the fluctuating pandemic situation in the 2021, several strategies were followed to collect the data with the aid of above instruments. Attention was paid on telephone conversations and social media platforms (such as Facebook page, WhatsApp account) to gather the primary data. Accordingly, telephone conversations were held for the initial phase questionnaire as mentioned previously and 518 list of respondents had to be contacted to acquire the data from 289 respondents of mushroom cultivators due to response rate was around 56%.

### **3.7 Data Analysis**

After the data was collected it was organized and analyzed with the aid of a computer programme called Statistical Package for Social Sciences (SPSS). Data was analyzed by using both descriptive and inferential statistics. Given below is how each objective has been analyzed.

#### **i. To assess the factors which affect the entrepreneurial behaviour of farmer entrepreneurs**

To analyze the entrepreneurial behaviour of mushroom farmers, entrepreneurial behaviour scale developed by Chaudhri (2007) was used with minor modifications. There were 32 questions/Likert items relevant to the eight components which result in the entrepreneurial behaviour. Among the Likert items, every four items represent one component. When using Likert-type scales it is imperative to calculate and report Cronbach's alpha coefficient for internal consistency reliability for any scales or subscales one may be using (Gliem and Gliem, 2003). Therefore, at very first Cronbach's alpha coefficients for internal consistency were calculated for each component and finalized whether every four items should be considered to measure each component or not. Then, the mean score of satisfaction level obtained by individual respondents on each component was calculated. After, the overall mean score of satisfaction level of eight components was measured by dividing the pool value of eight components by eight to assess the entrepreneurial behaviour for that respondent. Further respondents were categorized as low in entrepreneurial behaviour and high in entrepreneurial behaviour group on all the 8 components. This was done using the mean score of satisfaction level of each component and overall mean score of satisfaction level of entrepreneurial behaviour. If the mean score of satisfaction level is on or below the 3.40, then entrepreneurial behaviour can be considered as low and if the mean score of satisfaction level is above the 3.40, then

entrepreneurial behaviour can be considered as high. Table 3.3 below illustrates the criteria for understanding the mean of satisfaction level.

### Satisfaction Levels of the Respondents

The level of satisfaction is considered from score of the answers and was divided into five levels to the Likert scale as follow:

$$\begin{aligned} \text{Mean Scores of Satisfaction Level} &= (\text{Higher Score}-\text{Lower Score})/ \text{Number of Levels} \\ &= (5-1)/5 \\ &= 0.80 \end{aligned}$$

**Table 3.3: The Criteria for Understanding the Mean Scores of Satisfaction Level**

|   | <b>Mean Score</b> | <b>Level of Satisfaction</b> |
|---|-------------------|------------------------------|
| 1 | 1.00-1.80         | Very unsatisfactory          |
| 2 | 1.81-2.60         | Unsatisfactory               |
| 3 | 2.61-3.40         | Moderately satisfactory      |
| 4 | 3.41-4.20         | Satisfactory                 |
| 5 | 4.21-5.00         | Very satisfactory            |

Source: Authors' calculation (2021)

### 3.7.1 Model to Assess the Factors Affecting Entrepreneurial Behaviour

Binary logistic regression model with forward method was employed to assess the factors affecting the entrepreneurial behaviour among mushroom farmers. In the forward method the system takes each independent variable one after another and creates different models. With the aid of that, the model which is going to have more fit in order to adequately fit the data. According to the above demarcation, entrepreneurial behaviour consists of two levels namely high in entrepreneurial behaviour and low in entrepreneurial behaviour and other regress variables are shown in below Table 3.4. Logistic regression is useful when there is a mixture of numerical and categorical independent variables since it requires fewer assumptions and is more statistically robust (O'connell, 2006).

Study adopted the following model:

$$\text{Logit}(\rho_i) = \alpha + \beta_1 X_{1,i} + \beta_2 X_{2,i} + \beta_3 X_{3,i} + \dots + \beta_p X_{p,i} + \varepsilon$$

Where,

$Logit(\rho_i)$  = is the dependent, binary and represents the probability of having high in entrepreneurial behaviour or low in entrepreneurial behaviour coded as 1 or 0 respectively.

$\beta_1$  to  $\beta_p$  = Regression Coefficients

$\alpha$  = Intercept

$X_{1,i}$  to  $X_{p,i}$  = Independent Variables

$\varepsilon$  = Error Term

**Table 3.4: Variables Applied in the Binary Logistic Regression Analysis**

| Variable                                    | Type of Variable | Unit  |
|---|------------------|---|
| <b>Entrepreneurial Behaviour</b>            | Categorical      | Low degree (3.40>) or high degree (3.40<) {derived through mean score of satisfaction level}  |
| <b>District</b>                             | Categorical      | Ratnapura, Kalutara, Colombo, Kurunegala, Kegalle and Kandy   |
| <b>Age</b>                                  | Continuous       | Years   |
| <b>Gender</b>                               | Categorical      | Male or Female  |
| <b>Education Level</b>                      | Categorical      | No schooling, below grade five, between grade six and O/L, Between grade 12 and A/L, Vocational Training or any other Diploma, Graduate Studies               |
| <b>Monthly Household Income</b>             | Continuous       | LKR   |
| <b>No. of Income Sources</b>                | Continuous       | Number  |
| <b>Family Size</b>                          | Continuous       | Number  |
| <b>No. of Dependents</b>                    | Continuous       | Number  |
| <b>Availability of Self-processing</b>      | Categorical      | Yes or No   |
| <b>Primary Occupation of the Respondent</b> | Categorical      | Agriculture related occupation, self-employed, private sector occupation, government sector occupation, casual Labour, government sector occupation (retired) |

|   |             |  |
|---|-------------|--|
| <b>Primary Intention of Farming (Overall)</b> | Categorical | farming exclusive for home consumption, farming primarily for home consumption marketing surplus, farming primarily for the market with some home consumption and farming exclusively for the market |
| <b>Farming Experience</b>                     | Continuous  | Years  |
| <b>Economic Motive</b>                        | Categorical | Receiving or Not receiving   |

Source: Authors' own compilation (2021)

### 3.7.2 Entrepreneurial Behaviour Index (EBI)

Entrepreneurial behaviour index (EBI) was also calculated by using formula:

$$EBI = \frac{\sum_{n=1}^8 \frac{T_n}{M_n} \times R_{cn}}{\sum_{n=1}^8 R_{cn}} \times 100$$

Where,

T<sub>n</sub> = Total obtained score of the component "n"

M<sub>n</sub> = Maximum obtainable score of the component "n"

R<sub>cn</sub> = Scale value of the component "n"

n = Number of components

All eight components are based on categorical data type and measured through a set of Likert-scale type of questions. Customized Likert scales were constructed for each component (Wanole et al., 2018; Wankhade, et al., 2013). Hence, EBI can be calculated using the below formula too.

$$EBI = \frac{\text{Mean score of satisfaction level obtained by an individual respondent}}{\text{Maximum obtainable score can be obtained by an individual respondent}} \times 100$$

According to the entrepreneurial behaviour classification mentioned above, if the mean score of satisfaction level is on or below the 3.40, then entrepreneurial behaviour is considered as low and if the mean score of satisfaction level is above the 3.40, then entrepreneurial behaviour is considered as high. Also, the maximum obtainable score for overall satisfaction level can be obtained by an individual respondent is 5. Accordingly, entrepreneurial behaviour can be categorized based on EBI too. Then, if the EBI is on or below the 68%, then entrepreneurial behaviour can be considered as low and if the EBI is above the 68%, then entrepreneurial behaviour can be considered as high.

**i. To construct an entrepreneurial behaviour profile of farmer-entrepreneurs**

Entrepreneurial behaviour profiles of farmer-entrepreneurs were analyzed using descriptive statistics generated in the above objective.

**ii. To assess the present situation of production and economy of mushroom industry**

At first, multiple response analysis was employed to identify the different mushroom cultivars cultivated by the mushroom farmers in the survey. Then, the distribution of dependent variables of production, income and expenditure of mushroom cultivation across entrepreneurial behaviour levels and districts were assessed. Mann Whitney-U Tests were performed to assess the distribution of production and economy data of the mushroom industry across the two levels of entrepreneurial behaviour due to the assumptions that were violated to run the independent sample t-Test. Likewise, the Kruskal Wallis Test was employed to measure the distribution of production of mushrooms across districts due to the assumptions that were violated to run the analysis of variance (ANOVA) Test.

**iii. To explore current and emerging agribusiness opportunities to enhance entrepreneurship capacity of farmer-entrepreneurs**

At first, the quantity and values of mushrooms for import and export from 2016 to 2021 was gathered from the department of customs to explore the patterns of international trade and opportunities that exist. Additionally, export market opportunities and growth of global exports of mushrooms has been reviewed.

Then, SWOT analysis with multiple response analysis and narrative analysis were deployed to assess possible strengths, weaknesses, opportunities and threats in the industry. For this, all the data collection methods mentioned in the methodology chapter were applied. Furthermore, an examination of qualitative data was carried out with the identification of 'Critical' and 'Non-critical' issues existing with regard to the study matter (Attaie and Fourcadet, 2003).

### **3.8 Chapter Summary**

The researchers used a descriptive survey design that blends quantitative and qualitative data to unveil in-depth knowledge on entrepreneurial behaviour of mushroom farmer-entrepreneurs and emerging agribusiness opportunities to uplift the mushroom industry and thereby reinforce income generation and food security in Sri Lanka. This chapter described the research methodology, including research approach and design, conceptual framework, the geographical area where the study was conducted, sample of the population, sample selection & sampling techniques, data collection (instrument for data collection, validation of the questionnaire and methods of data collection) and data analysis techniques. Summary of the overall analysis is presented in Table 3.3 given below. Next chapter will discuss the factors affect the entrepreneurial behaviour of mushroom farmers.

**Table 3.5: Analysis Summary**

| <b>Specific Objective/s</b>   | <b>Data Collection Method/s</b>   | <b>Data Analysis Method/s</b>  | <b>KPI</b>  |
|---|---|--|---|
| To assess the factors which affect entrepreneurial behaviour of farmer-entrepreneurs  | Pre-Tested structured questionnaire survey  | Descriptive analysis and Logistic Regression analysis                | Key factor profile for entrepreneurship capacity development  |
| To construct an entrepreneurial behaviour profile of farmer-entrepreneurs   | Pre-Tested structured questionnaire survey  | Descriptive analysis and EBI calculation                             | Level of entrepreneurship for each component and the overall EB   |
| To assess the present situation of production and economy of the mushroom industry across entrepreneurial behaviour levels and districts                  | Pre-Tested structured questionnaire survey  | Descriptive analysis, Mann Whitney U Tests and Kruskal Wallis Tests  | -Distribution of production of the mushroom across entrepreneurial behaviour levels and districts<br>-Distribution of income and expenditure of the mushroom industry across entrepreneurial behaviour levels   |
| To explore current and emerging agribusiness opportunities with their value addition process to enhance entrepreneurship capacity of farmer-entrepreneurs | Pre-Tested structured questionnaire survey, Case study, KIIs, FGDs, Observations and Secondary data | SWOT analysis with multiple response analysis and narrative analysis | -Strategic guideline to improve entrepreneurship and agribusiness<br>-List of current and emerging ventures in the industry and value addition opportunities<br>-List of SWOT for the present mushroom industry<br>-Number of suggestions made for a policy strategy based on the lessons and experiences |

Source: Authors' Own Compilation (2021)

## **CHAPTER FOUR**

### **Factors Affecting the Entrepreneurial Behaviour of Mushroom Farmers**

#### **4.1 Introduction**

This chapter describes the demographic profile of the respondents who were selected for the study with respect to factors such as gender, age, education level, occupation, intention of farming, number of family members, experience in mushroom cultivation, average monthly income and districts across entrepreneurial behaviour. Then, reliability analysis is discussed in order to find Cronbach's alpha coefficient for internal consistency reliability for the components which make the entrepreneurship. Finally, logistic regression analysis is to be discussed to assess the factors affect the entrepreneurial behaviour of farmer entrepreneurs.

#### **4.2 Demographic Profile of the Respondents**

Investigating socio-economic factors are vital in order to identify specific communities in the society and in this study demographic profile was derived to get a better understanding of the farming communities which engage in mushroom cultivation and related allied agricultural activities. Social and economic factors have been derived for the household level since, household level is considered as the basic social and economic unit of the society. Demographic factors such as gender, age, education level, occupation, intention of farming, number of family members, experience in mushroom cultivation, average monthly income and districts were considered.

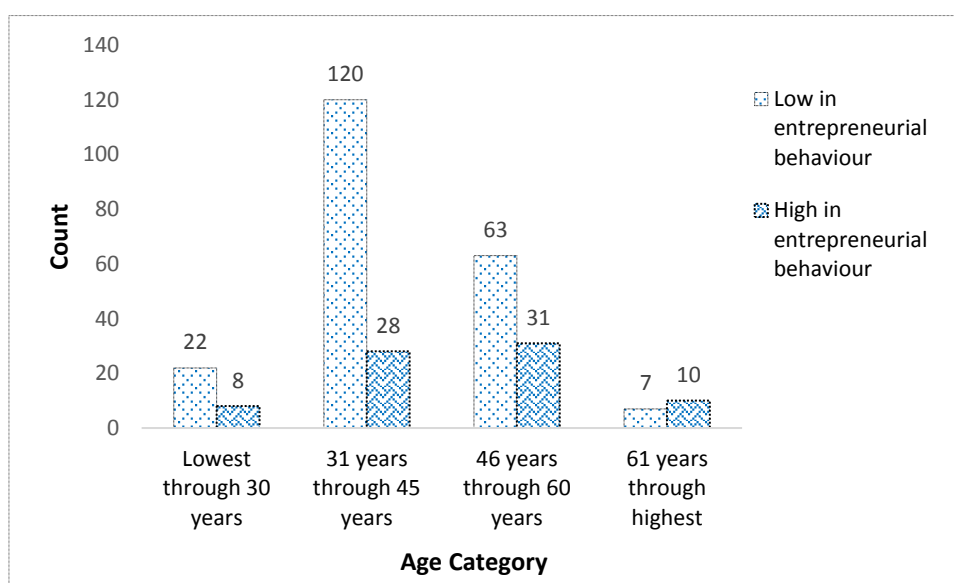
Notably, the majority of respondents were females (57.4%). Hence, the mushroom industry has been considered as one of the major agribusiness ventures which empowered rural as well as urban women farmers. Further, the study revealed that the main decisions related to the cultivation have been taken by women farmers. Moreover, women farmers were equipped with less extrovert characteristics than male farmers as reported through interviews.

**Table 4.1: Level of Entrepreneurship by Gender**

| District     | Gender        | Level of Entrepreneurial Behaviour (EB) |                   |
|--------------|---------------|---|-------------------|
|              |               | Low in EB                               | High in EB        |
| Ratnapura    | Male          | 26 (9.0%)                               | 6 (2.1%)          |
|              | Female        | 29 (10.0%)                              | 12 (4.2%)         |
| Kalutara     | Male          | 4 (1.4%)                                | 2 (0.7%)          |
|              | Female        | 14 (4.8%)                               | 8 (2.8%)          |
| Colombo      | Male          | 14 (4.8%)                               | 9 (3.1%)          |
|              | Female        | 21 (7.3%)                               | 2 (0.7%)          |
| Kurunegala   | Male          | 12 (4.2%)                               | 3 (1.0%)          |
|              | Female        | 26 (9.0%)                               | 3 (1.0%)          |
| Kegalle      | Male          | 8 (2.8%)                                | 13 (4.5%)         |
|              | Female        | 25 (8.7%)                               | 6 (2.1%)          |
| Kandy        | Male          | 16 (5.5%)                               | 10 (3.4%)         |
|              | Female        | 17 (5.9%)                               | 3 (1.0%)          |
| <b>Total</b> | <b>Male</b>   | <b>80 (27.7%)</b>                       | <b>43 (14.8%)</b> |
|              | <b>Female</b> | <b>132 (45.7%)</b>                      | <b>34 (11.8%)</b> |

Source: Authors' own compilation (2021)

In most cases, a high level of entrepreneurial behaviour was demonstrated by male farmers and this has been noted in Colombo, Kegalle and Kandy. In overall, more than two third (73.4%) of the sample demonstrated a low level of entrepreneurial behaviour.

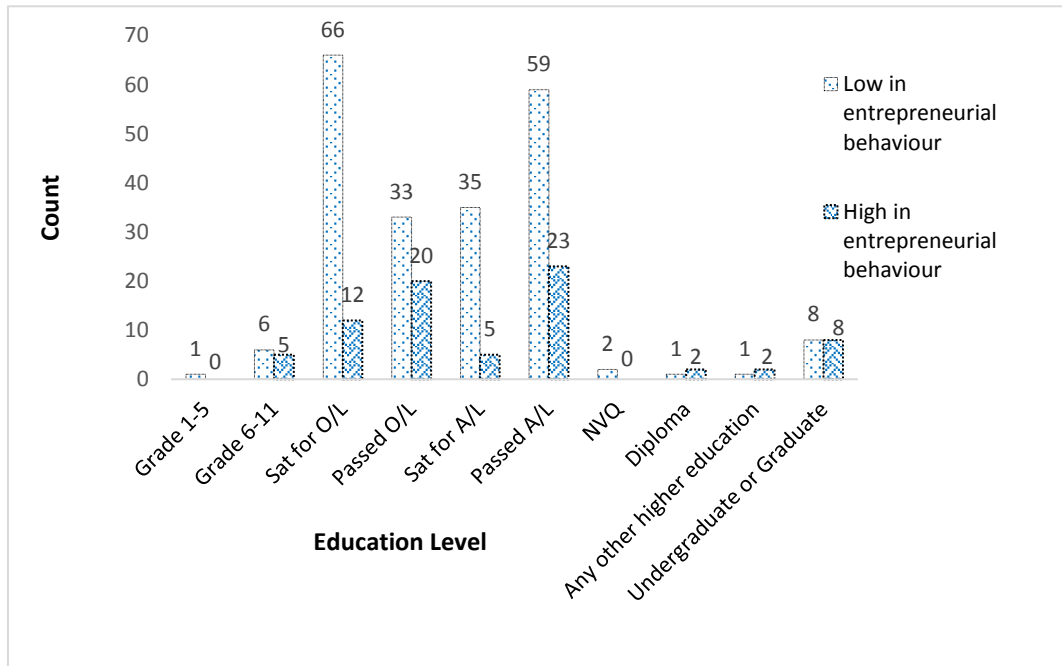


Source: Field Survey, 2021

**Figure 4.1: Age Distribution across Entrepreneurial Behaviour**



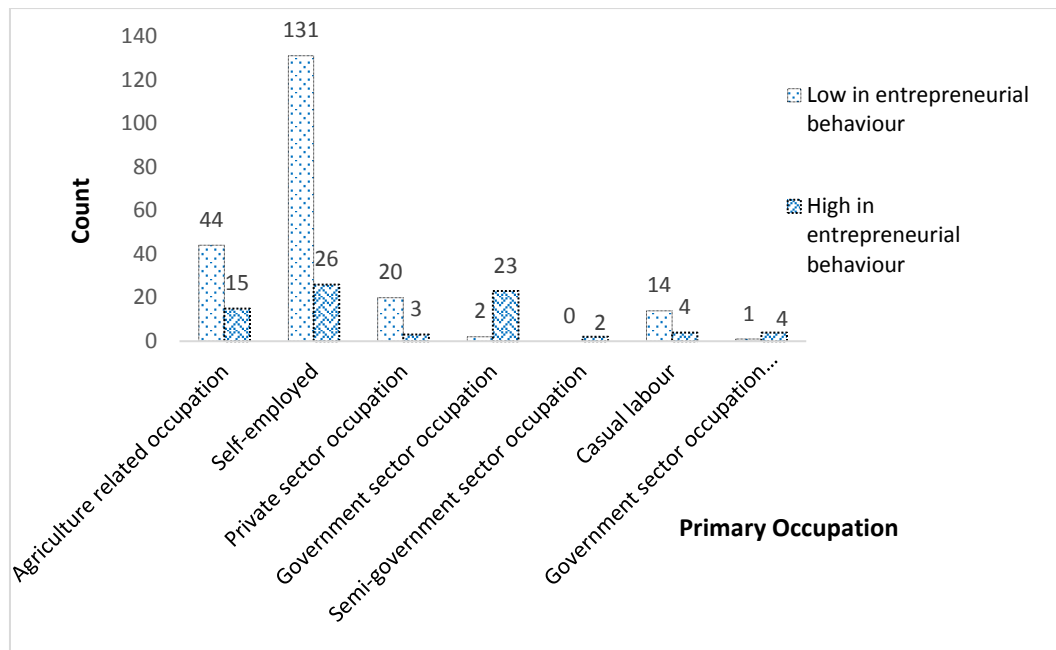
Most of the respondents (51.2%) were in the age category of 31 years to 45 years. This shows that mushroom cultivation is popular among the younger generation. Further, the second highest representation (32.5%) was from the age category of 46 years to 60 years. Interestingly, few respondents (10.4%) represented the age category which is below 30 years. Majority of the respondents of all three age categories: lowest through 30 years, 31 years through 45 years and 46 years through 60 years were low in entrepreneurial behaviour.



