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Value Chain Analysis of Mushroom and Identification of Defies and Prospects of Cultivation of Mushroom

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Abstract

As an emerging market in developing countries, mushrooms are promising in terms of agricultural trends, but have limitations due to their limited shelf life. To overcome these limitations, value-added fungi make products more durable must be converted to a product. The value added of mushrooms in India is about 7% (lower than in some developing countries) and the use of mushroom products in baked goods (cookies, breads, cakes) and fast food products such as burgers, chops and pizza. Marketing of products is uncoordinated as they are sold without standard packaging or dimensions. In order to protect smallholder farmers from exploitation by middlemen, central sourcing and processing units around potential/growth areas and need to set up an efficient marketing system with moving a farmer from production level to enterprise level requires proper integration of all parties in the value the chain through social media. More research, financial support, appropriate mushroom policies and laws, and efficient value chain governance systems are needed now. There is a need to increase mushroom production and consumption as mushrooms are nutritious, medicinal and functional food.

Keywords: *Value chain, Mushroom, value addition, challenge, risk*

1.0 Introduction

FAO recommends edible mushrooms as a food source for developing countries that rely heavily on cereals for food. In India, where the majority of the population is vegetarian, mushrooms play an important role in enriching the daily diet and are used to treat many human ailments. On the other hand, the total amount of mushroom cultivation in India is only 0.09% of the world production. After recognizing the importance of mushrooms under changing circumstances, the Government of India established a National Research Center in Solan, Himachal Pradesh to study various cultivation, fungal diseases, etc. in order to motivate people to use mushrooms. I did some research on the sides part of their diet.

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1.1 General Steps of Mushroom Cultivation

The cultivation process consists of 6 main steps. These steps are commonly followed to grow edible mushrooms such as oyster mushrooms, rice straw mushrooms, and white

button mushrooms. The flow of mushroom cultivation is shown in Figure 1. The first step, composting, takes place here in two stages.

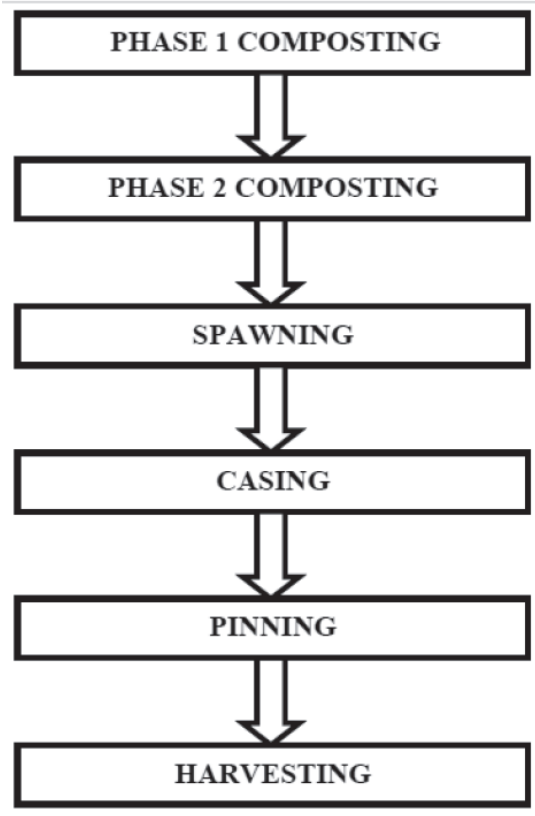

Figure 1: Flow diagram of steps in mushroom cultivation

1.2 Pests and Diseases of Mushrooms

1.2.1 Pests

When grown on fungi, pests either directly damage cultivated crops or damage crops from the spawning stage, reducing yields. Common pests include hornflies, cesids, mites, fungal gnats, nematodes and springtails. Other pests are:

a. Insects
   i. Phorid flies - Megasella halterata
   ii. Sciarid flies - Lycoriella solani
   iii. Spring tails - Lepidocystus cyaneus
   iv. Coccids - Heteropeza phagmae Mycophila brunnesi
   v. Mites - Rhizoglyphus phylloxerae
b. Nematodes : Dactylenthus myceliophagus affect mycelial growth
c. Rats: Damage the beds and eat grain spawn