Source: Field Survey, 2021

**Figure 4.2: Educational Distribution across Entrepreneurial Behaviour**

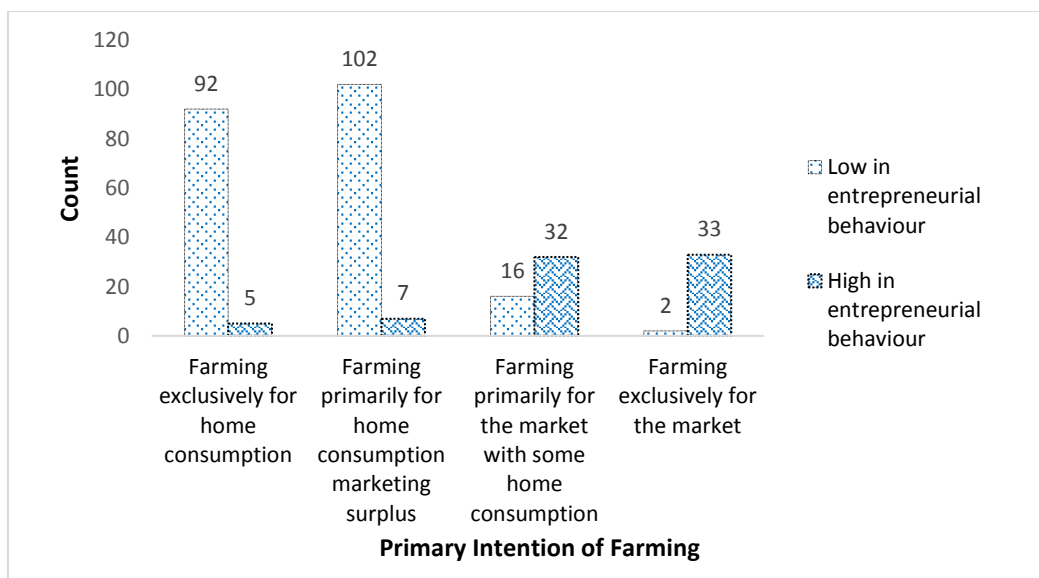
Respondents of the survey represented a variety of educational levels. Majority had passed advance level education qualification and hence, had a fair educational background. Even with this educational background still more than two third of the sample demonstrated low level of entrepreneurial behaviour.



Source: Field Survey, 2021

**Figure 4.3: Primary Occupation across Entrepreneurial Behaviour**

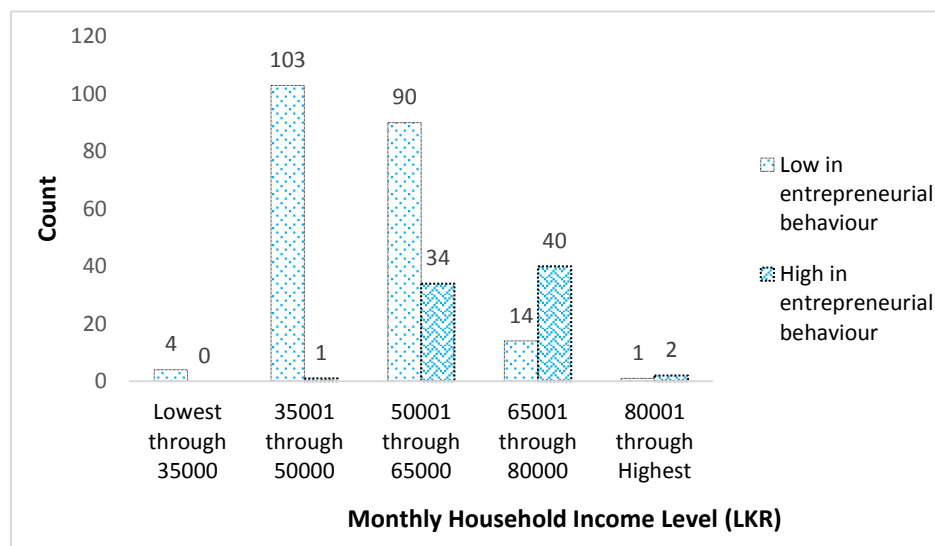
Most of the respondents (54.3%) were self-employed. Anyhow, the highest entrepreneurial behaviour within the primary occupation of the respondents was shown by the respondents (92.0%) who are employed in the government sector (qualitative data of the study elaborated that they had acquired standard awareness programmes prior to running the business) followed by the persons making agriculture-related careers except for mushroom cultivation (25.4%). The percentage of this for the self-employed persons was only 16.6%.



Source: Field Survey, 2021

**Figure 4.4: Primary Intention of Farming across Entrepreneurial Behaviour**

Primary intention of farming represents the intended orientation of the farmer or household towards farming and related allied activities. It is clearly visible that, majority (71.3%) had the primary intentions of farming exclusively for home consumption and farming primarily for home consumption with a certain marketing surplus. Hence, their overall entrepreneurial orientation was very low. Further, overall entrepreneurial behaviour was also low.



Source: Field Survey, 2021

**Figure 4.5: Monthly Household Income across Entrepreneurial Behaviour**

The highest (42.9%) number of respondents had an average monthly household income as Rs. 50,001 to 65,000 and the second highest (36.0%) category represented average monthly household income as Rs. 35,001 to 50,000. However, higher income earners had higher entrepreneurial behaviour than the lower categories.

**Table 4.2: Level of Entrepreneurship by District**

| District     | Level of Entrepreneurial Behaviour within District |                                   |
|--------------|--|-----------------------------------|
|              | Low in entrepreneurial behaviour                   | High in entrepreneurial behaviour |
| Ratnapura    | 55 (75.3%)   | 18 (24.7%)                        |
| Kalutara     | 18 (64.3%)   | 10 (35.7%)                        |
| Colombo      | 35 (76.1%)   | 11 (23.9%)                        |
| Kurunegala   | 38 (86.4%)   | 6 (13.6%)                         |
| Kegalle      | 33 (63.5%)   | 19 (36.5%)                        |
| Kandy        | 33 (71.7%)   | 13 (28.3%)                        |
| <b>Total</b> | <b>212 (73.4%)</b>                                 | <b>77 (26.6%)</b>                 |

Source: Authors' own compilation (2021)

According to the results, the highest percentage (36.5%) with high in entrepreneurial behaviour within the district was reported in the Kegalle district while the lowest was

reported in the Kurunegala district (13.6%). The FGDs and KIIs clearly emphasized that there were some awareness programmes and incentive programmes on mushroom cultivators in every district. But, public-private partnership (PPP) was high in the Kegalle district over the others and it was very low in the Kurunegala district. Accordingly, promoting infrastructure development and local development in the mushroom industry, increasing technical and technological cooperation, building cooperative growth through private sector integration, and promoting innovation have occurred. These may be the reasons for reporting the higher level of entrepreneurial behaviour in the Kegalle district over the other districts. However, the above results reveal that even in the Kegalle district it is not a considerable value.

#### **4.3 Reliability Analysis**

There were 32 questions/Likert items relevant to the eight components which result in entrepreneurial behaviour (Annexure 01). Among the Likert items, every four items represent one component. Accordingly, every four items resulted in a good Cronbach's alpha coefficient (over 0.8). As mentioned in the methodology chapter, it is imperative to calculate and report Cronbach's alpha coefficient for internal consistency reliability for any scales or subscales one may be using (Gliem and Gliem, 2003). Annexure 02 shows Cronbach's alpha coefficient for each component and the number of items used for measuring it.

#### **4.4 Logistic Regression Analysis**

As mentioned in the methodology chapter, the respondents were categorized into low and high entrepreneurial behaviour groups based on overall mean score of satisfaction level. Accordingly, all respondents (289) in the study area have been included in binary logistic regression analysis and no one has been ignored as missing cases. Also, 212 respondents out of 289 were low in entrepreneurial behaviour. The significant value of Omnibus Tests of Model Coefficients explicitly reveals whether the model is significant or not. The null hypothesis is that there is no significant difference between baseline model to final model. The baseline model doesn't consist of any independent variables. Final model will have all significant predictor variables in the model. Because the p-value of the model row in every step is less than 0.05, we can conclude that the null hypothesis is rejected. That means final models are more significant (Annexure 03).

Next, Hosmer and Lemeshow's goodness of fit Test depicts how far the model is fit. The null hypothesis here is the model adequately fits the data. If the significant value is less than 0.05, then the null hypothesis is rejected. In this case, every step of Hosmer and Lemeshow goodness of fit Test adequately fits the data (Annexure 04).

Then, Nagelkerke R-Square measures the variability in the dependent variable that is explained by the logistic regression model. More Nagelkerke R-Square, the better the variance is explained. Accordingly, step-3/model-3 explained better variance than other two steps/models. Nagelkerke R-Square value for the model is 78.6%. That

means that 78.6% variance is explained by the predictor variables on the entrepreneurial behaviour (Annexure 05).

Also, Classification Table (Annexure 06) describes how much percentage is correctly explained. According to the output, step-3 shows the highest value of classification namely 91.7%. That means step-3 has more percentage of correctly explaining the data than the other two steps in the survey. Moreover, total accuracy of the model is good owing to overall percentage of the classification table is on or above the 80%. As well, according to the 'variables in the equation' output (Annexure 07), step-3 contains three independent variables namely primary occupation of the respondent, primary intention of farming and monthly household income (LKR) in the survey. Other predictor variables used in the analysis were not in the model. That means other variables are not having adequate impact on the entrepreneurial behaviour at 95% confidence interval. The significant (sig.) value is the probability value associated with the adjusted odds ratios represented by exp. (B) at 95% confidence intervals (CIs) for each predictor. The lower and upper values are the limits of the 95% CI associated with the adjusted odds ratio. Accordingly, if the significant value of a certain independent variable is on or less than 0.05, that variable can be identified as a significant one at 95% CI. Annexure 7 shows the significant values of each predictor at 95% CI in the survey.

Here, predicted probability is of membership for high in entrepreneurial behaviour. Although there were six levels under the levels of the primary occupation of the respondents namely government sector occupation (retired), agriculture related occupation, self-employed occupation, private sector occupation, government sector occupation and casual labour, only government sector occupation (retired) was significant at 95% CI.

Hence, there were four levels under the primary intention of farming and farming exclusively for the market acted as the reference level for the analysis. Accordingly, mushroom entrepreneurs who were farming mushrooms exclusively for home consumption are 0.005 (95% CI, 0.000490 to 0.042) times less likely to become high in entrepreneur behaviour than the farmers who were farming exclusively for the market. This means that farmers who were farming mushrooms exclusively for the market had 200 times (95% CI, 23.81 to 2040.82) greater odds of having high entrepreneurial behaviour than the farmers who were farming mushrooms exclusively for home consumption. Moreover, the odds of having high entrepreneurial behaviour was 111.11 (95% CI, 16.39 to 1000.00) times greater for farmers who were farming mushroom exclusively for the market versus farmers who were farming mushroom primarily for home consumption with marketing surplus. Also, mushroom entrepreneurs who were farming mushroom primarily for the market with some home consumption is 0.118 (95% CI, 0.023 to 0.600) times less likely to become high in entrepreneur behaviour than the farmers who were farming exclusively for the market. This means that farmers who were farming mushroom exclusively for the market had 8.47 (95% CI, 1.67 to 43.48) times greater odds of having high entrepreneurial behaviour than the farmers who were farming mushroom primarily

for the market with some home consumption. In addition, monthly household income also has become a significant explanatory variable due to a significant value of .004 at 95% confidence interval.

#### **4.5 Chapter Summary**

This chapter elaborated the factors which affect the entrepreneurial behaviour of farmer entrepreneurs and results clearly revealed that commercial scale farmers have higher entrepreneurial behaviour than those who cultivated for domestic consumption. The next chapter will illustrate entrepreneurial behaviour profile of farmer-entrepreneurs.

## CHAPTER FIVE

### Entrepreneurial Behaviour Profile of Farmer-entrepreneurs

#### 5.1 Introduction

This chapter will explicitly delineate the entrepreneurial behaviour and its components using the insights from interviews in order to construct an entrepreneurial behaviour profile of farmer-entrepreneurs.

#### 5.2 Entrepreneurial Behaviour and Components

Table 5.1 represents the level of entrepreneurial behaviour of respondents (n=289) in the survey. Interestingly, nearly three fourth of the respondents demonstrated relatively lower scores for all components (innovativeness, farm decision making, achievement motivation, knowledge of farming enterprise, risk taking ability, planning ability, leadership ability and cosmo-politeness) of the entrepreneurial behaviour as per the cutoff marks allocated for each component. Entrepreneurial Index (EBI) is derived based on eight components thus, it is a composite value. Here the EBI is a number on the basis of which the respondents can be said to have more or less entrepreneurial attributes by virtue of their chance of success in the industry. Accordingly, the highest EBI was found in achievement motivation and the lowest in risk taking ability (Table 5.1). Further, both innovativeness and leadership abilities also ranked low.

When considering the innovativeness component, most farmers tended to retain only one mushroom variety and had no intention of cultivating any other variety since farmers were not aware of the performance of other varieties. Farmers relied only on the performances of a selected variety and cultivated it for a longer period with a standard set of cultural, social and economic practices. Most of the farmers obtained regular information and updates on production, financial and market data for that particular variety (especially for American oyster). Only few have tried new varieties during several cultivation cycles. As a result of limited support from extension services most farmers are reluctant to try new varieties.

**Table 5.1: Level of Entrepreneurial Behaviour of Respondents**

| Component  | Level of Entrepreneurship Behaviour |            |                |            | EBI  | Rank |
|--|-------------------------------------|------------|----------------|------------|------|------|
|  | High (if, >3.4)                     |            | Low (if, <3.4) |            |      |      |
|  | Frequency                           | Percentage | Frequency      | Percentage |      |      |
| Innovativeness<br>(Mean = 3.090;<br>SD = 0.565)                          | 73                                  | 25.3       | 216            | 74.7       | 61.8 | 7    |
| Farm decision<br>making<br>(Mean = 3.114;<br>SD = 0.665)                 | 76                                  | 26.3       | 213            | 73.7       | 62.2 | 5    |
| Achievement<br>motivation<br>(Mean = 3.164;<br>SD = 0.6898)              | 77                                  | 26.6       | 212            | 73.4       | 63.2 | 1    |
| Knowledge of<br>farming<br>enterprise<br>(Mean = 3.146;<br>SD = 0.685)   | 77                                  | 26.6       | 212            | 73.4       | 62.9 | 2    |
| Risk taking ability<br>(Mean = 3.066;<br>SD = 0.725)                     | 74                                  | 25.6       | 215            | 74.4       | 61.3 | 8    |
| Planning ability<br>(Mean = 3.115;<br>SD = 0.664)                        | 77                                  | 26.6       | 212            | 73.4       | 62.3 | 4    |
| Leadership ability<br>(Mean = 3.106;<br>SD = 0.735)                      | 77                                  | 26.6       | 212            | 73.4       | 62.1 | 6    |
| Cosmo-<br>politeness<br>(Mean = 3.128;<br>SD = 0.683)                    | 77                                  | 26.6       | 212            | 73.4       | 62.5 | 3    |
| Overall<br>entrepreneurial<br>behaviour<br>(Mean = 3.116;<br>SD = 0.636) | 77                                  | 26.6       | 212            | 73.4       | 62.3 | -    |

Source: Authors' own compilation (2021)

Farmers of a particular area have managed to build a network among their neighboring farmers to a certain extent and were able to share information pertaining (market channels, production techniques and disease control methods). Hence, the mushroom cultivation could be considered as a social entrepreneurship venture as well. However, these farmers have links only with the farmers and producers within their operational area. Further, these farmers knew the quantities and varieties grown by their neighboring farmers to a certain extent. Interestingly, farmers gained access to popular and established market channels in the area. Mostly harvest was marketed



in the raw form and the buyer, seller operations were based on the trust of each party. The only limiting factor was lack of information on novel and improved cultivation techniques in order to execute changes to the cultivation. That was one of the major setbacks which hindered entrepreneurial operations.

Referring to the achievement motivation, these farmers considered mushroom cultivation as a secondary occupation or an alternative income source and this is why farmers did not want to try out different varieties. Further, discontinued farming practices were observed for mushroom cultivation. Hence, priority was not given to the mushroom cultivation and intention was to have an alternative income source for the household to cover additional expenses such as medical, educational, housing and rotating savings (a type of microfinance technique). This is one of the major reasons why respondents did not expand their mushroom cultivation as an entrepreneurial venture. Simultaneously, respondents spent much less time on the cultivation compared to primary agricultural and non-agricultural activities. However, expected yield from the cultivation was satisfactory according to respondents compared to the time they allocated for cultivation. A very few had an intention to expand their mushroom cultivation in the near future knowing the prospects of the industry.

Respondents were aware of the operational cost (growbags/pots, growing media, spawn, supplements and other minor miscellaneous items) and revenue (setting base price per packet) components of the mushroom cultivation. However, accuracy of income and expenditure forecasts is therefore not reliable. Respondents had a fair and a basic knowledge on materials which were used for the cultivation. However, in most cases some of the critical practices such as selection of growing media, purchasing of quality spawn and maintenance of hygiene within the growth house were neglected. This adversely has an impact on quality and the quantity of the final output. Respondents were not updated regarding those practices and had limited access to such information. Therefore, overall understanding about the cultivation was less.

Respondents rarely adopted new planting techniques and methods as mentioned earlier. A majority intended to retain similar practices that they adopted over a period of time. Similarly, the majority did not have any intention to invest in expanding their production. However, respondents expected to increase production through enhancement of productivity (basically with less usage of input over output). Further, respondents did not want to invest in improved technology. Only a few farmers who had attempted were willing to try entirely different mushroom varieties. Hence, the value addition process was at a very lower level among these farming communities. Overall respondents were not willing to take any form of risk (economic, social and cultural) and could be considered as risk averse and laggards of adopting novel ways of practices and in the process of value addition.

Respondents did not undergo any prior planning stage before initiating their cultivation. In addition, there were no risk management strategies as well. For example, if a particular farmer lost his major market channel it may significantly affect

that farmer. This had an impact on the farmer which may lead him to exit from the cultivation. Another reason for this is the relative ease of entering and leaving the industry compared to other open field cultivations. Simply, farmers did not have either short or long run ideas on how to run the business. That drastically deteriorated the entrepreneurial behaviour of the considered farming communities. Sourcing and deploying of capital for the cultivation oriented more towards ad-hoc manner. Most of the time informal credit sources were used and invested for the cultivation. Notably, of formal credit lines microfinance played the dominant role. Farmers less frequently gathered industry updates and mostly confined to community level knowledge. This is one major reason why the industry is not progressing among those communities.

Respondents had well accumulated tacit knowledge on mushroom cultivation over the years. However, there was no proper mechanism to transfer such knowledge especially to the beginners. Some of the respondents were identified as leading farmers who are rich in every component of the EBI related to mushroom cultivation during the interview process. However, there was no proper official mechanism to recognize and disseminate their knowledge among other communities. Mushroom cultivation is identified as a family venture in most cases and hence, almost all family members in the household had a particular role (from source of inputs to market of the final product) in the cultivation. Interestingly, there were no gender or age restrictions in the cultivation. Mushroom cultivation could be therefore identified as a venture that empowers all categories in a society. That is why mushroom cultivation is ideal to promote among the rural and poverty struggling communities in developing countries. Leading farmers are engaged in the knowledge sharing process informally to a certain degree. However, the scope was very limited and made a trivial contribution as a whole. These leading farmers could be utilized to promote the industry. Simultaneously, leading farmers are also required to be updated on novel production schemes and varieties in order to reap the maximum benefit from the industry.

Respondents have rarely connected with other distance farming communities and had no idea regarding the varieties, quantities and market channels of those areas. Occasionally, respondents have participated in different types of seminars, workshops and exhibitions related to agriculture and not specifically related to mushroom cultivation. However, respondents had an intention to gather new information related to the cultivation. Fifty-six percent of the respondents have participated in training programmes related to mushroom cultivation prior to starting the cultivation. It is noted that, both private and public entities have arranged training programmes from time to time. The percentages of trained respondents in value-added products, seed/spawn production, disease and pest control in mushroom cultivation, and mushroom marketing are about 35%, 3.5%, 3.5%, and 2% respectively. Accordingly, the majority of trained farmers (around 99%) were satisfied with the content of the training. The main limitation of those programmes was lack of knowledge sharing on value addition techniques. Hence, in most cases respondents considered those training programmes as repetitive sessions which were only concerned with

production aspects. This is also one of the reasons for the slow progression of the industry in Sri Lanka. More than half of the respondents requested to conduct formal awareness programmes related to value addition processes, seed/spawn production, disease and pest control, and marketing aspects in the industry in order to operate it as a viable business venture. Also, the respondents have no idea regarding the total demand and supply of the local mushroom industry and the study identified that there were no official databases to extract such information for the general public. This limits the entrepreneurial capacities of new entrants in the industry.

### **5.3 Chapter Summary**

This chapter elaborated the entrepreneurial behaviour and its components using the insights from interviews in order to construct an entrepreneurial behaviour profile of farmer entrepreneurs and the next chapter will discuss the production of mushroom in Sri Lanka.



## **CHAPTER SIX**

### **Production of Mushroom**

#### **6.1 Introduction**

For a successful mushroom cultivation three factors; quality seeds/spawn, a good substrate and the presence of favourable environmental conditions; should be satisfied. Here, mainly commercial mushroom cultivation is done using mushroom growing bags in mushroom houses. For that, it is very important to find a suitable medium/substrate as well as suitable seeds/spawn. After the seeds/spawn is inserted into the mushroom growbags, the bags are placed in a dark room called an incubation chamber to facilitate mycelial growth. After the mycelia are grown throughout the bag, the bags are placed in a well-lit room called mushroom grow house for the fruiting stage. There the producer will be able to harvest the mushrooms. Many factors should be present for mushrooms to flourish. Environmental factors such as relative humidity, temperature, CO<sub>2</sub> concentration, and light conditions have to be controlled so that fungi can grow to the optimum level utilizing the media (Beetz and Greer, 2004). According to the results generated, 42% of the farmers have high knowledge of hanging, humidity control, pest and disease control, harvesting, packing, and transporting while around 57% of the farmers have an average knowledge of the above-mentioned factors. Moreover, with the aid of this chapter production of mushroom across entrepreneurial behaviour levels and districts can be assessed.

#### **6.2 Mushroom Housing**

Here the mushroom house means the house where the mushroom grows. Majority of the mushroom producers based on the study did not have a standard house recommended by the Department of Agriculture in Sri Lanka. Here, the recommended length, width and height of a house are about 15, 12 and 13 respectively (normally four thousand grow bags can be located in this kind of grow house), but the square footage of most cultivator houses was around 60-90 square feet. There are many varieties of mushrooms, and most varieties require very well-controlled environmental conditions. Research has confirmed that different temperatures (range from 17°C to 30°C) relative humidity (range from 85% to 100%), CO<sub>2</sub> (range from 500 to 20,000 ppm) and light (range from total dark to 2,000 lux) are necessary for mushroom cultivation to mycelial growth, as well as during harvesting. Also, the study revealed that many diseases and pest damage to mushroom cultivation can be reduced by making a proper growing house. Here, the aforesaid point can be achieved by constructing growing houses with double doors that can be opened outwards. Also, according to the experts, in a formal grow house, only a part of the wall (around two feet) should be built and the remaining part as well as the roof ceiling should be covered with insect-proof netting (a mesh with 40 squares per inch). However, the grow houses that were seen in this way were very few. Also, it was recommended by the Department of Agriculture that the floor of the grow house should be cement or

concrete, but a small number of producers still used clay to prepare the floor and instead of tiles, sheets, straw or coconut leaves were found to be the recommended materials for the roof.

Furthermore, many growers were found to be using 'sarees' instead of insect-proof nets, and many of them had more disease and pest damage to their mushroom cultivation. Here, it was revealed that the reason for producers not following the recommendations of the Department of Agriculture was due to non-awareness as well as the inability to bear the initial cost. In relation to the research, it was reported from an expert that to build a recommended grow house, at present, at least Rs. 250,000/= has to be spent and its lifespan is at least 10 years. Thus, in the chat with the producers, the expectation of them was that they want to set up their grow house with a proper standard and if they can support it in some way, it would be a relief for them. This situation became clear to the researchers who entered the field. When the growers made the mushroom house by surrounding a small space with cloth or sacks, it was also possible to identify the increase in the number of invaders (pests and diseases) that had come to the mushroom cultivation.

It was also reported that at the end of one mushroom production cycle, 10-15 days rest should be given to the mushroom grow house before starting a new mushroom production cycle. Then, after removing the grow bags, the mushroom grow house as well as the removed grow bags should be sprinkled with Sulphur powder or the grow house should be fumigated with Sulphur powder, and this can prevent many pests and diseases affecting mushrooms, said many growers as well as subject experts. Sulphur was used by the 27% of respondents from the study sample to disinfect the mushroom house prior to starting a new cycle and was never used during the life cycle of the plant.

### **6.3 Mushroom Grow Bags**

In order to get better income from mushroom cultivation, the medium used for it is very important. It was observed that most of the growers in the sample related to the study use rubber wood powder (about 85%) and the rest use mango and lunumidella wood powder as the medium used for mushroom grow bags. Even the growers who use other wood powder as substrate prefer to use rubber wood powder. Anyhow, due to its scarcity, other substrates were being used. Almost all of them, when asked about their willingness to use rubber wood powder, said that they can get a higher yield by using rubber wood powder grow bags than the yield obtained when making mushroom grow bags using other substrates. This is a confirmation of the fact that Joseph et al., (1998) indicated that rubber wood powder is the most appropriate medium for mushroom cultivation during the literature review. In addition to this, it was seen that nutrients such as  $MgSO_4$ , limestone ( $CaCO_3$ ), rice bran, green grams, soybean flour or food called "Samaposa" which is prepared from maize, rice, and soybean were used as nutrients.

But, nowadays, the demand for substrates especially for rubber wood powder has increased as the wood mill owners attend to small-scale needs after meeting the needs of the large-scale demanders. Here, the study identified that before getting the wood powder, they had to make an advanced payment and wait in line. When the study conducted by Thilakarathne and Sivasankar (2018), sawdust had been available all around the year. But within four years the situation has changed.

Those who were involved in the cultivation a few years (around three years) ago have been able to obtain the wood powder for cultivation free of charge from the owners of the wood mills, but now they have taken steps to set a price for it. That price fluctuates day by day in the market and the price of a bag of wood powder (20 kg-25 kg) has now reached around Rs. 300/=. Here, growers had averagely prepared around 50-60 grow bags from 20 kg of wood powder, 2 kg of rice bran, 400 g of lime, 200 g of soy flour or green gram flour or “Samaposa”, and 40 g of MgSO<sub>4</sub>.

Not only wood powder but also rice bran, which is a nutrient medium, has a similar fate. Due to the scarcity of raw materials for the animal feed industry with the restriction of imports, they have been tempted to collect rice bran to sustain their industry. Therefore, it was reported that there is a shortage of rice bran and the price is increasing day by day. Also, it is a pathetic situation that rice bran cannot be found in mushroom-growing areas due to reduced rice production. Although the price of a kilo of rice bran was twenty rupees when they started cultivation three years ago, it has now risen to sixty, eighty, not even a hundred rupees in some areas. Also, the price of a kilo of green grams, which is used as a nutrient in mushroom cultivation medium, has reached Rs. 800-1,000/=. Moreover, the price of a kilo of two-hundred-gauge polypropylene which is used to prepare to grow bags and pack mushrooms exceeded six hundred rupees. Normally, growers were making a maximum of 90 to 95 grow bags (7” width and 14” height) from one kilo of polypropylene. Anyhow many growers mentioned that the price of a 200g grain (rice) spawns packet is still around Rs. 100-120/= and 55-65 grow bags can be inoculated from it. Out of the total sample in the study, around 77% of the respondents obtain mushroom spawn from an authorized dealer or from the Farmer Society/Cooperative Society. About five percent of respondents obtain mushroom spawn from the EDB, DOA, or from a friend. Moreover, statistics show that 58% of the farmers are well knowledgeable on substrate preparation, grow-bag preparation, sterilization, grow-bag inoculation, and spawn production while around 41% of the farmers have an average knowledge of the above factors. Also, when asking the mushroom farmers about their willingness to prepare mushroom seeds, about 59% said they would like to prepare mushroom seeds, but only 3.5% of them have received training in this regard.

#### **6.4 Pest and Diseases on Mushroom Cultivation**

According to the study sample, mites poses a threat to the mushroom industry. In addition, pest damage is caused by worms, beetles, and flies. This situation has forced people to quit the industry. This is because there is no solution other than to remove and destroy the grow bags completely from the crop house when there is mite

damage. The main successive solution for these pest and disease problems is garlic-margosa extraction. To prevent mite attacks it is good to burn to grow bags and put Sulphur dust in the cleaned cultivation house. Lack of proper management of watering the flowers get yellow colour. To minimize pest and disease problems farmers cover their grow houses using polythene, sarees, gunny bags, pick flowers in the morning, fumigation, clean the racks and wash the grow house with chlorine water.

The study reported two major types of infections, bacteria, and fungi, affecting mushroom cultivation. Here, the most common bacterial infection was called "Pseudomonas infection" and was prominent in oyster mushroom cultivation. This type of bacteria is very easy to identify and it is yellow in colour, slimy, and has an unpleasant smell. Subject experts are of the opinion that this bacterial infection is spread by insects and water. It was revealed that the growth of the mushroom due to infection with "Pseudomonas" bacteria is a reason for the reduction in yield. This bacterial infection was observed both in the mycelial growth grow bags, as well as the fruiting stage grow bags. The mushroom growers said that the growth of bacteria in the grow bags where the mushroom spawn grows can be controlled by using healthy mushroom seeds, carrying out the maintenance process to the proper standard, removing the bacteria-infected grow bags in a proper manner, and using rice bran and wood powder of the prescribed standard. Here, it was clear in the investigation of the qualitative data related to the research that the development of "Pseudomonas infection" can be prevented by following measures such as the safe removal and destruction of the crops as soon as these bacteria are seen in the early stages of growth and by following measures such as dissolving 1 gram of chlorine in 1 liter of water when spraying.

In addition to this, infected black and green mushroom grow bags were also observed in the study and these were fungi belonging to the genera "*Aspergillus niger*" and "*Trichoderma spp.*" respectively. The study revealed that this fungus is spread by water, air, and insects and that the spread of the fungus can be prevented by safely removing and destroying the crops at the first sight of the spread of the fungus. Experts in the field have pointed out that the development of this fungus can be prevented by using healthy mushroom seeds, using rice bran and wood powder in accordance with the prescribed standard and avoiding damage from animals such as cockroaches, rats, squirrels during the germination period. In order to prevent fungal infection in fruiting stage grow bags, they should be safely removed from the house and destroyed at the first sign of disease fungal growth. There are two things that need special attention here. That is, the black "*Aspergillus niger*" fungus or black mold can reduce the yield due to the spoilage of the grow bags, so always make sure that the grow bags are not perforated during the design of them, during curing, and putting them in the barrel to sterilize. Furthermore, it was further recognized that the growth of the green "*Trichoderma spp.*" fungus or green mold is quite difficult to identify in the early stage, and to control it once it has developed, the infected crops must be completely destroyed. Out of the total sample, 87% of farmers' mushroom fields were affected by pests and diseases during the last season. Anyhow, around 91% of farmers



have been able to mitigate pest and disease attacks to some extent by following the measures on pests and diseases.

Here, most of the farmers (46%) had applied bio-pesticides made from herbal leaves (Margosa/Lantana/Annona/Tobacco). And around 32% of respondents had removed disease affected grow bags. Also, the application of bio-pesticides made from Garlic-Margosa extraction had been followed by around 24% of farmers. While about 16% of farmers had fumigated the mushroom house. As well, less than three percent of mushroom cultivators had repaired mushroom grow houses with insect-proof nets. Even in 80% of the cultivations where various measures have been taken to control pests and diseases, there is little or moderate yield loss. But even if there is an attack, the amount of crops that could have been harvested without this is 20%.

### 6.5 Varieties of Mushroom Cultivated

Table 6.1 shows the varieties of mushrooms cultivated by the respondents of the survey. The table details the actual percentage of each mushroom variety cultivated by the mushroom farmers relevant to the sample size of mushroom farmers. Here, although the respondent sample was 289, the total of each variety cultivated by farmers is not equal to the sample size due to the same farmer was cultivating different mushroom varieties.

**Table 6.1: Varieties of Mushroom Cultivated**

| Variety         | Responses |                  |
|-----------------|-----------|------------------|
|                 | N         | Percent of Cases |
| American Oyster | 278       | 96.20%           |
| Abalone         | 99        | 34.30%           |
| Bhutan Oyster   | 35        | 12.10%           |
| Pink Oyster     | 10        | 3.50%            |
| Makandura White | 8         | 2.80%            |
| Straw Mushroom  | 1         | 0.30%            |

Source: Authors' Own Compilation (2021)

According to the findings, the majority of farmers (96.2%) farmed American oysters followed by Abalone (34.3%). This is a confirmation of the fact that was mentioned in the literature investigation as the type of mushroom cultivated by the majority of people in Sri Lanka. Compared to finding seeds of other varieties, the main reason for this is the ease of finding seeds of this variety and consumer demand.

## 6.6 Number of Mushroom Growbags/Pots Cultivated per Cycle from each Variety

Table 6.2 depicts the number of mushroom grow bags/pots cultivated per cycle from each variety by the respondents (n=289). Accordingly, American Oyster was being cultivated vastly by the farmers and the mean value of grow bags cultivated in American Oyster is around 2,204 while the median value is around 1,510. That means, 50% of farmers who were cultivating American Oyster were cultivating on or below 1,510 grow bags of American Oyster. The next highest number of grow bags were being cultivated from Abalone followed by Bhutan Oyster and Pink Oyster. When considering the mean and median values for the total number of grow bags cultivated per cycle by an individual farmer, those were around 2,731 and 1,834 respectively. Further, the results reveal that generally, the number of mushroom grow bags cultivated by farmers varies between 50 to 40,000 per cycle. Table 6.2 delineates the results further and 'sum' column describes the total number of grow bags cultivated by the farmers from each mushroom variety per cycle.

**Table 6.2: Number of Growbags Cultivated per Cycle from each Mushroom Variety**

|   | Variety   | N   | Mean | Median  | Minimum | Maximum | Sum    |
|---|---|-----|------|---------|---------|---------|--------|
| Number of Growbags Cultivated per Cycle | American Oyster                                 | 277 | 2204 | 1510    | 50      | 25000   | 610508 |
|   | Abalone   | 71  | 1783 | 1312    | 250     | 15000   | 126593 |
|   | Bhutan Oyster                                   | 34  | 1091 | 750     | 250     | 10000   | 37094  |
|   | Pink Oyster                                     | 10  | 905  | 500     | 250     | 3000    | 9050   |
|   | Makandura White                                 | 8   | 688  | 464     | 250     | 2500    | 5504   |
|   | Straw Mushroom                                  | 1   | 500  | -       | 500     | 500     | 500    |
|   | Total Number of Growbags Cultivated by a Farmer |     | 289  | 2730.97 | 1834.48 | 50      | 40000  |

Source: Authors' Own Compilation (2021)

## 6.7 Duration of a Production Cycle (in Months) of Different Mushroom Varieties

Table 6.3 outlines the duration of a production cycle (in Months) of different mushroom varieties cultivated by the respondents (n=289) in a detailed manner. Duration of a production cycle varies based on the variety and according to the experts economically valid period for American Oyster and other Oysters are around two and half to three months while it's around four to five months for the Abalone.

**Table 6.3: Duration of a Production Cycle (in Months) of Different Mushroom Varieties**

|   | Variety         | Mean | Median | Minimum | Maximum |
|---|-----------------|------|--------|---------|---------|
| <b>Duration of a Production Cycle (in Months)</b> | American Oyster | 2.90 | 2.85   | 2       | 8       |
|   | Abalone         | 5.60 | 5.57   | 4       | 8       |
|   | Bhutan Oyster   | 2.78 | 2.75   | 2       | 4       |
|   | Pink Oyster     | 2.80 | 2.83   | 2       | 3.5     |
|   | Makandura White | 3.13 | 3.10   | 2.5     | 4       |
|   | Straw Mushroom  | 3.00 | -      | 3       | 3       |

Source: Authors' Own Compilation (2021)

Accordingly, the minimum duration of the production cycle of American Oyster was two months while the maximum duration was eight months. The mean value of the duration of the production cycle of American Oyster was around three. Statistics show that 52% of American Oyster farmers have a production cycle of two and half to three months and 12% of growers have a production cycle of more than three months.

In the case of Abalone, the minimum duration of the production cycle was four months. The maximum duration of the production cycle of Abalone was eight months while the mean value of the duration of the production cycle of Abalone was about six. Also, 32% of Abalone farmers have a production cycle time of four to five months while 31% have five to six months. The percentage of mushroom growers who were growing Abalone with more than six months of the production cycle was around twenty-two.

The minimum duration of the production cycle of Bhutan Oyster was two months as well as the maximum duration of the production cycle was four months. The mean value of the duration of the production cycle of Bhutan Oyster was around three. Furthermore, 76% of Bhutan Oyster growers have a production cycle time of two and a half to three months while 15% have a production cycle of more than three months. The minimum duration of production cycle of Pink Oyster was two months while the maximum duration of production cycle was three and half months. Sixty percent of Pink Oyster farmers have a production cycle of two and half to three months and 20% of growers have a production cycle of more than three months.

The statistical data shows that the minimum duration of production cycle of Makandura White was two and half months. As well as the maximum duration of production cycle of Makandura White was four months. The mean value of the production cycle of Makandura White was around three. Also, 38% of Bhutan Oyster growers have a production cycle time of two and a half to three months while around 37% have a production cycle of more than three months.