1.2.2 Control measures of pests

Maintain hygiene and cleanliness of growing areas:

- Avoid contact between soil, compost and straw
- Tools used during cultivation should be sanitary and can be treated with 2% formalin to disinfect
- Insecticides such as Dichlorovas (Nuvan) or 0.6ml/l for spraying insecticides and Dicofil (0.01%) for mites control
- Rats are baited and killed.

1.2.3 Diseases

Different parasites that grow on beds will cause different characteristic diseases, which are responsible for loss in the yield and decreases productivity. Common diseases of mushrooms are as follows:

a. Fungal diseases:
   i. Wet bubble – mucogene penniciosa
   ii. Dry bubble – verticillium malthousia
b. Bacterial diseases:
   i. Bacterial pit - pseudomonas sp
   ii. Bacterial brown blotch – pseudomonas tolassii
c. Viral diseases:
   i. Elongated bend stipes – seven types of viral particles
   ii. Disintegration of mycelium

1.2.4 Social Benefits of Mushroom Cultivation

- Can eliminate problems related to malnutrition in India.
- Mushrooms can strengthen the immune system, thus reducing the cost of curing disease.
- Increased production capacity and improved income streams.
- Efficient use of human power in mushroom cultivation.
- Unemployment can be partially eliminated through effective use of human resources.
- Empower women by providing employment to rural women.

2.0 Literature Review

There is ample literature on mushroom value creation, challenges and opportunities. This section provides an overview of the literature in all areas, including mushrooms and their importance, this supply chain of mushrooms and their value creation, demand-supply gaps, SWOT analysis, SOPs for mushrooms in various fields, etc.

The purpose of this section is to provide an assessment of some of the previous studies relevant to the current observations. A review of the relevant literature in all studies is essential as it provides scope for reviewing the body of know-how and data relevant to the proposed study.

Value chain analysis assesses a company's dynamics and competitive potential through the study of the actors, factors and transactional connecting factors from the product's

inception to its abandonment or ultimate consumption tool. There are external factors influences that affect the nature and terms of trading along the price chain. As such, the value chain assessment creates a cost chain roadmap that indicates whether to slide products, add costs to key market channels, or stop the market for last-revenue. This price chain map provides a tool to visualize the cost chain dynamics and identify the affected deals with the highest value or highest industrial development potential within the market (Ganeshkumar et. al 2020). In the second approach, the fee chain is a complex process implemented by using parties such as primary producers, processors, traders and shippers to bring uncooked material into the final product sale. defined as sports (Chang and Wasser, 2012).

Value Chain Assessment is a useful tool for achieving the best possible rates for consumers. Contribution value is created, at an exclusive level, between different parties along the cost chain.

The duration of the value provided is determined by the willingness to pay of the surrendered consumer. Whether a company can charge a fee depends on several factors, including the characteristics of the market (market size and diversity) and the technical talent of the players. Introduced value is created in a price chain that targets a specific market and comprises some actors (Raut & Jay Kant, 2019). Location value expressed in terms of delivering products in a favourable environment such as home delivery, mail order, convenience store (Arumuganathan et al. 2004). The value of time is put into the product through workshops, planning, transportation and processing. Mushrooms maintain sustainable livelihoods by solving malnutrition, improving health, generating income and providing human well-being (Raut and Jay Kant, 2019). Mushrooms are an excellent source of vitamins B, C, and D, along with niacin, riboflavin, thiamine, folic acid, ascorbic acid, and various minerals such as potassium, phosphorus, calcium, magnesium, iron, and copper. can be a valuable addition to the regularly unbalanced diet of people in developing countries (Aremu, 2009). It has been used clinically as a remedy for various diseases. Ganoderma basidiocarp has several additives that are responsible for inhibiting HIV replication (David & Ravi, 2017). Most important is the level of expertise required for each management and strategy development in mushroom development. If skills are not present in both regions, production can vary significantly between cultures, regardless of the development machines used (Zhang et al. 2019).

This section provides an overview of the literature in all areas, including mushrooms and their importance, his chain of supply of mushrooms and their value creation, supply and demand gaps, SWOT analysis, his SOPs for mushrooms in different sectors.

2.1 Problem Definition and Purpose

As mushroom is an emerging industrial sector in this country, the details of the value chain dynamics are not well covered in the literature. In addition, a SWOT analysis is needed to reveal the main challenges and issues related to mushroom cultivation. Once the issues are identified, appropriate measures can be proposed to increase the competitiveness of the mushroom market.

This study was therefore undertaken to consider all the above points and the following objectives were set accordingly. Status Supply and Demand Gap

- Conduct a SWOT analysis to identify challenges and opportunities.
- Developing Standard Operating Procedures (SOPs) for mushroom cultivation to improve efficiency in the value chain.

3.0 Methodology

3.1 Description of the Study Area

The study was conducted in Tumkur Taluk, Karnataka. The area was chosen because he has a base called Krisi Vignana Kendra (KVK) in this Hirehalli in Tumkur District, which coordinates mushroom cultivation activities in the area. We also train individuals in mushroom growing techniques and maintain a database of all trained mushroom growers. Bangalore's metropolitan commercial center is just 70 km away. This surrogate market hub acts as a major buyer and distributor of mushroom products, consolidating points of supply and demand.

Tumkur Taluk is located in Tumkur district, one of the 31 districts in Karnataka, India. At 13.34 degrees north latitude, 77.1 degrees east longitude and an average elevation of 822 meters (2696 feet), it lies 70 kilometers northwest of Bangalore, the capital of Karnataka. Tumkur District is this fourth largest district in Karnataka with an area of 10,598 km^2. This district is known for its coconut production known as 'Kalpattal Nadu'. The district occupies an area of 10,598 km^2 in this, with a population of 28,82,980 of which 22% were urban in 2021. Tumkur Taluk has a population of 13%. Estimates based on December 2020 data from Aadhar uidai.gov.in. The climate of Tumkur is tropical. Summers here have a lot of precipitation, and winters are almost dry. Average temperatures range from 23°C to 28°C. Average annual rainfall is 983 mm.

3.2 Produce Explanation

Widely cultivated variety in the study area is Oyster mushroom though demand is majorly for button mushroom. Main reason for not cultivating button variety is that it is

cultivated using a chemicalized process. Organic development process is risky to adopt. Oyster mushroom, is commonly called as Dhingri. The regions suitable for button mushrooms are equally suitable for this mushroom. It has great potential as it can be grown on different substrates under different conditions. Accessible by public transport, India produces about 10,000 tonnes of this mushroom annually.

3.3 Mushroom Evaluation

Evaluation activities are mainly concerned with changes in utility. As the product moves through the distribution channel, a place of value creation is created. This can be achieved through processing, packaging and quality improvement. Value creation has many benefits such as ease of use, loss avoidance, ease of transportation, job creation, extended shelf life, export objectives, increased profits, and efficient use of resources. Value-added products include pickled mushrooms, jams, soups and French fries. Further details regarding mushroom growers based in Tumkur Taluk are provided by KVK Spawning Suppliers. A total of 71 actors were identified in this study, the total population identified was not large, and therefore all identified actors were selected, resulting in a sample size equal to the total population. Based on focus groups and a review of previous studies, three types of structured/semi-structured questionnaires were developed. These questionnaires contained questions focused on the research goals to be explored during the study. Three types of this interviews and this schedule were used in the study to gather information from various actors in the value chain. they were:

a. Schedule of interviews with spawners
b. Interview schedule with mushroom producers
c. Dealer, fabricator and consumer interview plans

are analyzed with cost, revenue and added value along the chain using descriptive statistics such as percentage, mean and range. Along the mushroom value chain, key strengths, weaknesses, opportunities, and challenges have been identified and addressed. Finally, standard operating procedures (SOPs) are also presented to improve the effectiveness of the value chain.