Anyhow, there was only one respondent who was cultivating Straw Mushroom/ 'Piduru Bimmal' and accordingly, the duration of production cycle of Piduru Bimmal was three months.

### 6.8 Number of Production Cycles Cultivated per Year by the Farmers

Table 6.4 illustrates the number of production cycles of different mushroom varieties cultivated per year by the farmers (n=289). This is a very important component as the frequency of cultivation determines the mushroom production and the farmer's income.

**Table 6.4: Number of Production Cycles Cultivated per Year by the Farmers**

| Mushroom Variety | No. of Cycles | Frequency | Valid Percent |
|------------------|---------------|-----------|---------------|
| American Oyster  | 1             | 1         | 0.4           |
|                  | 2             | 13        | 4.8           |
|                  | 3             | 84        | 30.8          |
|                  | 4             | 158       | 57.9          |
|                  | 5             | 16        | 5.9           |
|                  | 6             | 1         | 0.4           |
| Abalone          | 1             | 9         | 12.7          |
|                  | 2             | 45        | 63.4          |
|                  | 3             | 17        | 23.9          |
| Bhutan Oyster    | 2             | 1         | 2.9           |
|                  | 3             | 6         | 17.6          |
|                  | 4             | 18        | 52.9          |
|                  | 5             | 9         | 26.5          |
| Pink Oyster      | 3             | 2         | 20.0          |
|                  | 4             | 6         | 60.0          |
|                  | 5             | 2         | 20.0          |
| Makandura White  | 3             | 4         | 50.0          |
|                  | 4             | 3         | 37.5          |
|                  | 5             | 1         | 12.5          |
| Straw Mushroom   | 3             | 1         | 100.0         |

Source: Authors' Own Compilation (2021)

Accordingly, the majority of American Oyster (around 58%), Bhutan Oyster (around 53%) and Pink Oyster (60%) growers perform four production cycles per year. Also, the majority (63%) of Abalone growers have two production cycles per year. Moreover, 50% of Makandura White growers have three production cycles per year. There is only one Straw Mushroom/'Piduru Bimmal' maker and that person does three production cycles per year.

## 6.9 Production of Mushroom per Growbag/Pot (g) by different Mushroom Varieties

Table 6.5 explains the mushroom production (g) per pot from different mushroom varieties by the respondents (n=289). Accordingly, the highest median value for the production of mushroom per pot shows Makandura White (566 g/pot) followed by Abalone (478 g/pot) and Pink Oyster (344 g/pot). Anyhow, the median value of the mushroom production (g) per pot for American Oyster is 319 g/pot while Bhutan Oyster shows the lowest median value (311 g/pot). The reason for discussing the median value is, that results show that the production of mushrooms per grow bag (g) by different mushroom varieties is not normally distributed. Further, because only one producer cultivated Straw Mushroom/ 'Piduru Bimmal', a median value does not prevail. There were not enough studies conducted in Sri Lanka to find the production of mushrooms per grow bag by different varieties. According to the experts on the subject, the average American Oyster production is around 300-350g/pot and the average Abalone production is about 400-450g/pot.

**Table 6.5: Production of Mushroom per Growbag/Pot (g) by Different Mushroom Varieties**

| Statistics  |                 | Mean | Median | Minimum | Maximum |
|---|-----------------|------|--------|---------|---------|
| <b>Production of Mushroom per Growbag/Pot (g)</b> | American Oyster | 322  | 319    | 200     | 571     |
|   | Abalone         | 479  | 478    | 360     | 650     |
|   | Bhutan Oyster   | 316  | 311    | 265     | 390     |
|   | Pink Oyster     | 346  | 344    | 270     | 430     |
|   | Makandura White | 565  | 566    | 496     | 640     |
|   | Straw Mushroom  | 480  | -      | 480     | 480     |

Source: Authors' Own Compilation (2021)

## 6.10 Mushroom Yield Produced (kg) by Different Mushroom Varieties in One Production Cycle

Mushroom yield produced (kg) by different mushroom varieties in one cultivation cycle is basically depends on the production of mushroom per growbag (g) and the number of mushroom grow bags cultivated per cycle. Table 6.6 represents the mushroom yield produced (kg) by different mushroom varieties in one cultivation cycle by the respondents. Accordingly, the highest median value of the mushroom production per cycle reported by the farmers who were cultivating Abalone (560 kg) followed by American Oyster (450 kg) and Makandura White (268 kg). The reason for discussing the median value is, that results show that the yield produced (kg) by different mushroom varieties in one production cycle is not normally distributed. Then, in order to have a better understanding median values should be considered. The 'sum' column in Table 6.6 describes the total mushroom yield produced by the farmers from each mushroom variety per cycle. Then, the highest mushroom

production per cycle is given by the farmers who cultivated American Oyster and that is around 195,195 kg.

**Table 6.6: Mushroom Yield Produced (kg) by Different Mushroom Varieties in One Production Cycle**

|   | Statistics      | N   | Mean | Median | Minimum | Maximum | Sum    |
|---|-----------------|-----|------|--------|---------|---------|--------|
| <b>Mushroom Production (kg) per Cycle</b> | American Oyster | 273 | 715  | 450    | 20      | 8500    | 195195 |
|   | Abalone         | 71  | 878  | 560    | 100     | 7800    | 62338  |
|   | Bhutan Oyster   | 34  | 339  | 238    | 70      | 2890    | 11526  |
|   | Pink Oyster     | 10  | 300  | 155    | 85      | 840     | 3000   |
|   | Makandura White | 8   | 390  | 268    | 140     | 1430    | 3120   |
|   | Straw Mushroom  | 1   | 250  | -      | 250     | 250     | 250    |

Source: Authors' Own Compilation (2021)

### 6.11 Total Annual Mushroom Production (kg) in Different Mushroom Varieties

Table 6.7 elaborates the total annual mushroom production (kg) from different mushroom varieties by the respondents (n=289). Accordingly, the highest median value of the total annual mushroom production (kg) reported by the farmers who were growing American Oyster (1724 kg) followed by Abalone (1280 kg) and Makandura White (1016 kg). As before, the reason for discussing the median value is that the results show that the total yield (kg) produced annually by different mushroom cultivars is not normally distributed. Therefore, the median values should be considered for better understanding. The 'sum' column in Table 6.7 depicts the total annual mushroom production produced by the farmers from each mushroom variety. Then, the highest total annual mushroom production is given by the farmers who cultivated American Oyster and that is 715,260 kg. Moreover, when considering the median value of the total annual mushroom production of all types, it is 2,025 kg. That is, 50% of the farmers in the study sample produce on average or more than 2025 kg of mushrooms per year. In total, mushroom farmers produced 913,995 kg of mushroom products.

**Table 6.7: Total Annual Mushroom Production (kg) by Different Mushroom Varieties**

|  | Statistics  | N          | Mean        | Median      | Minimum   | Maximum      | Sum           |
|--|---|------------|-------------|-------------|-----------|--------------|---------------|
| <b>Total Annual Mushroom Production (kg)</b> | American Oyster   | 273        | 2620        | 1724        | 80        | 34000        | 715260        |
|  | Abalone   | 71         | 1789        | 1280        | 125       | 15600        | 127019        |
|  | Bhutan Oyster   | 34         | 1415        | 810         | 240       | 14450        | 48110         |
|  | Pink Oyster   | 10         | 1212        | 688         | 340       | 4200         | 12120         |
|  | Makandura White   | 8          | 1342        | 1016        | 420       | 4290         | 10736         |
|  | Straw Mushroom  | 1          | 750         | -           | 750       | 750          | 750           |
|  | <b>Total Annual Mushroom Production (kg) Produced by a Farmer</b> | <b>285</b> | <b>3207</b> | <b>2025</b> | <b>80</b> | <b>49600</b> | <b>913995</b> |

Source: Authors' Own Compilation (2021)

## 6.12 Distribution of Total Annual Production of Mushroom (kg)

### 6.12.1 Distribution of Total Annual Production (kg) across Entrepreneurial Behaviour Levels

As mentioned in the methodology chapter, the Mann Whitney-U Test was performed here to assess the distribution of the median value of the total annual production of mushroom by the mushroom farmers across entrepreneurial behaviour levels. As previously identified, entrepreneurial behaviour consists of two levels called high in entrepreneurial behaviour and low in entrepreneurial behaviour. Accordingly, the null hypothesis of 'the distribution of total annual mushroom production is the same across entrepreneurial behaviour levels' is rejected due to the probability value being less than 0.05 and that is 0.018. That means entrepreneur behaviour affects the total annual production of mushroom produced by an individual farmer at 95% confidence level. Table 6.8 delineates the total annual mushroom production (kg) of the respondents (n=289) across entrepreneurial behaviour levels.

**Table 6.8: Total Annual Production of Mushroom (kg) across Entrepreneurial Behaviour Levels**

| Statistics | Entrepreneurial Behaviour Level  |                                   |         |
|------------|----------------------------------|-----------------------------------|---------|
|            | Low in entrepreneurial behaviour | High in entrepreneurial behaviour |         |
| N          | Valid                            | 209                               | 76      |
|            | Missing                          | 3                                 | 1       |
| Mean       | 2989.98                          |                                   | 3803.25 |
| Median     | 1840.00                          |                                   | 2600.00 |

Source: Authors' Own Compilation (2021)

Accordingly, farmers who are in high entrepreneurial behaviour produce a significant amount of mushroom production (2,600 kg) per year over the farmers who are in low entrepreneurial behaviour at 95% confidence interval. The median production for the farmers who are low in entrepreneurial behaviour is 1,840 kg. As mentioned in the methodology chapter, the reason for employing the Mann Whitney-U Test was because total annual mushroom production didn't follow the assumptions to be required to conduct an independent sample T-Test.

### 6.12.2 Distribution of Total Annual Production (kg) across Districts

The Kruskal Wallis Test was run here to assess the distribution of the median value of the total annual production of mushroom produced by the mushroom farmers across districts. Accordingly, the null hypothesis of 'the distribution of total annual mushroom production is the same across categories of districts' is rejected due to the probability value being less than 0.05 and that is 0.001. That means the total annual production of mushroom produced by an individual farmer is significantly changed based on districts at 95% confidence level. Table 6.9 demonstrates the total annual mushroom production (kg) of the respondents (n=289) across districts.

**Table 6.9: Total Annual Mushroom Production (kg) across Districts**

| Statistics | District  |          |         |            |         |         |
|------------|-----------|----------|---------|------------|---------|---------|
|            | Ratnapura | Kalutara | Colombo | Kurunegala | Kegalle | Kandy   |
| N Valid    | 73        | 28       | 46      | 43         | 49      | 46      |
| Missing    | 0         | 0        | 0       | 1          | 3       | 0       |
| Mean       | 2746.82   | 4134.57  | 3382.24 | 2154.10    | 4202.37 | 3387.61 |
| Median     | 2400.00   | 2880.50  | 2017.00 | 1280.00    | 3280.00 | 1282.50 |

Source: Authors' Own Compilation (2021)

Accordingly, farmers who are in Kegalle district produce the highest median mushroom production (3,280 kg) per year followed by Kalutara (around 2,881 kg), Ratnapura (2,400 kg) and Colombo (2,017 kg) districts. Moreover, the median value of the total annual production of mushroom produced by the mushroom farmers who are in Kandy district is around 1,283 kg while the lowest median value (1,280 kg) results from Kurunegala district for the same scenario. Because the null hypothesis is rejected, at least one median comparison should be significant at 95% confidence interval. That means the median value of the total annual production of mushroom produced by an individual farmer is significantly changed by districts at 95% confidence level. Table 6.10 demarcates and interprets what could be the significant comparison. Accordingly, if the probability value/significant value is less than 0.05 for a particular comparison (called sample 1-sample 2), that infers the comparison is significant at 95% confidence level. That means there is a significant difference between the median value of the total annual production of mushroom produced by the mushroom farmers across districts. As mentioned in the methodology chapter, the



reason for employing the Kruskal Wallis Tests was because total annual mushroom production didn't follow the assumptions to be required to conduct an analysis of variance (ANOVA) Test.

**Table 6.10: Pairwise Comparisons of Total Annual Mushroom Production (kg) across Districts**

| No. | Sample 1-Sample 2    | P-value |
|-----|----------------------|---------|
| 1   | Kurunegala-Kandy     | 0.992   |
| 2   | Kurunegala-Ratnapura | 0.136   |
| 3   | Kurunegala-Colombo   | 0.035   |
| 4   | Kurunegala-Kegalle   | 0.005   |
| 5   | Kurunegala-Kalutara  | 0.000   |
| 6   | Kandy-Ratnapura      | 0.147   |
| 7   | Kandy-Colombo        | 0.039   |
| 8   | Kandy-Kegalle        | 0.006   |
| 9   | Kandy-Kalutara       | 0.000   |
| 10  | Ratnapura-Colombo    | 0.405   |
| 11  | Ratnapura-Kegalle    | 0.110   |
| 12  | Ratnapura-Kalutara   | 0.009   |
| 13  | Colombo-Kegalle      | 0.478   |
| 14  | Colombo-Kalutara     | 0.077   |
| 15  | Kegalle-Kalutara     | 0.260   |

Note: Each row Tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.

Source: Authors' Own Compilation (2021)

According to the output, comparison number 3, 4, 5, 7, 8, 9 and 12 are significant comparisons at 95% confidence interval due to the probability value being less than 0.05. For example, if we move on to comparison number 3, the median value of the total annual production of mushroom produced by an individual farmer is significantly different between Kegalle and Colombo at 95% confidence level. Other comparisons also can be explained the same way.

### 6.13 Chapter Summary

This chapter detailed some main factors affecting for successful mushroom cultivation while it discussed the production of mushroom across entrepreneurial behaviour levels and districts. The next chapter will outline the economy of mushroom cultivation in Sri Lanka.



## CHAPTER SEVEN

### The Economy of Mushroom Cultivation

#### 7.1 Introduction

As mentioned in the methodology chapter, researchers were able to cover only 100 out of the 173 interviewees who were cultivating American Oyster (*Pleurotus ostreatus*) only for the second phase survey within the study period. The chapter details the income and expenditure of mushroom cultivation across entrepreneurial behaviour levels.

#### 7.2 Distribution of Income and Expenditure of Mushroom across Entrepreneurial Behaviour Levels

Independent sample t-Test assumes that the data is normally distributed. The independent sample t-Test also assumes homogeneity of variance, which means that the variance among the samples should be approximately equal. It also assumes that the observations are independent of each other. However, Mann Whitney-U Test had to be performed to assess the distribution of income and expenditure data of the mushroom industry across the two levels of entrepreneurial behaviour due to the assumptions that were violated to run the independent sample t-Test. Under the income and expenditure of mushroom, seven components were identified and they are discussed one by one below Table 7.1. Interestingly, except for unit cost of production, every component shows significant variation across levels of entrepreneurial behaviour.

##### 7.2.1 Income and Expenditure Component of Mushroom across Entrepreneurial Behaviour

Table 7.1 describes the average expenditure (LKR) for 1,000 grow bags of mushrooms, average income (LKR) that can be obtained from 1000 grow bags of mushrooms, net income/profit (LKR) that can be obtained from 1,000 grow bags of mushrooms per cycle, net income/profit (LKR) that can be earned per month by growing 1,000 grow bags of mushrooms, unit cost of production (LKR/Kg) of mushrooms, average sale price (LKR/kg) of mushroom from the last harvest and unit profit (LKR/kg) of mushrooms (last season) across entrepreneurial behaviour levels.

**Table 7.1: Income and Expenditure Component of Mushroom across Entrepreneurial Behaviour Levels**

| <b>Income and Expenditure Component of Mushroom</b>                                    | <b>Low in Entrepreneurial Behaviour</b> | <b>High in Entrepreneurial Behaviour</b> |
|--|---|--|
| Average expenditure (LKR) for 1000 grow bags of mushroom                               | 42000.00                                | 45400.00                                 |
| Average income (LKR) that can be obtained from 1000 grow bags of mushroom              | 81916.67                                | 99000.00                                 |
| Net income/profit that can be obtained from 1,000 grow bags of mushrooms per cycle     | 39040.00                                | 57000.00                                 |
| Net income/profit that can be earned per month by growing 1,000 grow bags of mushrooms | 13366.67                                | 19555.56                                 |
| Unit cost of production (LKR /Kg) of mushrooms   | 132.56                                  | 136.84                                   |
| Average sale price (LKR/kg) of mushroom from the last harvest                          | 255.88                                  | 336.11                                   |
| Unit profit (LKR/kg) of mushrooms (last season)  | 123.80                                  | 185.74                                   |

Source: Authors' Own Compilation (2021)

Accordingly, the median value of the average expenditure on 1000 grow bags of mushroom for the farmers who are low in entrepreneurial behaviour is Rs. 42,000.00 while it is Rs. 45,400.00 for the farmers who are high in entrepreneurial behaviour. Accordingly, the cost per 1000 bags of mushroom cultivation for mushroom farmers with low entrepreneurial behaviour is lower than that of farmers with high entrepreneurial behaviour. But the reason for this is the fact that the qualitative data analysis of the study revealed that farmers who are more entrepreneurial behaviour invest more money as initial costs with the aim of earning better profits. This is proved by the median value of the average income (LKR) obtained from 1000 grow bags of mushrooms. The median value of the average income obtained from 1000 grow bags of mushrooms for the farmers who are low in entrepreneurial behaviour is Rs. 81,916.67 while it is Rs. 99,000.00 for the farmers who are high in entrepreneurial behaviour.

Further, the median value of the net income/profit (LKR) obtained from 1,000 grow bags of mushroom per cycle for the farmers who are low in entrepreneurial behaviour is Rs. 39,040.00 while it is Rs. 57,000.00 for the farmers who are high in entrepreneurial behaviour. Moreover, results revealed that Rs. 19,555.56 of net income/profit (LKR) can be earned per month by growing 1,000 grow bags of mushroom for the farmers who are high in entrepreneurial behaviour while it is Rs. 13,366.67 for the farmers who are low in entrepreneurial behaviour.

Also, the median unit cost of mushroom production (LKR/Kg) for less entrepreneurial farmers was Rs. 132.56/kg and for farmers with high entrepreneurial behaviour it is Rs. 136.84. The reason for this is that as mentioned earlier, the high capital investment of farmers with high entrepreneurial behaviour is higher than that of farmers with low entrepreneurial behaviour. Moreover, the median value of the average sale price of mushrooms from the last harvest for the farmers who are low in entrepreneurial behaviour is Rs. 255.88 /kg while it is Rs. 336.11/kg for the farmers who are high in entrepreneurial behaviour. Finally, the median value of the unit profit (LKR/kg) of mushroom (last season) for the farmers who are low in entrepreneurial behaviour is Rs. 123.80 while it is Rs. 185.74 for the farmers who are high in entrepreneurial behaviour. These income and expenditure statistics show how much economic gain can be obtained through mushroom cultivation with high in entrepreneurial behaviour.

### **7.3 Chapter Summary**

This chapter discussed main income and expenditure components of mushroom and next chapter will delineate the current and emerging agribusiness opportunities in Sri Lanka.