4.0 The Value Added at Each Stage of the Chain

Value added calculation was done based on the formulae and calculation methodology provided by:

VA player = Total sales player – Total cost player.

Total sales player = Total quantity sold player * Unit price

Total Cost player = Total quantity produced player * (Fixed Cost + Variable Cost)/unit

5.0 Actors and Activities of Mushroom Value Chain

5.1 Socioeconomic Characteristics

The actors in the Tumkur Taluk mushroom value chain are input suppliers, producers, distributor markets, traders, processors and consumers. All parties along the chain add value in the product change process. Not all actors are required. Based on the number of parties present, five types of value chains were active in Tumkur Taluk during the study. Starting with a 3-party value chain and ending with a 5-party value chain, consider processors and consumers co-located. A total of 71 actors were identified and interviewed. The results show that 20% of the respondents were producers, 5% commissioners, 16% distributors and 59% processors and consumers/non-consumers. Most of the respondents were men. Males have been observed to be dominant in this activity, as physical strength is required to mix the substrate and thus more males are involved in the growth process. However, filling and picking of the base can be done by women. The study found that the educational background of mushroom growers varied from minimal school to vocational level. However, more educated producers have been able to move from cultivation level to enterprise level through vertical integration of the value chain. Since the activities of the mushroom value chain are considered and carried out as income diversification activities, most, if not all, of the participants have primary occupations. The main occupation of most actors was agriculture/fish farming etc. Farmers were mainly engaged in rice/ragi cultivation.

The continued use of rice/ragi straw adds sustainability to current farming practices.

The oyster mushroom value chain and all the stakeholders and activities are shown in Figure 2.

5.2 Processes and Functions of Players in the Pilz Value Chain

5.2.1. Input Suppliers such as training

For other inputs such as bedding materials, chemicals and other materials, producers source from local markets.

Spawn Vendor: The Spawn Vendor plays the primary role of distributing spawn (mushroom seeds) and educating producers by providing the necessary training. During the survey period, it was noted that Krish Vignana Kendra (KVK), a state spawning supplier based in Hirehalli, Tumkur District, was the main spawning supplier. 85% of this spawning is supplied from KVK to Tumkur Taluk mushroom growers and the remaining 15% to others. As mentioned above, spawn prices and quality vary depending on whether they are 1st, 2nd or 3rd generation spawns and are shown in the Table 1.