## CHAPTER EIGHT

### Current and Emerging Agribusiness Opportunities

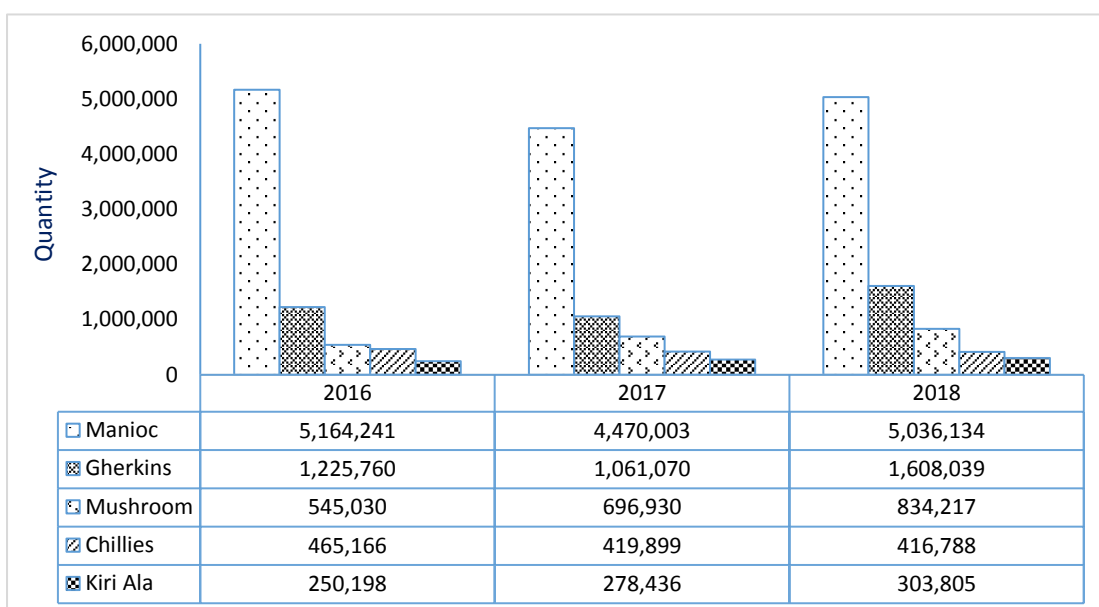
#### 8.1 Introduction

This chapter describes trading of mushrooms worldwide with the main focus of Sri Lankan mushroom imports and exports. Accordingly, mushroom marketing, mushroom societies, mushroom growers who won their lives through mushrooming, training on mushroom, constraints faced by mushroom farmers, farmers' suggestions to overcome the constraints in mushroom industry are discussed. Finally, SWOT analysis with multiple response analysis and narrative analysis has been deployed to assess possible strengths, weaknesses, opportunities and threats in the industry. Because, they directly impact on agribusiness opportunities in Sri Lanka.

#### 8.2 Mushroom Imports and Exports

Mushroom is a popular vegetable around the globe and used for many purposes. Mushrooms are loaded with supplements like nutrients, minerals, cell reinforcements and protein. As consumers perceive the significance of maintainable food utilization, many are moving to a plant-based diet, putting the focus on different wellsprings of supplements, including mushrooms. However, among a large number of accessible assortments of mushrooms, just a modest bunch are notable and consumed all over the planet. The international mushroom development market is assessed to represent a worth of USD 16.7 billion in 2020 (Market Data Forecast, 2020). The worldwide mushroom development market is projected to develop because of a number of factors such as the multiple health benefits of mushrooms, increasing per capita mushroom consumption, cost-effective production and rising demand for vegan and natural food in the diet and increasing health-conscious population across the globe. However, the lack of technical knowledge for spawn production among growers in developing countries has hindered the growth of the market.

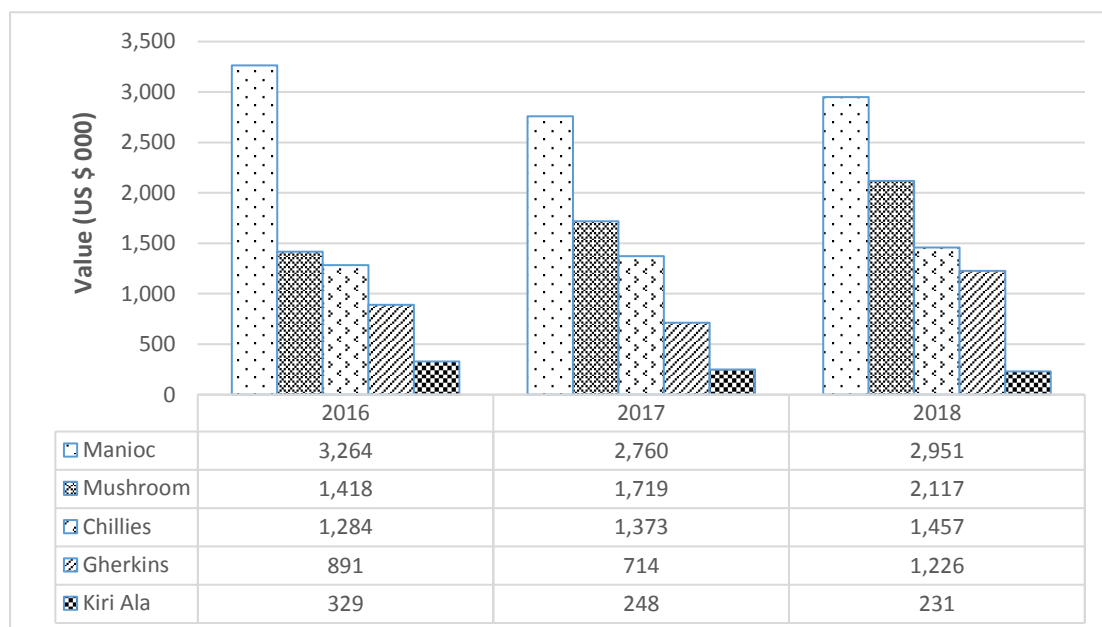
Button mushroom accounted for the largest market share in 2019. The button mushroom is widely consumed across the world and can potentially offer many health benefits. It is commercially grown in almost all the major mushroom producing countries such as China, Japan, the USA, the UK, Germany, and Poland. China was the largest edible mushroom producer at a global level and reached an estimated annual yield of 38.42 million tonnes in 2017. This accounted for about 75% of the total global output (Market Data Forecast, 2020). The Asia Pacific is the leading region in the global mushroom production market. The per capita consumption in China, the largest producer of mushrooms in the world, is higher than any other country. The consumption of mushrooms in Asian countries such as Japan, India, and others countries is increasing at a significant rate, accredited by increasing production. Increasing vegan population and shifting trend toward nutrition-rich food have led to the market growth of mushrooms in Asian countries.



Sources: Sri Lanka Export Development Board, 2019

**Figure 8.1: Mushroom Exports by Quantity from 2016 to 2018**

According to Figure 8.1, mushroom is the third highest contributor by export quantities to the total vegetable exports during 2016 to 2018 in Sri Lanka. The quantities have gradually increased over the period notably.

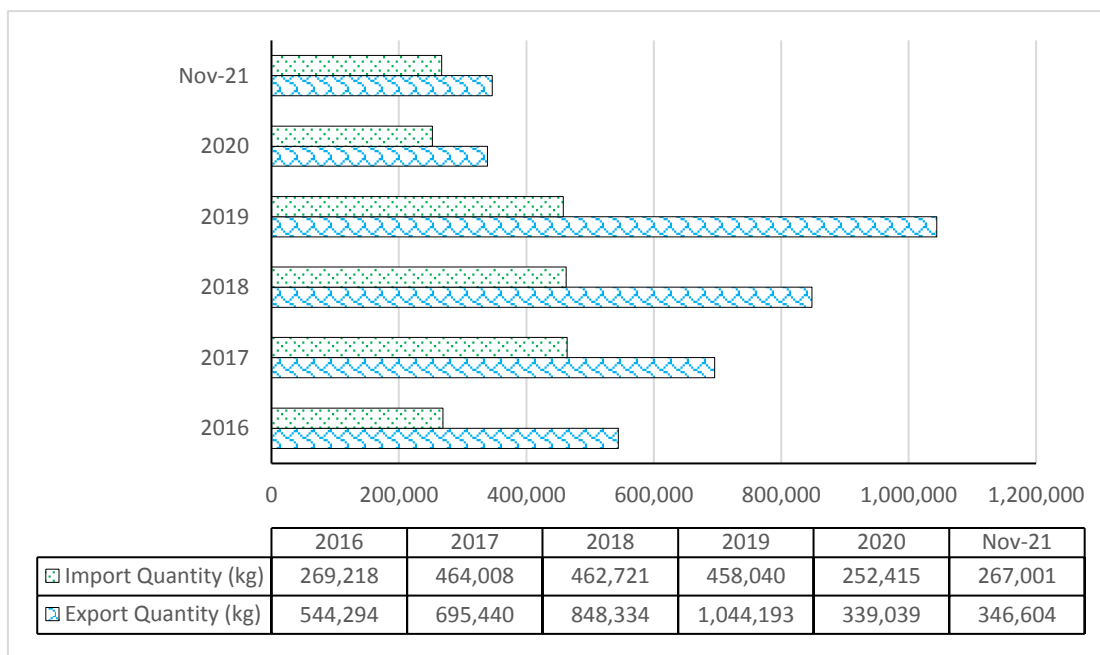


Sources: Sri Lanka Export Development Board, 2019

**Figure 8.2: Mushroom Exports by Value from 2016 to 2018**



According to Figure 8.2, mushroom is the second highest contributor by export value to the total vegetable exports during 2016 to 2018. A significant increment could be noted during the years.



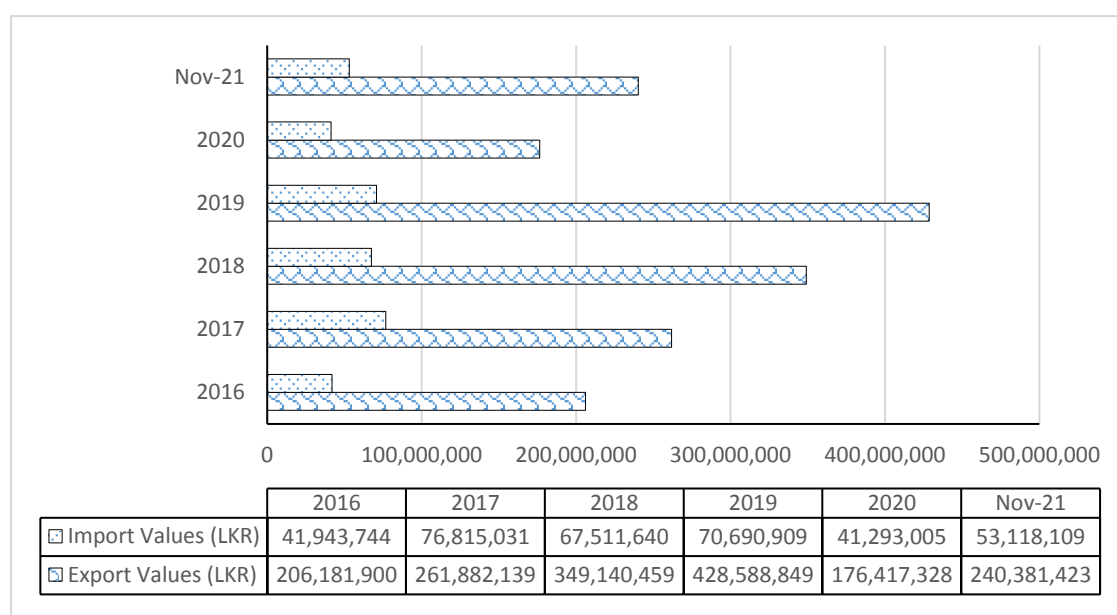
Source: Authors' Own Compilation based on Department of Customs Data, 2021

**Figure 8.3: Import & Export of Mushroom by Quantities from 2016-2021 November**

Figure 8.3 illustrates total export and import quantities of mushroom during the period from 2016 to November 2021, considering mushroom as an individual commodity. Until 2019 export quantities of mushroom have significantly increased and during the year 2020, mushroom exports have drastically decreased and this is mainly due to the adverse impact of the Covid-19 pandemic to world trade activities. Mushroom imports have also significantly decreased in 2020 due to the pandemic situation. Main imports included button mushrooms, other mushroom varieties and related value added products. Hence, there is a growing demand for mushroom value added products within Sri Lanka. Demand mainly derived from the food and beverage sector in Sri Lanka.

However, button mushroom production in Sri Lanka is carried out by only two large-scale companies (Ambewela Button Mushroom, Sri Lanka and Nature Harvest Mushroom Lanka (Pvt) Ltd.). The reason for this is that button mushroom production must be done in air-conditioned houses and the necessary seeds are not produced in Sri Lanka. When asked by the Sri Lanka Export Development Board about the potential for mushroom export in the world market, one of the additional directors in the EDB said that it is difficult to compete with large-scale growers such as China, Japan, and America with the existing technology for mushrooms. She stated that the reason for that is that the air conditioning conditions required for the production of button mushroom, which is the main type of mushroom in the world market, and the seeds

required for it are not produced in Sri Lanka. She also mentioned that button mushrooms are currently produced in Sri Lanka only by the above two institutions. However, according to Mr. Palitha Rajapaksa, Deputy Director of Regional Agricultural Research and Development Centre-Makandura, Sri Lanka's economy can be greatly strengthened through mushrooms if there is a right public-private relationship. The research team related to the study also understands well that this fact is true. Apart from edible mushroom varieties, Mr. Rajapaksa revealed the facts about a mushroom variety called 'Ganoderma (*Ganoderma lucidum*)', which is used for medicine (they appear to increase bodily resistance against the growth of tumors, induce the production of interferon, enhance the immunity function, and kill tumor cells within the body) and cosmetic purposes (Jong and Birmingham, 1992). Actually, this is a type of mushroom that most of us know. It's nothing else, it's the kind of mushroom that we often find on old logs with brown colour. However, allowing this to be slightly modified, the respective mushroom variety can be used to make export products. However, the necessary contribution for this must be received through the intervention of the state.



Source: Authors' Own Compilation based on Department of Customs Data, 2021

**Figure 8.4: Import & Export Values of Mushroom from 2016-2021 November**

Figure 8.4 illustrates total export and import values of mushroom during the period from 2016 to November 2021, considering mushroom as an individual commodity. From 2016 to 2019 export earnings have significantly increased. However, after 2019 there was a sudden decrease in export earnings.

From 2016 to 2021, Maldives was the largest importer of Sri Lanka mushrooms while France was the second best export destination for mushrooms in both 2016 and 2017. It is important to understand that, Sri Lanka has exported mushrooms in bulk

quantities to Asian, European and Middle Eastern countries and hence, had a stable market demand from those three regions. In addition, Sri Lanka had exported to other regions such as Oceanic countries (Australia and New Zealand) and to the North American region as well. See Annexure 08 for the mushroom export quantities and values by export destinations.

Focusing on neighboring India, they have first exported mushrooms in 1991 and it was around 790 kg. However, by 2001-02 it had increased to 11.8 million kg. Also, in 2008-09, 15.1 million kg of processed mushrooms and 0.06 million kg of fresh mushrooms has been exported. The global recession had an impact on both prices and export volume. The fact that the bulk of the export was being done to the US further aggravated the problem. The export of processed mushrooms in 2009–10 dropped to 9.3 million kg. However, export of fresh mushrooms increased from 0.06 to 0.39 million kg in 2009–10 due to an increase in demand from countries like Israel and Nepal (Singh et al., 2011).

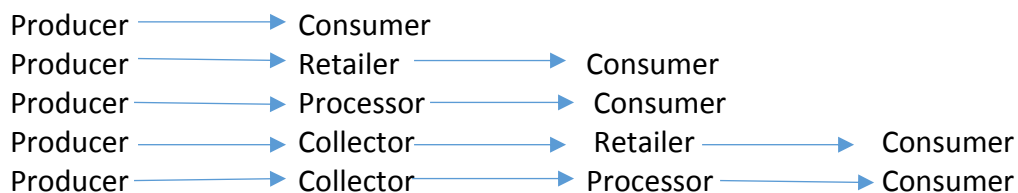
### **8.3 Mushroom Marketing**

Compared to other crops, mushroom cultivation is an industry that can be sustained at only a basic cost. This is because there is no need for inorganic agro-chemicals for its survival. It is enough to maintain cleanliness and order from the beginning to the end of the cultivation. Mushrooms are a good food substitute for vegetarians, not only nutritious but also beneficial and have preventive properties. It is unfortunate that such a valuable industry is suffering today. It is a problem that the authorities are not paying significant attention to an industry that can go beyond the fresh mushroom market. The time has come for everyone to pay attention to the mushroom industry, which is maintained by a group of innocent people amidst difficulties.

At present, due to the severe economic inflation in the country, compared to the increase in the prices of other food items, the market demand has increased rapidly due to the decrease in the amount that consumers have to spend on mushrooms. Also, due to the unique cancer-killing properties of mushrooms and the fact that this is an ideal alternative for vegetarians, there is a high demand for mushroom consumption day by day.

Mushroom cultivation is also important as a direct and indirect source of employment. Because with the advancement of technology, besides supplying mushroom packets and bulk to the market, various multiple jobs have emerged in connection with it. In particular, some mushroom growers still do not produce mushroom grow bags by themselves and buy them from the manufacturers of mushroom grow bags and carry out cultivation. Because of this, an indirect job related to the sale of mushroom grow bags has also emerged. In addition to this, employment opportunities have also been created for the production of machines for the production of mushroom grow bags as well as boilers for boiling the grow bags. Results represent that 91% of mushroom growers sell mushrooms in packets while 2% sell mushrooms in bulk. As well, 7% had gotten used to selling either way.

Mushroom producers in the study area sold their harvest for consumers directly, retailers, hotels, collectors and super markets. Mushroom producers use many transport methods to take the harvest to their customers. Majority of the producers (67.5%) sold their harvest for consumers through intermediaries/collectors who come and collect their harvest in the village. Also, 28.0% of producers had used their own vehicle for the transport of the mushroom from the farm to the consumer within six kilometers from the mushroom house. The remained portion of the mushroom farmers transported the mushroom harvest by public transport or on foot. This is because some of the small scale mushroom farmers tend to door to door selling for the daily harvested mushroom when supplying directly to the consumer. When considering the governance of the mushroom value chain in the study area, it was understood that the decision-making power of the price is with the intermediaries/collectors most of the time. There were five main marketing channels that were identified during the study. Value addition varied significantly in each different channel.



With regard to grading and value addition of the mushroom products, results show that only 41% of farmers grade their products, and 61% pack the mushrooms as a means of value addition. Also, there is a huge demand for mushroom cutlets, mushroom soup, mushroom moju, mushroom pickles as value added products in Sri Lanka. Under the concept of Hela Bojun, good market opportunities have been created for the sale of these products and the domestic and foreign demand for this is not decreasing. Therefore, as a very good self-employment concept that can be done from home, mushroom cultivation is very important, as a main occupation as well as a secondary occupation, the mushroom industry can make a unique contribution to the country's economy.

Also, through the 'Prosperity Village' programme introduced by the previous government, an effort has been made to give some value to the mushroom industry and popularize it, and it is a matter that should be appreciated. The value of this is shared with the researchers by the mushroom growers of 'Gini Damana' village in Ratnapura district and 'Oloboduwa' village in Kalutara district. The main thing revealed in the analysis of the facts of this project implemented by the government in relation to the research is that although this concept and project is really helping to develop the mushroom industry in Sri Lanka if it was done in a more organized way, the desired results could have been obtained than the results that are being obtained now. Here, an amount of Rs. 100,000/= was given to one grower through that programme for the development of mushroom cultivation. However, it was revealed that several people who have no basic knowledge about mushrooms without any

training have received the same benefits. Due to this, such people have been away from mushroom cultivation for some time.

In mushroom cultivation, the preparation of the growing medium as well as the filling is often done using human labour and it takes a lot of effort. As a solution to that, some of the growers related to the study were using the mushroom bag preparation machines introduced by Mr. Janaka (Janaka Welders) in Balangoda Kalthota area in 2018. Here, it was also seen in some areas that one of the grow bag preparing machine was bought by the mushroom growers in a mushroom cultivation society and used in common. This involves mixing and filling the mushroom growing medium and it was reported that a single person can make about four mushroom grow bags per minute. If the mushroom cultivation bags are filled by hand, a single person can fill up to 200 cultivation bags in one day, but with this, at least 600 grow bags can be filled very easily.