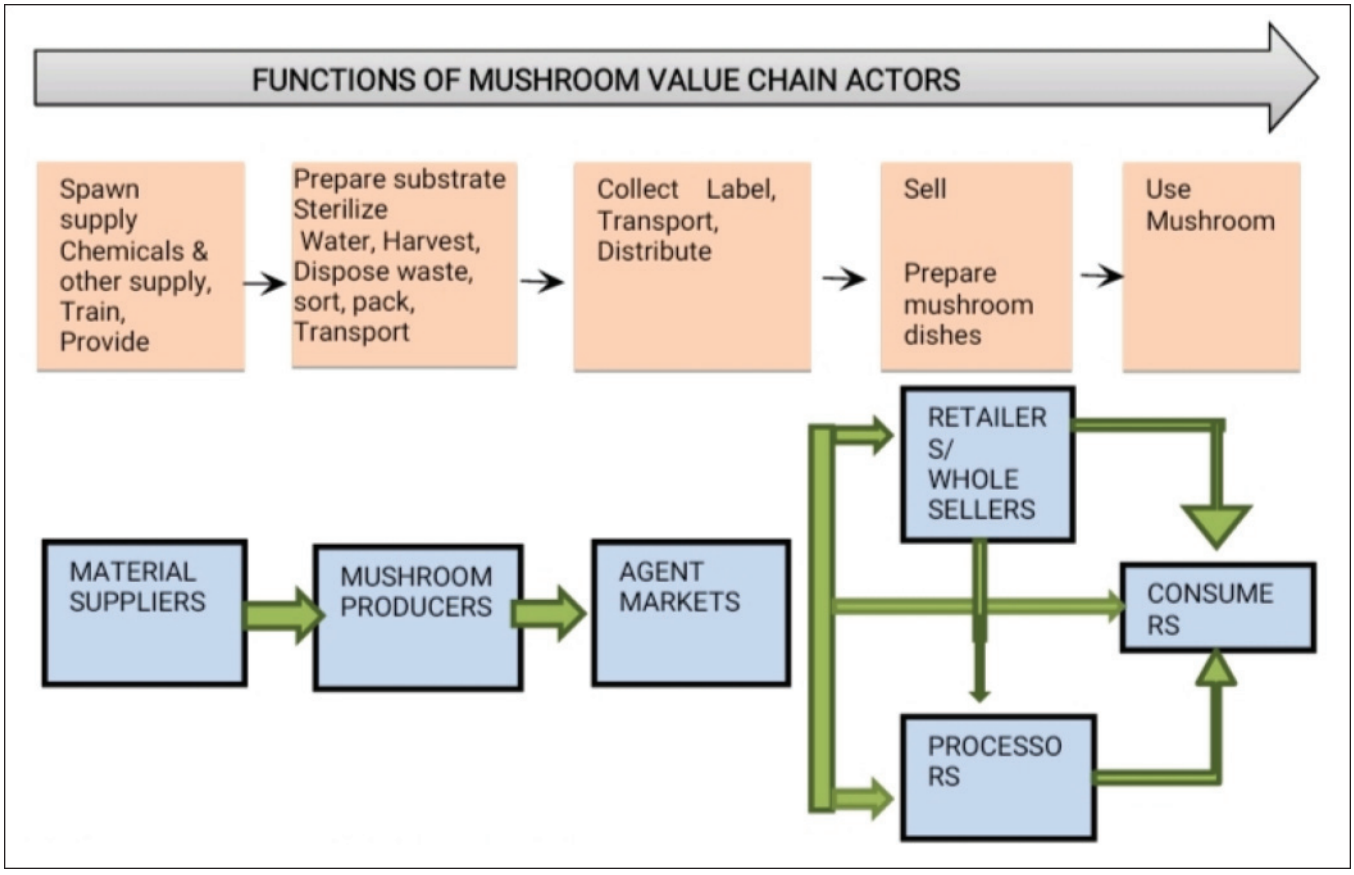

Figure 2 : Oyster mushroom value chain with all the actors and important activities

5.2.2 Substrate

The most important thing in mushroom cultivation is good quality compost. High quality chicks you can trust and the right temperature throughout the process. Mushroom substrate is the material on which mushroom hyphae can grow and colonize. The substrate provides mushrooms with the nutrients, moisture, and energy they need to grow and bear fruit. The substrate should be slightly acidic with a pH of 5-6.5. (However, oyster mushrooms can tolerate a PH of about 8). During the investigation, it was observed that natural compost was made from agricultural waste, rice straw/ ragi hay.

5.3 Training

Mushroom growers received training from spawners. Under the government, spawn supplier (KVK) has organized training for the unemployed on the whole process of mushroom seed collection, cultivation and harvesting.

5.4 Producers

Mushroom producers are the next big players and are responsible for greater value creation. They carry out all the activities necessary to turn egg-laying into saleable fruit. These activities include purchasing supplies, preparing substrate, managing shade, controlling disease and pests, and harvesting.

5.5 Traders (Alternative Markets)

Traders collect products from farmers. Their activities are collecting, sorting, packing, labeling and transporting to their next destination. Their target markets are consumers, supermarkets, hotels, restaurants and retailers. It just connects producers with wholesalers, retailers or direct consumers.

5.6 Processors

As can be seen from the discussion, there were no mushroom processing and packaging companies in the study area. Instead, hotels and restaurants use mushrooms in a variety of dishes. All hotels and restaurants imported mushrooms from Bangalore agency market and supplied them at low prices. This is because the required varieties are not available locally and these mushrooms have a shorter shelf life compared to locally grown mushrooms.

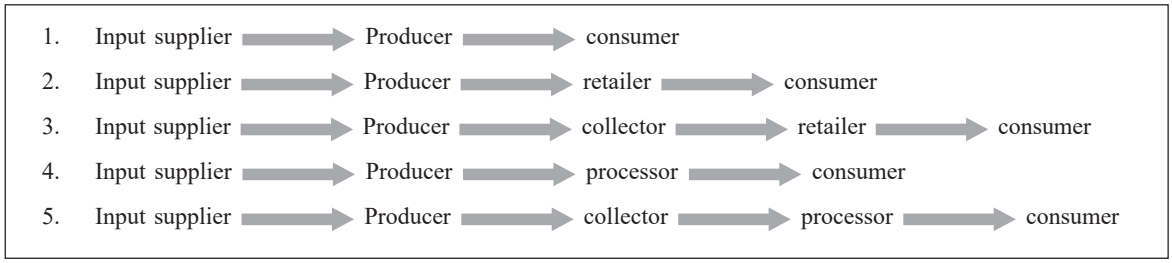

Figure 3: Different models of the Pilz value chain

5.7 Consumer

The consumer is the final consumer, the value of mushrooms – He is the most important player in the chain. Consumers purchase mushrooms from growers, traders and processors. He had two types of consumers in this mushroom value chain. One type of consumer is someone who buys mushrooms in fresh form from retailers or directly from growers. Another type were those who consume value added products

6.0 Mushroom Value Chain Mapping

6.1 Mushroom Value Creation along Market Channels

Participants in the mushroom value chain add value as products move from one party to another. Actors change the shape of products through processing, improve quality through sorting, cleaning and packaging, and create spatial and temporal advantages. His five different models of the Tumkurs mushroom value chain were identified and shown in Figure 3.

Table 1 shows the corresponding added value at the interface between the two consecutive parties. Costs are assigned to actors in the table, but actually occur at the interface. Among these chains, mushroom's total value added was highest at Rs.200 for the third chain represented by all parties. In contrast, the 1st and his 4th chains with the few actors had the lowest overall added value. Mushrooms flow almost directly from the farm to the consumer. As the number of value chain participants increases, the final cost of the product increases. Processors here represent hotels, restaurants, and cafeterias that process mushrooms to prepare a variety of dishes, with mushrooms having the highest overall value. With all the parties involved, the post-processing activities until the mushrooms reach the customer are costly compared to the production activities. The final mushroom yield and cost will vary depending on the quality, brood production, and value of the number of players in his chain.

7.0 Demand Patterns and Supply Situation to Identify Supply and Demand Gap

Mushroom demand patterns and supply situation are described using information from three main sources:

(1) Daily turnover varies between 3 kg and 10 kg. Sold in packs of 200g, typically 15-50 packs are sold per day. Sales are different on weekdays and weekends, and usually there are more sales on Saturdays and Sundays.

He had only two retail outlets selling wild varieties in one season. Despite the availability of oyster and milk mushroom varieties, the demand for mushrooms is high, with almost 95% of the city's population preferring them. The price depends on the quantity of mushrooms purchased by the customer. If you buy it in small quantities, it usually costs 40-50 rupees per pack, I mean. However, since raw mushrooms are a perishable product, they can be stored for up to two days. After that, it cannot be reused and can only be used for compounding fertilizer.