According to the amount of media that this machine can fill at a time, two machines with two capacities of 25 kg and 50 kg have been produced by this company and their selling price was Rs. 245,000/= and Rs. 285,000/= respectively by the end of December 2021. Also, until recently, there was no other way to sterilize the mushroom grow bags except to burn the mushroom grow bags by putting them in barrels, and the use of boilers produced by this institution as a solution for this was also seen in the sample related to the study. Although the maximum number of grow bags that can be boiled in a barrel is about 64-66, a boiler introduced by this institution can boil 275 mushroom grow bags at a time. The price of this boiler at that time was around Rs. 210,000/=. When the researchers visited their factory, one of the things they said was that they had to increase the price of the products due to the daily increase in the price of the raw material.

Here this institution has been selected for setting up mushroom processing machines and boilers under 50% contribution to mushroom growers through the 'Prosperity Village' programme introduced by the previous government. Thus, by now they have produced more than 500 machines. Also, 15 young workers were working in that company at that time and they said that due to the demand for these machines in mushroom cultivation, they got a job with a very good salary. Here, Mr. Janaka, who gave further information, pointed out that his business was born because of mushrooms, and that there is a need for awareness about what other products should be made in his field in the mushroom industry. It was also pointed out that due to the increase in the price of raw materials if the government could support the procurement of raw materials, it would lead to the future success of the mushroom industry.

#### **8.4 Mushroom Societies**

Among the mushroom growers in Sri Lanka, Ratnapura and Kegalle can be identified as areas where a high number of growers can be identified. Mushroom cultivation societies can be called as a unique observation seen in these areas and many people

are associated with these societies. The research team was able to visit and get ideas from actively functioning mushroom societies in Ginidamana, Eheliyagoda and Kuruwita in Ratnapura district and Dibbedda in Kalutara district and Pitiyagama and Hewadiwela in Kegalle district. Although Mushroom Society is a combination of public and private sectors, the private sector is more active with more ownership and power. It is notable that the private sector is adopting low-cost, profit-oriented business and strategic methods and is presenting itself as a service provider to meet the needs of the growers. It is special that they provide training services to mushroom growers and provide raw materials for basic needs as well as providing technical support. It was seen that they provided the basic needs such as seeds, nets, sealers as well as boilers needed to sterilize the mushroom grow bags.

It was also revealed that with the intervention of private institutions, money (from one lakh rupees to one hundred and eighty thousand rupees) is given to the growers by banks or through various financial institutions for the creation of cultivation houses. It was also suggested that although the amount of loan given is sufficient to buy the basic factors needed to set up the house, it is not enough to complete the grow house. Here, often the growers give their harvest to the institution that gave the loan through the society and the amount paid for the harvest is credited to the bank account that gave the loan to the growers. Then, after collecting the loan installment related to each month, the remaining amount will be received by the growers. The price for mushroom transactions conducted through the institution is decided by the concerned institution. It should also be mentioned here that there were some weaknesses as well as misdeeds. It was reported that some of the farmers get 5-6 years of cultivation, but the price they get for a packet of 200 grams of mushrooms is Rs. 45-50. It was also revealed that according to the agreement made by the growers with the institution that provided the loan, the mushroom should be sold at the amount determined by them until the loan is completed. Anyhow, statistics show that around 89% of mushroom cultivators find cultivation cost from personal funds while the rest borrow cultivation costs from mushroom societies, relatives or friends.

The People's Livelihood Development Foundation (PLDF) is a voluntary organization that carries out several activities with mushroom growing associations in the region, especially to increase the livelihood of farmers in several ways. PLDF is spearheading a project to develop the livelihoods of 350 mushroom farmers in seven mushroom associations in the region. Some of them are already engaged in mushroom cultivation and some are willing to start them. All the members of these societies are unemployed youth and women. Based on this information, the members are classified into three categories as new entrants (beginners), existing farmers in need of technical know-how and existing farmers in need of extension. Therefore, this project focuses mostly on these three groups. However, the proposed development activities are relevant and beneficial to these farming groups and the introduction of spawn laboratory and processing unit are creating new employment opportunities for youth and women and a new market avenue for the mushroom farming community. Lack of good technical guidance for mushroom production, lack of proper farm houses, lack of quality spawns, poor market channel and high post-harvest losses due to lack of value

addition products can be outlined as some of the critical issues observed by the project.

In relation to this study, "SAEMAUL" Pitiyagama Co-operative Society can be called as another unique organization that provides support to the mushroom growers identified in the field study conducted in Kegalle district. The aim of this mushroom society is to "give your hands a chance to own your own self-employment by maintaining a successful cultivation". The products offered through this society are presented under the name "SAEMAUL Kegalu Mushroom" and their products include American Oyster, Bhutan Oyster, Abalone Mushroom. Apart from that, dried mushrooms are also produced. This mushroom project is a joint project of South Korea's SAEMAUL Globalization Foundation and Sabaragamuwa Provincial Council of Sri Lanka, and a part of the income will be allocated to improve the living conditions of the poor people. At present, about 28 members of this society are members and they work voluntarily. They own the only manufacturing plant in Sri Lanka where the production is carried out by machinery with a fully equipped mushroom processing house under South Korean modern technology and guidance. Mushroom products produced under the supervision and guidance of this society are available in supermarkets and general stores.

#### **8.5 Mushroom Growers who Won Their Lives through Mushrooming**

Mrs. Mallika, who was met in Morontuduwa area of Kalutara district, can be called a courageous woman who has succeeded in life as mushroom cultivation and said that the main occupation of her family is mushroom cultivation. For the past 15 years, she has been engaged in mushroom cultivation and she and her husband, who have received basic training on mushrooms from the Horana Kananwila Farmers Training Center through an agricultural instructor in Morontuduwa area, then went to Gannoruwa, Department of Agriculture and learned how to set up a formal mushroom grow house according to that model. A mushroom house has been set up. She says that disease-free cultivation can be maintained by setting up a standard mushroom grow house as well as disposing of the things removed from the mushroom grow house in a safe manner. In the beginning, some of the mushroom growers who were there at that time did not give them the opportunity to observe how to set up a mushroom farm, but she did not give up her efforts and went to a faraway area and overcame those challenges with great joy. Also, she added that because of the job that can be done from home and the mental happiness that comes from it is very high. Also, she emphasized that there should be a proper training prior to starting the cultivation, a good understanding of the external market, a plan should be kept for the continuous supply of mushrooms to the market, and a good relationship should be maintained with other entrepreneurs in the field. These characteristics reflect that she is a very good entrepreneur. Taking advantage of it, she has won many victories in entrepreneurial competitions in Kalutara district. She further said that if she does what she is doing with sincerity and dedication and if she can keep moving forward in the face of setbacks then she can be successful and at present she and her husband earn a monthly profit of over Rs. 100,000/= per month.

Among the characters met here, Mrs. Indrani Silva who grows mushrooms belonging to the Kuruwita Divisional Secretariat in Ratnapura district has resorted to mushroom cultivation because the income from her small piece of tea was not enough to meet the expenses of the children and the household. Here, she first became a member of a local mushroom association. Here, she first became a member of a local mushroom association. Then she cultivated American oysters and Abalone and the necessary seeds/spawn were obtained through the intervention of the chairman of the Mushroom Cultivation Society. However, on one occasion, among the packets of American oyster and Abalone mushroom seeds that the chairman brought and distributed, there was a packet of Bhutan oyster seeds that had been hand-grown and the result was unique, so she was inspired to grow it. As a result, the yield obtained from it is economically profitable, so she has continued to grow Bhutan oysters. Also, it should be mentioned here that she had prepared mushroom 'moju' from the first workshop conducted by the 'Vidatha Resources Center' in the area on the by-product of mushroom production and shared it among the surrounding households. Also, together with other colleagues of the Mushroom Cultivation Society, they have planned to start a ready-to-eat shop with mushroom by-products (mushroom moju, soup, chips, etc.).

As well, Mrs. Inoka Dilrukshi is another successful entrepreneur who met researchers in Kahathuduwa. Although she started mushroom farming one year ago with 1,000 grow bags of mushroom, she now she possesses 10,000 grow bags with different mushroom varieties. Not only that, now she is earning around Rs. 150,000/= profit per month. Also, Mr. & Mrs. Jayasiri who reside in Dibbedda in Kalutara district have also succeeded in their life through mushrooming. According to them, every asset they have earned has been obtained through mushroom farming. An important message by all these entrepreneurs was that to be successful, training in mushroom farming is essential furthermore there is a need to devote time and have a love for farming.

Also, a person living in Malambe area of Colombo district whose main occupation is an accountant also produces and distributes mushroom moju, mushroom slices and mushroom sandwiches with the help of mushrooms. He also said that he is currently supplying the same products to his brother's restaurant and hopes to open his own mushroom shop in Battaramulla in the future. He is very happy to say that this industry, which is run as a family business, is more profitable than packing and selling mushrooms. He further said that there is a group of consumers who love mushroom products around his area and that he hopes to buy a production machine for the production of mushroom sausages in the future. However, since its price is quite high, he was of the opinion that it is more important if some easy system is prepared for making value added products as well as buying other machines related to mushroom cultivation.

## **8.6 Constraints Faced by Mushroom Farmers**

When considering the constraints in mushroom industry, most of the farmers responded that it is having problem related to pests and diseases problems. The



analysis of the facts of the study revealed that the main reason for falling victim to various types of diseases is the mushroom cultivation without standard cropping house and absence of proper training about the mushroom cultivation. Here, because of absence of proper training about the mushroom cultivation has caused to the backwardness of the mushroom industry. When there is little understanding, the control of insects and pests that occur in the cultivation is lost from the producer, so they are discouraged and are motivated to abandon the mushroom industry. This clearly shows that even though government institutions like the Department of Agriculture, Vidatha Resources Center, Ratmalana Mushroom Development and Training Centre as well as the private sector have made some intervention regarding mushroom cultivation, it has not been enough to solve many problems of mushroom cultivation.

Here, majority of farmers mentioned that there isn't suitable market for getting enough profit and intermediaries earn high profit. Also, a significant number of growers said that it is questionable that no good quality wood powder and no alternative especially for rubber wood powder for mushrooms. Also, many growers are unhappy that the inputs of the mushroom cultivation are expensive. As the basic cost to be made increases gradually, the growers naturally become frustrated. Because if an industry is sustained by only bearing the basic costs, it is only the mushroom itself. Mushrooms are a nutritious food that can be produced naturally without inorganic agro-chemicals. But if this happens day by day, it will be a problem to meet the country's consumption needs. See Table 8.1 for identifying the further constrains in the mushroom industry.

**Table 8.1: Constraints Faced by Mushroom Farmers**

| Constraints  | Responses |                  |
|--|-----------|------------------|
|  | N         | Percent of Cases |
| Having problems related to pests and diseases problems   | 207       | 86.6%            |
| Improper cropping houses   | 148       | 61.9%            |
| Absence of proper training about the mushroom cultivation  | 145       | 60.7%            |
| There isn't suitable market for getting enough profit and intermediaries earn high profit                                    | 116       | 48.5%            |
| Inputs (polythene, seeds, wood powder, soya powder, rice powder and etc.) and machines related to the industry are expensive | 115       | 48.1%            |
| Having problem related to find good quality wood powder/No alternative especially for rubber wood powder                     | 84        | 35.1%            |
| No responsible party is present to monitor their cultivation   | 62        | 25.9%            |
| Difficulty in obtaining high quality seeds   | 57        | 23.8%            |
| Poor knowledge of value added products   | 42        | 17.6%            |
| Difficult to supply products to the market due to prevailed covid-19 pandemic  | 24        | 10.0%            |
| It is difficult to boil pots using a boiler because due to high fuel (gas and wood) prices                                   | 28        | 11.7%            |
| Yield of mushroom harvest is insufficient to sustain a by-product  | 21        | 8.8%             |
| Mushroom industry does not receive the financial support provided to other self-employment sectors                           | 18        | 7.5%             |
| No constraints   | 8         | 3.3%             |

Source: Authors' Own Compilation (2021)

Additionally, as mentioned previously many farmers grow the white mushroom called American Oyster and Abalone. According to the producers, the main reason for this has happened due to consumer choice. Producers further mentioned that consumers are still misconceptions about other mushroom varieties and therefore many consumers do not like a variety of mushrooms with a colour that deviates from the norm. Because of this, the growers have also been nervous to switch to another variety.

### 8.7 Farmers' Suggestions to Overcome the Constraints in Mushroom Industry

There are various suggestions from farmers' end to overcome the constraints which are faced by them. According to the statistics 73.6% of farmers suggest that they need of a financial help to build a proper mushroom grow house. As well 53.1% of them proposed some awareness programmes to overcome the pests and diseases problems

while 48.5% showed that they need a reasonable farm-gate price for mushrooms. And, 48.1% of respondents suggested that there should be a room to obtain inputs (polypropylene, seeds, wood powder, soya powder, rice bran etc.) and machines related to the industry at concessionary prices. See Table 8.2 for further suggestions from their end.

**Table 8.2: Suggestions from Farmers' End to Overcome the Issues in Mushroom Industry**

| Suggestions   | Responses |                  |
|---|-----------|------------------|
|   | N         | Percent of Cases |
| Need a financial help to build a proper mushroom grow house   | 176       | 73.6%            |
| Need some awareness programmes to overcome the pests and diseases problems  | 127       | 53.1%            |
| A reasonable farm-gate price for mushrooms is needed (at least Rs. 70/= per 200 g packet of mushroom)   | 116       | 48.5%            |
| Need to obtain inputs (polypropylene, seeds, wood powder, soya powder, rice bran and etc.) and machines related to the industry at concessionary prices | 115       | 48.1%            |
| Need a wood crushing machine to have good quality wood powder   | 84        | 35.1%            |
| Need some trainings on how to produce the mushroom seeds  | 44        | 18.4%            |
| Need some trainings on how to produce mushroom value-added products   | 42        | 17.6%            |
| Need some trainings on new technology of mushrooms  | 32        | 13.4%            |
| Need some concessions to have pot making machines, boilers, sausages preparation machines on 50% contribution   | 30        | 12.6%            |

Source: Authors' Own Compilation (2021)

## 8.8 SWOT Analysis for the Industry

Mushrooms could be possibly identified as a cultivation that results in multiple outputs and utensils. However, mushroom cultivation and industry in Sri Lanka is still at a primitive stage. There are immense opportunities for mushroom cultivators in both local and international markets. Hence, proper identification of strengths, weaknesses, opportunities and threats are vital for industrial sustainability. Table 8.3 represents the SWOT analysis for the mushroom industry in Sri Lanka.

**Table 8.3: SWOT Analysis for the Mushroom Industry in Sri Lanka**

| <b>Strengths</b>   | <b>Weaknesses</b>  |
|--|--|
| <ul style="list-style-type: none"> <li>● Less capital requirement for the cultivation</li> <li>● Abundant rural labour force</li> <li>● Mix array and abundant quantities of raw materials for the industry</li> <li>● Less land and space requirement</li> <li>● Engagement of younger generation in the cultivation and marketing process of mushroom</li> <li>● Evidence of popularized social-media groups and network in the country</li> <li>● Producers with high intention to gather new information related to the cultivation</li> </ul> | <ul style="list-style-type: none"> <li>● Information asymmetry among producers and between producers and buyers</li> <li>● Inadequacy of proper extension service related to mushroom cultivation and value addition process</li> <li>● No proper mechanism to link producers and buyers in the country</li> <li>● Difficulties in conformance with standards and quality of mushroom</li> <li>● Less access to advanced production methods and machineries</li> <li>● Lack of technical knowledge for spawn production</li> <li>● Limited range of mushroom varieties used in the cultivation</li> <li>● Low entrepreneurial skills among producers</li> <li>● Lack of capital (Savings)</li> <li>● Limited access to credit</li> <li>● Risk averse and laggards of adopting novel ways of practices</li> <li>● Producers don't have enough idea regarding the total demand and supply of the local mushroom industry</li> <li>● Decision-making power of the price is with the intermediaries/collectors most of the time</li> </ul> |
| <b>Opportunities</b>   | <b>Threats</b>   |
| <ul style="list-style-type: none"> <li>● Tool to uplift livelihood of all categories in a society</li> <li>● Expected yield from the cultivation is satisfactory</li> <li>● Possible value creation opportunities in the industry like (Frozen, canned, dried, soup powder, pickles, chips, paste, ketchup, noodles, pasta, biscuits, nuggets, mushroom</li> </ul>   | <ul style="list-style-type: none"> <li>● Changing nature of policies related to international trade and economics</li> <li>● Low quality and illegal spawn production</li> <li>● Growing intra and inter-regional development disparities</li> </ul>   |

- based flour and additives in beverages, medical and cosmetic products, energy boosts etc.)
- Window of opportunities available in both local and international markets for value added products
  - An industry that can be sustained at only a basic cost
  - Increasing trend in demand for fresh and processed products
  - Direct and indirect source of employment
  - Prevalence of alternatives and substitutes for mushrooms such as tofu, Zucchini, caramelized onions etc.
  - High cost of input materials
  - Pest and disease attacks
  - Low availability of good quality substrates, rice bran and no alternative for wood powder especially for rubber wood powder
  - Global competitors

Source: Authors' Own Compilation (2021)

## **8.9 Chapter Summary**

This chapter explained the current and emerging agribusiness opportunities with possible strengths, weaknesses, opportunities and threats in the industry and next chapter will illustrate the conclusion and recommendation of the study.



## CHAPTER NINE

### Conclusion and Recommendation

#### 9.1 Conclusion

From the findings, it can be envisaged that the mushroom industry is an ideal agribusiness venture which empowered people's livelihood. Compared to other crops, mushroom cultivation is an industry that can be sustained at only a basic cost. This is because there is no need for inorganic agrochemicals for their survival. It is enough to maintain cleanliness and order from the beginning to the end of the cultivation. At present, due to severe economic inflation persisting in the country, the market demand has increased rapidly due to the decrease in the money amount that consumers have to spend on mushrooms. Mushroom cultivation is also important as a direct and indirect source of employment.

Notably, the majority of mushroom producers were females (57.4%) and 51.2% of them were 31 years to 45 years. This shows that mushroom cultivation is popular among the younger women generation. Anyhow, the majority of farmers (73.4%) of the sample demonstrated a low level of entrepreneurial behaviour.

Interestingly, farmers who are in high entrepreneurial behaviour produce a significant amount of mushroom production (2,600 kg) per year over the farmers who are in low entrepreneurial behaviour (1,840 kg) at 95% confidence interval. Further, the net income/profit (LKR) obtained from 1,000 grow bags of mushroom per cycle for the farmers who are low in entrepreneurial behaviour is Rs. 39,040.00 while it is Rs. 57,000.00 for the farmers who demonstrate high entrepreneurial behaviour. Also, there is a huge demand for mushroom cutlets, mushroom soup, mushroom moju, mushroom pickles as value added products in Sri Lanka. Under the concept of Hela Bojun, good market opportunities have been created for the sale of these products and the domestic and foreign demand for this is not decreasing. Therefore, as a very good self-employment concept that can be done from home, mushroom cultivation is very important, as a main occupation as well as the secondary occupation.

In most cases, some of the critical practices such as selection of growing media, purchasing of quality spawn, and maintenance of hygiene within the growth house were neglected by the producers and this adversely has an impact on the quality and the quantity of the final output. Farmers were not updated regarding those practices and had limited access to such information. Also, most of the farmers responded that it has problems related to pests and diseases problems. The analysis of the facts of the study revealed that the main reason for falling victim to various types of diseases is mushroom cultivation without a standard cropping house and the absence of proper training about mushroom cultivation. When there is little understanding about the cultivation and the inability to bear the initial cost for the cultivation, the control of

insects and pests that occur during the cultivation is lost from the producer, so they are discouraged and are motivated to abandon the mushroom industry.

Referring to the achievement motivation, these farmers considered mushroom cultivation as a secondary occupation or an alternative income source. Simultaneously, respondents spent much less time on cultivation compared to primary agricultural and non-agricultural activities. However, the expected yield from the cultivation was satisfactory according to respondents compared to the time they allocated for the cultivation.

Another aspect revealed in the study was that the majority of producers were not willing to take any form of risk (economic, social and cultural) and could be considered as risk averse and laggards of adopting novel ways of practices and in the process of value addition. Only a few farmers who had attempted were willing to try entirely different mushroom varieties. Hence, the value addition process was at a very lower level among these farming communities.

The study was able to find that most of the time informal credit sources were used and invested for the cultivation. Notably, in formal credit lines microfinance played the dominant role. Farmers less frequently gathered industry updates and were mostly confined to community-level knowledge. In the meantime, some of the respondents were identified as leading farmers who are rich in every component of the EBI related to mushroom cultivation during the interview process. However, there was no proper official mechanism to recognize and disseminate their knowledge among other communities. Occasionally, respondents have participated in different types of seminars, workshops and exhibitions related to agriculture and not specifically related to mushroom cultivation. However, respondents had an intention to gather new information related to cultivation. Fifty-six percent of the respondents participated in training programmes related to mushroom cultivation before starting the cultivation. Accordingly, the majority of trained farmers (around 99%) were satisfied with the content of the training. The main limitation of those programmes was a lack of knowledge sharing on value addition techniques. More than half of the mushroom producers requested to conduct programmes related to value addition processes and marketing aspects in the industry to operate it as a viable business venture. Also, the respondents have no idea about the total demand and supply of the local mushroom industry and the study identified that there were no official databases to extract such information for the general public. This limits the entrepreneurial capacities of new entrants in the industry.

Here, the majority of farmers mentioned that there is not a suitable market for getting enough profit and intermediaries earn high profits. Also, a significant number of growers said that it is questionable that no good quality wood powder and no alternative, especially for rubber wood powder for mushrooms. Also, many growers are unhappy that the inputs for mushroom cultivation are expensive. As the basic cost to be made increases gradually, the growers naturally become frustrated. Because if an industry is sustained by only bearing the basic costs, it is only the mushroom itself.



Mushrooms are nutritious food that can be produced naturally without inorganic agrochemicals. But if the prices of the inputs are increased day by day, it will be a problem to meet the country's mushroom consumption needs.

Additionally, the majority of farmers (96.2%) farmed American oysters followed by Abalone (34.3%). According to the producers, the main reason for this has happened due to consumer choice. Producers further mentioned that consumers are still misconceptions about other mushroom varieties and therefore many consumers do not like a variety of mushrooms with a colour that deviates from the norm. Because of this, the growers have also been nervous to switch to another variety.

Further, a proper linkage was not established between all actors (producer, retailer, collector, processor and consumer) in many cases. Private entities somehow play a dominant role to build networks among producers and sellers. However, government bodies have not yet made a significant presence in the industry.

All the data of the study elaborated that the farmers who had acquired standard awareness programmes before running the business showed higher entrepreneurial behaviour. Further, the study revealed that obtaining proper training before starting the cultivation, promoting infrastructure development, increasing technical and technological cooperation, building cooperative growth through private sector integration, a good understanding of the external market, and a good relationship should be maintained with other entrepreneurs in the field and promoting innovation directly cause for increasing entrepreneurial behaviour of mushroom farmers and thereby strengthen the national economy.

## **9.2 Recommendations**

According to the facts recorded throughout the study, it is clear that the mushroom industry is an ideal agricultural business that exists to empower the livelihood of the Sri Lankan people. Compared to other crops, mushroom cultivation is very profitable and does not require inorganic agrochemicals. Also, due to the severe economic inflation currently prevailing in the country, the market demand for mushrooms has increased rapidly due to the decrease in the amount of money consumers have to spend on mushrooms compared to the increase in the prices of other food items. Also, being a very good source of protein, it contributes to food security.

However, due to lack of proper supervision over a valuable industry, many different problems have been created. Many of the problems thus created have their origins in the less entrepreneurial behaviour of mushroom producers. Therefore, the intervention of the public sector is the need of the hour as it can open the door to solving many problems by improving entrepreneurship. At present, although some programmes have been launched for mushroom cultivation with the intervention of the government as well as private and NGO sectors, it has not been enough to solve many problems of mushroom cultivation. In this case, programmes that includes main entrepreneurial components (planning ability, embracing risk, leadership or

management ability, cosmo-politeness, knowledge of farming and allied activities, ability to implement decisions, farm innovativeness, achievement orientations, and market orientation) should be prepared for the development of entrepreneurship of mushroom producers.

Other problems encountered in the mushroom industry include the high cost of inputs (polypropylene, spawns/seeds, wood powder, soy powder, rice bran powder, etc.), lack of money to build a proper grow house and purchase other machinery (mushroom grow bags/pots making machines, boilers, dryers, and other processing machines used for processing value-added products), high fuel (gas and wood) prices, problems in finding good quality wood powder, scarcity of crushing machines for obtaining good quality wood powder, difficulty in obtaining high-quality spawns/seeds, lack of suitable market to generate adequate income, high profit making by middlemen, poor control of diseases and pests, lack of knowledge sharing on value addition techniques, prevailing poor knowledge about total demand and supply of the local mushroom industry, poor linkage between all actors (producer, retailer, collector, processor and consumer) in many cases, poor knowledge of mushroom seed production, and insufficient knowledge on technology, etc. are dominant. Among them except the constraints which are based on money, other issues can be mitigated through the proper training of the farmers while all constraints can be solved by the proper intervention by the government.

Therefore, the government should act mainly as mentioned above to address the problems in mushroom cultivation and for this purpose, the government should create a public-private-partnership prospect for the industry by taking the contribution of the private sector by making a formal follow-up. Initially, setting up an official database that includes all stakeholders (producer, retailer, collector, processor, and consumer) currently involved in the mushroom industry is paramount. Some of the information of some of the stakeholders involved in the mushroom industry is already at the local level, but the lack of a national-level database that includes all information is a barrier to solving many problems in mushroom cultivation. A database that is well-maintained will facilitate information on the demand and the supply, the problems that exist for each stakeholder in the industry, what needs to be done to solve those problems, and the existing opportunities in the local and foreign markets of the mushroom industry, what training programmes are required for each stakeholder. For example, when a project related to mushrooms is carried out, it can be carried out as a government initiative and the area and stakeholders can also be determined accordingly.

At the same time, a virtual platform and physical platforms made up of all the actors (producer, retailer, collector, processor, and consumer) in the mushroom value chain, mushroom cultivation societies, private and non-governmental organizations related to the mushroom industry, and government officials dealing with them should be set up with the intervention of the government. Here a YouTube channel and a web page should be set up. This platform can be formalized as a Hub for the mushroom industry in Sri Lanka to share anything on the mushroom. Also, stakeholders perceive assurance because there is government authority. Moreover, physical platforms also

should be formed at local levels. Then, the database created at the national level should be continuously maintained by integrating all the groups thus created locally. Then the government can mediate to solve every query in the mushroom industry and strengthen the national economy and food security through the mushroom. Below explain how some issues are solved with the aid of both virtual and physical platforms.

- i. Considering the challenges posed by the prevalently low entrepreneurial behaviour of farmers, there is need for the implementation of comprehensive entrepreneurship development programmes among the smallholder farmers. Such programmes, apart from concentrating on entrepreneurial awareness, training and credit reach to farmers must also concentrate upon bringing the new technology within the reach of farmers and acquaint them with the new avenues of entrepreneurship.
- ii. Furthermore, the available extension personnel are always trained in basic agricultural practices with the component of entrepreneurship almost non-existent in their curriculum. In this regard the government needs to come up with an intensive farm entrepreneurship programme. For the success of such a programme the first point of call should be on equipping the extension officers with sufficient training on entrepreneurship thus orientating farmers into becoming successful entrepreneurs.
- iii. Considering the effect of high illiteracy levels on the farmers' basic entrepreneurial skills such as record keeping and production planning, the need for an intensified adult literacy programme on mushroom cultivation programmes must also be taken into consideration. If the improvement of farmer literacy levels is timeous then agricultural training can be conducted using low –literacy farmer training methods.
- iv. As already highlighted, most of the farmers had low innovativeness. It means, still there is a need to expose the farmers to recent developments in agricultural technologies and motivate them to adopt the new technologies by organizing group discussions, meetings, study tours and incursions. Another way of promoting farmer innovativeness is by making them join commodity associations where they will receive regular technical and specialized agricultural support services.
- v. Promoting farmer diversification into agro processing ventures as a way of adding value to farm products. This can also be reinforced through the formation of partnerships with established agro dealers and retail outlets. This is an effective way to ensure that they work in close collaboration with each other in all areas attributed to the agribusiness chain thus strengthening communication and cooperation between the farmers and these institutions.
- vi. Additionally, the study revealed that some consumers have misconceived other mushroom varieties except American oyster and Abalone. Therefore, consumer awareness also can be done with the aid of virtual platform in order to diversify the industry.

## REFERENCES

- Anthony, O., Ndubuto, N., Ogbonnaya, O. & Etomchi, N., 2014. Analysis of entrepreneurial behaviour among cassava farmers in Ebonyi State, Nigeria. *International Journal of Agricultural Science, Research and Technology in Extension and Education Systems*, 4(2), pp. 69-74.
- Archana, K., 2013. *A study on entrepreneurial behaviour of commercial seed growers of Dharwad District*, Dharwad: University of Agricultural Sciences.
- Attaie, H. & Fourcadet, O., 2003. *Guidelines for value chain analysis in the agri-food sector of transitional and developing economics*, France: ESSEC Business School.
- Baraza, L.D., Joseph, C.C., Moshi, M.J. and Nkunya, M.H.H., 2007. Chemical constituents and biological activity of three Tanzanian wild mushroom species. *Tanzania Journal of Science*, 33.
- Barros, L., Cruz, T., Baptista, P., Estevinho, L.M. and Ferreira, I.C., 2008. Wild and commercial mushrooms as source of nutrients and nutraceuticals. *Food and Chemical Toxicology*, 46(8), pp.2742-2747.
- Beetz, A.E. and Greer, L., 2004. *Mushroom cultivation and marketing*. ATTRA.
- Bhendarkar, M. et al., 2017. An assessment of entrepreneurship behaviour of fisherwomen in the Ratnagiri block of Ratnagiri District, Maharashtra State, India. *Asian Journal of Agricultural Extension, Economics & Sociology*, 17(3), pp. 1-8.
- Burns, N. and Groves, K., 1997. *Practice of nursing research*.
- Charan, J. and Biswas, T., 2013. How to calculate sample size for different study designs in medical research? *Indian journal of psychological medicine*, 35(2), pp.121-126.
- Chaudhari, R. et al., 2007. A scale for measurement of entrepreneurial behaviour of dairy farmers. *Karnataka Journal of Agricultural Science*, 20(4), pp. 792-796.
- Chitsa, G., 2014. *An analysis of entrepreneurial behaviour of smallholder irrigation farmers: Empirical evidence from Qamata irrigation scheme*, Alice, South Africa: University of Fort Hare.
- Chiu, S. and Moore, D., 2001. Threats to biodiversity caused by. *Fungal Conservation: Issues and Solutions*, 14(22), pp.111-119.
- Cho, E.J., Oh, J.Y., Chang, H.Y. and Yun, J.W., 2006. Production of exopolysaccharides by submerged mycelial culture of a mushroom *Tremella fuciformis*. *Journal of Biotechnology*, 127(1), pp.129-140.

- Davis, J. H. & Goldberg, R. A. A., 1957. *Concept of agribusiness*. Boston: Division of Research, Graduate School of Business Administration, Harvard University.
- Dembitsky, V. M., Terent'ev, A. O., & Levitsky, D. O. (2010). Amino and fatty acids of wild edible mushrooms of the genus *Boletus*. *Records of Natural Products*, 4(4), 218–223
- Dias, C.S., Rodrigues, R.G. and Ferreira, J.J., 2019. What's new in the research on agricultural entrepreneurship. *Journal of rural studies*, 65, pp.99-115.
- Faugier, J. and Sargeant, M., 1997. Sampling hard to reach populations. *Journal of advanced nursing*, 26(4), pp.790-797.
- Food and Agriculture Organization of the United Nations, 2020. *FAOSTAT*. [Online] Available at: <http://www.fao.org/faostat/en/#data/QC> [Accessed 10 January 2021].
- Gamage, S. & Ohga, S., 2018. A comparative study of technological impact on mushroom industry in Sri Lanka: A review. *Advances in Microbiology*, 8(8), pp. 665-686.
- Getachew, D., Zemedu, L., & Eshete, A. (2016). Journal of Agricultural Extension and Rural Development Mushroom value chain analysis in Addis Ababa, Ethiopia. *Journal of Agriculture*.
- Gliem, J.A. and Gliem, R.R., 2003. Calculating, interpreting, and reporting Cronbach's alpha reliability coefficient for Likert-type scales. Midwest Research-to-Practice Conference in Adult, Continuing, and Community Education.
- Gnaneswaran, R., & Wijayagunasekera, H. N. P. (1999). Survey and identification of insect pests of oyster mushroom (*Pleurotus ostreatus*) cultures in the Central province of Sri Lanka. *Tropical Agricultural Research and Extension*, 2(1), 21–25.
- Hami, H., 1990. *Cultivation of oyster mushroom on sawdust of different woods* (Doctoral dissertation, M. Sc. Thesis, University of Agriculture, Faisalabad, Pakistan).
- Hisrich, R.D. and Peters, M.P., 1989. *Entrepreneurship: Starting, Developing, And Managing a New Enterprise*, Homewood, IL: BPI, IrwinMcGraw-Hill.
- Jahan, A. & Singh, B., 2019. Mushroom Value Chain and Role of Value Addition. *International Journal of Botany and Research*, 9(1), pp. 5-10.
- Jong, S.C. and Birmingham, J.M., 1992. Medicinal benefits of the mushroom *Ganoderma*. *Advances in applied microbiology*, 37, pp.101-134.
- Joseph, K., Kothandaraman, R. and Mathew, J., 1998. Rubber wood saw dust-an ideal substrate for summer mushroom cultivation

- Kahan, D., 2012. *Entrepreneurship in farming*. Rome: Food and Agriculture Organization
- Karlsson, C., Friis, C. & Paulsson, T., 2004. *Relating entrepreneurship to economic growth*, s.l.: CESIS/JIBS.
- Karunaratna, S., Mortimer, P., Xu, J., & Hyde, K. (2017). Overview of research of mushrooms in Sri Lanka. *Revista Fitotecnia Mexicana*, 40(4), 399–403.
- Manikandan, K., 2011. Nutritional and medicinal values of mushrooms. *Mushrooms cultivation, marketing and consumption*, pp.11-14.
- Market Data Forecast (2020). *Mushroom Cultivation Market*. [Online] Available at: <https://www.marketdataforecast.com/market-reports/mushroom-cultivation-market> [Accessed 15 January 2022].
- McBurney, B.H. and Filoromo, T., 1994. The nightingale pledge: 100 years later. *Nursing Management*, 25(2), p.72.
- Ministry of Agriculture, 2018. *Agriculture Sector Modernization Project*. [Online] Available at: <http://www.agrimin.gov.lk/web/index.php/home-1/12-project/841-agriculture-sector-modernization-project> [Accessed 13 July 2021].
- Ministry of Finance, 2020. *Vistas of prosperity and splendour*. [Online] Available at: [http://www.treasury.gov.lk/national-policy#policy\\_4](http://www.treasury.gov.lk/national-policy#policy_4) [Accessed 12 January 2021].
- Moser, A. & Korstjens, I., 2017. Series: Practical guidance to qualitative research. Part 3: Sampling, data collection and analysis. *European Journal of General Practice*, 24(1), pp. 9-18.
- Mouton, J., 1996. *Understanding social research*. Van Schaik Publishers.
- Naude, W., Szirmai, A. and Goedhuys, M., 2011. Innovation and entrepreneurship in developing countries. UNU.
- No, I., 2010. United States International Trade Commission.
- Nworgu, B.G., 1991. Educational research: Basic issues and methodology. Ibadan. *Wisdom Publishers Ltd. NGO clients TOTAL Number Distributed*, 3(6), p.3.
- O'Connell, A., 2006. *Logistic Regression Model for Ordinal Response Variables*. California: SAGE Publications.
- Rajapakse, J.C., Rubasingha, P. and Dissanayake, N.N., 2007. The effect of six substrates on the growth and yield of American oyster mushrooms based on juncao technology.

- Rajaratnam, S., Bano, Z. and Miles, P.G., 1988. Pleurotus mushrooms. Part IB. Pathology, in vitro and in vivo growth requirements, and world status. *Critical Reviews in Food Science & Nutrition*, 26(3), pp.243-311.
- Rusu, S., Isac, F., Cureteanu, R. & Csorba, L., 2012. Entrepreneurship and entrepreneur: A review of literature concepts. *African Journal of Business Management*, 6(10), pp. 3570-3575.
- Sandika, A. & Kulasinghe, G., 2010. Analysis of entrepreneurial characteristics of vegetable farmers in Matara District. *Sri Lanka Journal of Agrarian Studies*, 14(1 & 2), pp. 83-102.
- Shane, S. & Venkataraman, S., 2000. The promise of entrepreneurship as a field of research. *Academy of Management Review*, 25(1), pp. 217-226.
- Singh, M., Kamal, S. and Wakchaure, G.C., 2011. Earning more through exporting mushrooms. *Indian Horticult*, 56(3), pp.41-43.
- Singh, M., Shwet, K. & Sharma, V., 2017. Status and trends in world mushroom Production-I. *Mushroom Research*, 26(1), pp. 1-20.
- Spreen, M., 1992. Rare populations, hidden populations, and link-tracing designs: what and why. *Bulletin of Sociological Methodology/Bulletin de Methodologie Sociologique*, 36(1), pp.34-58.
- Sri Lanka Council for Agricultural Research Policy, 2017. *National Research Priorities on Socio-economic and Policy Analysis 2017-2021*, Colombo: Sri Lanka Council for Agricultural Research Policy.
- Sri Lanka Export Development Board (2016). Mushroom Products. [Online] Available at: <http://www.srilankabusiness.com/mushroom/index.html> [Accessed 23 July 2021]
- Thilakarathne, S. & Sivashankar, P., 2018. Mushroom value chain analysis in Kegalle District of Sri Lanka. *Amity Journal of Agribusiness*, 3(2), pp. 1-19.
- Thilakarathne, S., Sivashankar, P., Matandare, M.A., Matandare, T.O., Kokerai, L.K., Kugedera, A.T., Chimbwanda, F., Baruah, A., Mohan, G.M., Muzenda, A. and Kugedera, A.T., 2018. Mushroom Value Chain Analysis in Kegalle District of Sri Lanka.
- Thilakarathna, S. & Pathirana, P., 2018. Prospects and challenges of mushroom production in Kuruwita, Sri Lanka: comparative report on two consecutive years. *Journal of Dry Zone Agriculture*, 4(1), pp. 1-7.
- Uher, J., 2016. What is behaviour? And (when) is language behaviour? A meta-theoretical definition. *Journal for the Theory of Social Behaviour*, Volume 46, pp. 475-501.