(2) We also collected data from hotels and malls, which are key demand points. Dishes with mushrooms are in high demand and usually use mushrooms. Some hotels used canned mushrooms that were stored in tin cans in brine (2.5% salinity) and kept for up to two years. This variety has been found to improve its flavor when stored in brine.

(3) Demand point starts with cultivator

7.1 Delivery Status

Delivery status was determined based on a survey of retailers, hotels and delivery sources. Supermarkets such as 'More' had higher daily supplies depending on the previous day's and weekend sales. The supply came from the headquarters of the supermarket (Bangalore). In addition, two of the retail outlets received daily supplies from Tamil Nadu (adjacent state). The hotel was supplied by his marketing

Table 1 Value addition at all the actors of above-mentioned models of value chain

Channel	Cost/Price	Spawn +substrate materials supplier	Producer	Collector	Retailer	Processor /Consumer
1	RM cost	-	90	-	-	130
	SP	75+15	130	-	-	-
	VA	90	40	-	-	-
	Cumulative VA	90	130	-	-	130
	VA in %	41.5%	58.5%	-	-	
2	RM cost	-	90	-	130	160
	SP	75+15	130		160	-
	VA	90	40		30	
	Cumulative VA	90	130		160	160
	VA in %	34.5%	52%		13.5%	
3	RM cost	-	90	130	170	200
	SP	75+15	130	170	200	-
	VA	90	40	40	30	
	Cumulative VA	90	130	170	200	200
	VA in %	29%	15.5%	45.5%	10%	
4	RM cost	-	90	-	-	140
	SP	75+15	140			-
	VA	90	50			
	Cumulative VA	90	140			140
	VA in %	45.5%	54.5%			
5	RM cost	-	90	130	-	180
	SP	75+15	130	180	-	-
	VA	90	40	50	-	
	Cumulative VA	90	130	180	-	180
	VA in %	34%	21.5%	44.5%	-	

agent in Bangalore. The amount depends on different dishes with mushrooms and varies from hotel to hotel. Growers who have grown in bulk supplied marketing agents in Bangalore. The delivery quantity depends on the demand. As mentioned earlier, the agent creates a marketplace where farmers can sell their crops and customers can buy them. During that time, the agent receives commissions from both sides.

From the above discussion, it can be concluded that mushrooms are mainly in demand in the study area, but mainly oyster mushrooms are cultivated due to the simple and cheap technical process. Unnecessary travel increases the cost of mushrooms as locally available mushrooms are not consumed and produce grown in the same area does not meet local demand. This also facilitates the presence of middle men/ agent marketing and related commission will increase the cost of mushroom further. Demand-supply gap clearly exists variety wise, volume wise etc. Lack of distributor-cultivator integration and inefficient marketing system, have been identified as the major bottlenecks in further development of self-sufficient mushroom industry.

8.0 To do SWOT Analysis to Identify Challenges and Opportunities

Based on the survey and discussion conducted with various players of mushroom value chain in the study area, SWOT

Table 2: Strengths and weaknesses in mushroom value chain

Strengths	weakness
Training from KVK within Tumkur taluk	No trained and experienced mushroom growers
Less competition in mushroom cultivation	Poor cultivation practices
Minimum education required	Lack training advise during farming
Eco friendly farming	In adequate public awareness

Table 3: Opportunities and Risks in mushroom value chain

Opportunities	Risks
Gap analysis in terms of supply and demand	Diseases and pets damage the product quality
Increase in need for cultivation of nutritious crops	Rise of inputs and labour price
Can be treated as extra source of income	In efficient disposal system of used mushroom substrate
Rapid growth of national and global market for mushroom	

Table 4: Challenges and measures needed for value addition

Challenges	Measures needed
Creation of demand and less consumption	Create awareness among people regarding nutritious and medical value of mushroom
Integrated effort to improve profitability	Make use of mobile apps networks and social media to integrate
Creation of skills to create local markets	Explore local markets hotels ,stores and farmer cooperatives
Creation awareness and skills to convert unsold mushroom in to value added products	Use of well equipped machineries for storage
Efficient cultivation and disposal systems	Applying scientific cultivation and disposal process

analysis for mushroom industry in Tumkur Taluk was carried out (Tables 2 and 3). This analysis is made to bring out the issues related to and identify various factors influencing mushroom farming and throw light on challenges and measures to be taken there-on (Table 4).