- Vostrovsky, V. & Jablonska, E., 2007. Mushroom growing with information support as opportunity for the developing countries. *Agricultura Tropica ET Subtropica*, 40(3), pp. 120-125.
- Wakchaure, G.C., 2017. Mushrooms-value added products. *Manjit Singh, Bhaunesh Vijay, Shwet Kamal et al., Mushrooms-cultivation, marketing and consumption, Directorate of Mushroom Research, Solan, Himachal Pradesh-173213, India*, pp.233-238.
- Wankhade, R., Sagane, M. & Mankar, D., 2013. Entrepreneurial behaviour of vegetable growers. *Agricultural Science Digest*, 33(2), pp. 85-91.
- Wanole, S., Bande, K., Holkar, S. & Mardane, R., 2018. Relational analysis of entrepreneurial behaviour of banana growers. *International Journal of Chemical Studies*, 6(3), pp. 2407-2411.
- Wijeratne, M. and De Silva, N., 2014. Mobile phone intervention for Sri Lankan mushroom producers. *Asian Association of Open Universities Journal*, 9(1), pp.57-63.
- Zhang, Y., Geng, W., Shen, Y., Wang, Y. and Dai, Y.C., 2014. Edible mushroom cultivation for food security and rural development in China: bio-innovation, technological dissemination and marketing. *Sustainability*, 6(5), pp.2961-2973.
- Zylbersztajn, D., 2016. *ThinkBoxAgribusiness systems analysis: origin, evolution and research perspectives*, s.l.: Elsevier Editora Ltda.



## ANNEXURES

### Annexure 01: Likert Items Relevant to the Eight Components which Result in the Entrepreneurial Behaviour

#### Descriptive Statistics

|   | N   | Mean | Std. Deviation | Minimum | Maximum |
|---|-----|------|----------------|---------|---------|
| 2.1 I'm trying to cultivate new mushroom varieties more frequently  | 289 | 3.10 | .642           | 2       | 5       |
| 2.2 I always try to keep myself up to date with information on new mushroom production practices                            | 289 | 3.10 | .715           | 2       | 5       |
| 2.3 From time to time I have heard of new mushroom production practices and I have tried out most of them in last few years | 289 | 3.04 | .796           | 1       | 5       |
| 2.4 I'm really cautious about trying new mushroom cultivation practices   | 289 | 3.12 | .692           | 1       | 5       |
| 2.5 I know most of the market information regarding mushroom cultivation in my area   | 289 | 3.15 | .758           | 2       | 5       |
| 2.6 I know information of other mushroom cultivators and producers in my area   | 289 | 3.12 | .814           | 1       | 5       |
| 2.7 Usually I provide mushroom harvest continuously on a stable price for the market  | 289 | 3.06 | .812           | 1       | 5       |
| 2.8 I have enough updated information on mushroom cultivation if I want to do any changes in my cultivation                 | 289 | 3.12 | .730           | 2       | 5       |
| 2.9 I always give priority to my mushroom cultivation compared to other agriculture activities                              | 289 | 3.20 | .804           | 1       | 5       |
| 2.10 I spend more time with my mushroom cultivation compared to other non-agriculture activities                            | 289 | 3.13 | .782           | 2       | 5       |
| 2.11 I'm satisfied with the current level of harvest of my mushroom cultivation   | 289 | 3.13 | .873           | 2       | 5       |

|   |     |      |      |   |   |
|---|-----|------|------|---|---|
| 2.12 I'm willing to expand my mushroom cultivation in the near future and increase the level of harvest                               | 289 | 3.19 | .775 | 2 | 5 |
| 2.13 I know all cost components that I incur and incomes that I earn from my mushroom cultivation                                     | 289 | 3.16 | .776 | 1 | 5 |
| 2.14 I keep all records of costs and incomes of my mushroom cultivation regularly   | 289 | 3.13 | .812 | 1 | 5 |
| 2.15 I purchase and use only recommended and quality inputs for my mushroom cultivation   | 289 | 3.11 | .817 | 2 | 5 |
| 2.16 I believe that I have a satisfactory level of overall understanding about my mushroom cultivation as a growing business venture  | 289 | 3.18 | .782 | 1 | 5 |
| 2.17 I'm willing to adopt an entirely new method of mushroom production in any time if it's profitable                                | 289 | 3.11 | .828 | 1 | 5 |
| 2.18 I'm willing to invest in new and improved production house if it provides me more harvest  | 289 | 3.07 | .866 | 1 | 5 |
| 2.19 I'm willing to purchase and try out entirely new seed variety which was not cultivated before                                    | 289 | 3.03 | .951 | 1 | 5 |
| 2.20 I'm willing to produce value added mushroom products as the next step of my venture using my current mushroom harvest            | 289 | 3.06 | .880 | 1 | 5 |
| 2.21 Before starting each mushroom cultivation cycle, I prepare simple plan to get an idea about required inputs and expected harvest | 289 | 3.11 | .815 | 1 | 5 |
| 2.22 I'm willing to expand my mushroom cultivation and I have a rough idea on how to do it  | 289 | 3.09 | .781 | 1 | 5 |
| 2.23 If I want to expand my mushroom cultivation, I know how to gather capital for that purpose                                       | 289 | 3.09 | .814 | 2 | 5 |

|   |     |      |      |   |   |
|---|-----|------|------|---|---|
| 2.24 I obtain information and knowledge regarding farm management and planning from officers and other people in the industry frequently  | 289 | 3.17 | .805 | 1 | 5 |
| 2.25 I am willing to share my knowledge regarding the mushroom cultivation to those who really want it                                    | 289 | 3.08 | .961 | 1 | 5 |
| 2.26 I get the help of my family members and also assign them various work related to mushroom cultivation                                | 289 | 3.15 | .887 | 1 | 5 |
| 2.27 Most of the farmers in the area who engage in mushroom cultivation used to obtain essential information from me                      | 289 | 3.03 | .877 | 1 | 5 |
| 2.28 I have sufficient knowledge on mushroom cultivation even to train young farmers in my area   | 289 | 3.16 | .770 | 1 | 5 |
| 2.29 I have connected with mushroom farmers in other areas and time to time I get new information from them                               | 289 | 3.06 | .835 | 1 | 5 |
| 2.30 I frequently participate various types of training programmes, workshops and seminars to get new information on mushroom cultivation | 289 | 3.18 | .846 | 1 | 5 |
| 2.31 I have already obtained information about value-added mushroom products from producers and traders                                   | 289 | 3.10 | .802 | 1 | 5 |
| 2.32 I have a reasonable knowledge on overall mushroom cultivation and production trends and behaviours in Sri Lanka                      | 289 | 3.18 | .792 | 1 | 5 |

## Annexure 02: Reliability Analysis for the Component of Entrepreneurial Behaviour

| Component of Entrepreneurial Behaviour | Cronbach's Alpha | N of Items |
|--|------------------|------------|
| Innovativeness                         | .803             | 4          |
| Farm decision making                   | .877             | 4          |
| Achievement motivation                 | .874             | 4          |
| Knowledge of farming enterprise        | .883             | 4          |
| Risk taking ability                    | .841             | 4          |
| Planning ability                       | .845             | 4          |
| Leadership ability                     | .860             | 4          |
| Cosmo-politeness                       | .855             | 4          |

Source: Authors' own compilation (2021)

## Annexure 03: Omnibus Tests of Model Coefficients of Logistic Regression

| Block 1: Method = Forward Stepwise (Likelihood Ratio) |       |            |    |       |
|---|-------|------------|----|-------|
| Omnibus Tests of Model Coefficients                   |       |            |    |       |
|   |       | Chi-square | df | Sig.  |
| Step 1  | Step  | 167.251    | 3  | 0     |
|   | Block | 167.251    | 3  | 0     |
|   | Model | 167.251    | 3  | 0     |
| Step 2  | Step  | 47.968     | 6  | 0     |
|   | Block | 215.22     | 9  | 0     |
|   | Model | 215.22     | 9  | 0     |
| Step 3  | Step  | 8.69       | 1  | 0.003 |
|   | Block | 223.909    | 10 | 0     |
|   | Model | 223.909    | 10 | 0     |

**Annexure 04: Hosmer and Lemeshow Test of Logistic Regression**

| <b>Hosmer and Lemeshow Test</b> |                   |           |             |
|---------------------------------|-------------------|-----------|-------------|
| <b>Step</b>                     | <b>Chi-square</b> | <b>df</b> | <b>Sig.</b> |
| 1                               | 0                 | 2         | 1           |
| 2                               | 2.299             | 6         | 0.89        |
| 3                               | 3.5               | 8         | 0.899       |

**Annexure 05: Model Summary of Logistic Regression**

| <b>Model Summary</b> |                          |                                 |                            |
|----------------------|--------------------------|---------------------------------|----------------------------|
| <b>Step</b>          | <b>-2 Log likelihood</b> | <b>Cox &amp; Snell R Square</b> | <b>Nagelkerke R Square</b> |
| 1                    | 167.805 <sup>a</sup>     | 0.439                           | 0.64                       |
| 2                    | 119.836 <sup>b</sup>     | 0.525                           | 0.765                      |
| 3                    | 111.147 <sup>b</sup>     | 0.539                           | 0.786                      |

a. Estimation terminated at iteration number 6 because parameter estimates changed by less than .001.

b. Estimation terminated at iteration number 20 because maximum iterations has been reached. Final solution cannot be found.

**Annexure 06: Classification Table of Logistic Regression**Classification Table<sup>a</sup>

|        | Observed     | Predicted                         |                                   | Percentage Correct |      |
|--------|--------------|-----------------------------------|-----------------------------------|--------------------|------|
|        |              | Level of EBI                      |                                   |                    |      |
|        |              | Low in entrepreneurial behaviour  | High in entrepreneurial behaviour |                    |      |
| Step 1 | Level of EBI | Low in entrepreneurial behaviour  | 194                               | 18                 | 91.5 |
|        |              | High in entrepreneurial behaviour | 12                                | 65                 | 84.4 |
|        |              | Overall Percentage                |                                   |                    | 89.6 |
| Step 2 | Level of EBI | Low in entrepreneurial behaviour  | 192                               | 20                 | 90.6 |
|        |              | High in entrepreneurial behaviour | 5                                 | 72                 | 93.5 |
|        |              | Overall Percentage                |                                   |                    | 91.3 |
| Step 3 | Level of EBI | Low in entrepreneurial behaviour  | 200                               | 12                 | 94.3 |
|        |              | High in entrepreneurial behaviour | 12                                | 65                 | 84.4 |
|        |              | Overall Percentage                |                                   |                    | 91.7 |

a. The cut value is .500

**Annexure 07: Variables in the Equation in Logistic Regression**

|                     |   | <b>Variables in the Equation</b> |       |        |    |      |        |                     |          |
|---------------------|---|----------------------------------|-------|--------|----|------|--------|---------------------|----------|
|                     |   | B                                | S.E.  | Wald   | df | Sig. | Exp(B) | 95% C.I. for EXP(B) |          |
|                     |   |                                  |       |        |    |      |        | Lower               | Upper    |
| Step 3 <sup>c</sup> | Government sector occupation (Retired)                        |                                  |       | 20.744 | 6  | .002 |        |                     |          |
|                     | Agriculture related occupation                                | -<br>2.052                       | 2.380 | .743   | 1  | .389 | .128   | .001                | 13.631   |
|                     | Self-employed occupation                                      | -<br>1.424                       | 2.360 | .364   | 1  | .546 | .241   | .002                | 24.589   |
|                     | Private sector occupation                                     | -<br>1.424                       | 2.475 | .331   | 1  | .565 | .241   | .002                | 30.790   |
|                     | Government sector occupation                                  | 3.004                            | 2.538 | 1.401  | 1  | .237 | 20.164 | .139                | 2917.206 |
|                     | Casual labour   | -<br>1.372                       | 2.570 | .285   | 1  | .593 | .254   | .002                | 39.077   |
|                     | Farming exclusively for the market                            |                                  |       | 31.693 | 3  | .000 |        |                     |          |
|                     | Farming exclusively for home consumption                      | -<br>5.390                       | 1.139 | 22.417 | 1  | .000 | .005   | .00049<br>0         | .042     |
|                     | Farming primarily for home consumption with marketing surplus | -<br>4.697                       | .966  | 23.659 | 1  | .000 | .009   | .001                | .061     |

|   |            |       |       |   |      |       |       |       |
|---|------------|-------|-------|---|------|-------|-------|-------|
| Farming primarily for the market with some home consumption | -<br>2.141 | .832  | 6.627 | 1 | .010 | .118  | .023  | .600  |
| Monthly household income (LKR)                              | .000       | .000  | 8.161 | 1 | .004 | 1.000 | 1.000 | 1.000 |
| Constant  | -<br>2.737 | 3.433 | .636  | 1 | .425 | .065  |       |       |



**Annexure 08: Mushroom Export Quantities and Values by Export Destinations**

| YEAR | COUNTRY NAME | QUANTITY (Kg) | VALUE (Rs.) |
|------|--------------|---------------|-------------|
| 2016 | MALDIVES     | 509178.95     | 195011096   |
| 2016 | FRANCE       | 15522.9       | 2306210     |
| 2016 | BAHRAIN      | 5824          | 807282      |
| 2016 | SEYCHELLES   | 4533          | 1840863     |
| 2016 | U.A.E.       | 3346.5        | 339237      |
| 2016 | NORTH KOREA  | 1450          | 2677465     |
| 2016 | SAUDI ARABIA | 969           | 101121      |
| 2016 | QATAR-DHOHA  | 757           | 185113      |
| 2016 | SWAZILAND    | 636.55        | 374820      |
| 2016 | OMAN         | 575           | 46654       |
| 2016 | SOUTH KOREA  | 564           | 812105      |
| 2016 | AUSTRALIA    | 460           | 1181992     |
| 2016 | MONACO       | 160           | 37381       |
| 2016 | IRAQ         | 158           | 66696       |
| 2016 | NEW ZEALAND  | 67.1          | 97228       |
| 2016 | JORDAN       | 45            | 254397      |
| 2016 | JAPAN        | 29.5          | 12068       |
| 2016 | U.K.         | 17.5          | 30172       |
| 2017 | MALDIVES     | 530053.16     | 221117985.8 |
| 2017 | FRANCE       | 48178.2       | 7979630     |
| 2017 | U.A.E.       | 41538.25      | 7005562     |
| 2017 | OMAN         | 22666.1       | 2117340     |
| 2017 | QATAR-DHOHA  | 8849.5        | 2872548     |
| 2017 | KUWAIT       | 8345.5        | 1157809     |
| 2017 | U.K.         | 6556.3        | 1474475     |
| 2017 | BAHRAIN      | 6281          | 1072539     |
| 2017 | SEYCHELLES   | 5105          | 3051784     |
| 2017 | SWITZERLAND  | 5017.55       | 2774714     |

|      |              |           |             |
|------|--------------|-----------|-------------|
| 2017 | SAUDI ARABIA | 4219.4    | 1062046     |
| 2017 | SWEDEN       | 2000      | 1343562     |
| 2017 | AUSTRALIA    | 1991.6    | 1934607     |
| 2017 | NORTH KOREA  | 1890      | 3261772     |
| 2017 | CANADA       | 1385.07   | 1643833     |
| 2017 | GERMENY      | 1163      | 1934874     |
| 2017 | IRAQ         | 109       | 46344       |
| 2017 | MALI         | 63        | 27921       |
| 2017 | JAPAN        | 28        | 2793        |
| 2018 | MALDIVES     | 678290.62 | 279477936.8 |
| 2018 | U.A.E.       | 50907.07  | 12290586    |
| 2018 | SWITZERLAND  | 36697.3   | 24403099    |
| 2018 | KUWAIT       | 20007.5   | 3681438     |
| 2018 | INDIA        | 14400     | 4549937     |
| 2018 | QATAR-DHOHA  | 9793.8    | 1630960     |
| 2018 | ITALY        | 8494      | 1297396     |
| 2018 | U.K.         | 8046.1    | 3740156     |
| 2018 | OMAN         | 6337      | 1188602     |
| 2018 | BAHRAIN      | 5551.5    | 1310222     |
| 2018 | CANADA       | 2506.5    | 3784713     |
| 2018 | SAUDI ARABIA | 2469.5    | 808969      |
| 2018 | AUSTRALIA    | 1008.6    | 845213      |
| 2018 | NORTH KOREA  | 800       | 1413766     |
| 2018 | SOUTH KOREA  | 800       | 1414284     |
| 2018 | GERMENY      | 623       | 6230853     |
| 2018 | JORDAN       | 530       | 245337      |
| 2018 | SWAZILAND    | 511.3     | 395572      |
| 2018 | NEW ZEALAND  | 387.29    | 354746      |
| 2018 | IRAQ         | 106       | 47641       |
| 2018 | MALI         | 42        | 19939       |

|      |              |           |           |
|------|--------------|-----------|-----------|
| 2018 | JAPAN        | 21.27     | 8526      |
| 2018 | FIJI ISLAND  | 3.78      | 567       |
| 2019 | MALDIVES     | 777360.4  | 308367148 |
| 2019 | INDIA        | 56575.2   | 12607731  |
| 2019 | SWITZERLAND  | 47502.9   | 32185834  |
| 2019 | CANADA       | 40501.14  | 38040225  |
| 2019 | QATAR-DHOHA  | 39015.05  | 9905853   |
| 2019 | U.A.E.       | 23283.2   | 4449926   |
| 2019 | BAHRAIN      | 23149.59  | 2666125   |
| 2019 | KUWAIT       | 15416.5   | 3337602   |
| 2019 | U.K.         | 6549.5    | 3303897   |
| 2019 | FRANCE       | 3231      | 576790    |
| 2019 | AUSTRALIA    | 2746.58   | 3195169   |
| 2019 | GERMENY      | 2562      | 5383987   |
| 2019 | SOUTH KOREA  | 1140      | 2064538   |
| 2019 | SWAZILAND    | 1011.5    | 555750    |
| 2019 | OMAN         | 973.25    | 299984    |
| 2019 | ITALY        | 917.9     | 202384    |
| 2019 | NORWAY       | 488.26    | 402604    |
| 2019 | JORDAN       | 464.7     | 92380     |
| 2019 | SAUDI ARABIA | 443.3     | 166853    |
| 2019 | U.S.A.       | 337.2     | 299930    |
| 2019 | NEW ZEALAND  | 336.8     | 303180    |
| 2019 | MALI         | 125       | 11581     |
| 2019 | IRAQ         | 60        | 29378     |
| 2019 | JAPAN        | 2.5       | 140000    |
| 2020 | MALDIVES     | 238527.48 | 109398840 |
| 2020 | QATAR-DHOHA  | 43903.35  | 9460414   |
| 2020 | SWITZERLAND  | 27377.45  | 32360667  |
| 2020 | CANADA       | 13186.4   | 10881405  |

|      |              |        |         |
|------|--------------|--------|---------|
| 2020 | GERMANY      | 5641.6 | 9403265 |
| 2020 | BAHRAIN      | 2725.2 | 242793  |
| 2020 | U.A.E.       | 1850   | 319086  |
| 2020 | OMAN         | 1232.6 | 561733  |
| 2020 | U.K.         | 1166.8 | 300693  |
| 2020 | NETHERLANDS  | 921.5  | 1006701 |
| 2020 | AUSTRALIA    | 672.2  | 1250925 |
| 2020 | NEW ZEALAND  | 612.44 | 576354  |
| 2020 | KUWAIT       | 420    | 86805   |
| 2020 | ITALY        | 400    | 44808   |
| 2020 | SEYCHELLES   | 384.51 | 515333  |
| 2020 | SAUDI ARABIA | 10     | 4372    |
| 2020 | HONG KONG    | 7      | 3134    |

Source: Authors' Own Compilation based on Department Customs, 2021