By this analysis we can observe that there are a lot of advantages in mushroom farming, if proper methods are adopted as mentioned in "measures needed for value addition", more values can be added at each stage.

9.0 Prepare Mushroom Cultivation Sop (Harvest Calendar) for Value Chain Improvement

Finally, here are the standard steps for improving the oyster mushroom value chain. For this purpose, data were collected from both primary and secondary sources. The basic steps were bed preparation, germination, seed set, harvesting, packing, transportation and distribution. Materials needed include tape measure, mushroom growing chamber, exhaust fan, desert cooler, thermometer, hygrometer, light meter, mushroom shipping crate, straw soaking tank, Tulu pump set, sprayer, chaff cutter, and platform bamboo, polyethylene, rice straw, spawn bottles, chemicals for sterilization and processing, scales. The SOP (harvest calendar) for oyster mushroom cultivation is shown in Figure 4.

Some things to consider:

- Proper large-scale cultivation requires sanitizing the mushroom growing room to grow healthy mushrooms.

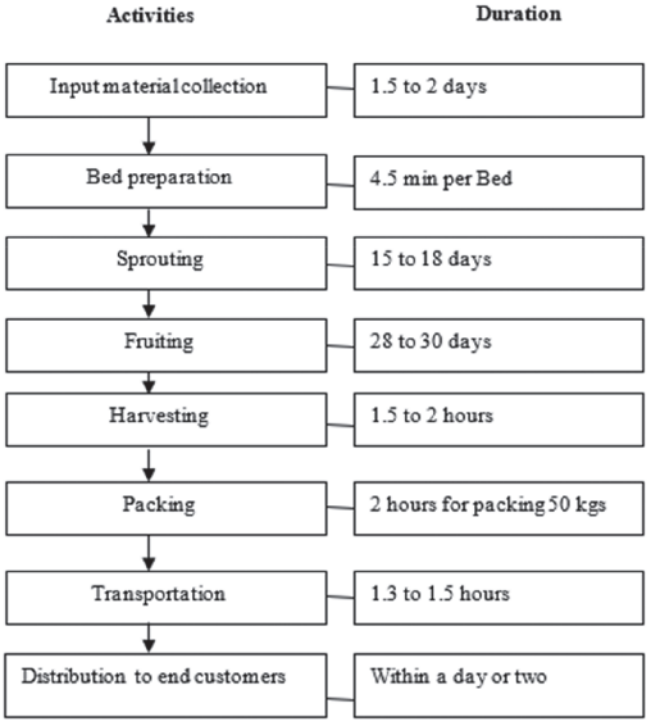

Figure 4: SOP (crop calendar) for Oyster mushroom cultivation

- At least 4 people to grow, care, harvest and pack mushrooms. from 5 skilled workers (for 50 kg yield and packaging per day) daily.
- Total cultivation time – (approximately) 60 days.
- Total lifespan of mushrooms after harvest - 2 days.

9.0 Summary

Mushrooms are easy to grow and offer opportunities for self-sufficiency for rural youth and farmers. Involving women in mushroom cultivation helps empower women, increase employment and improve socio-economic conditions for farmers. Before starting mushroom production, it is important to master mushroom cultivation techniques. Spawn providers play an important role in input distribution, data collection, and training, but their market is unstructured. Mushrooms are sold in most local markets, with standard packages and variations in dimensions, quantities, grades and prices not specified. Therefore, it is necessary to improve the mechanism of the value chain and increase the added value. As mushrooms are highly nutritious, medicinal and functional food, it is necessary to raise awareness of various uses and value-added products in order to increase production and consumption.

From the supply and demand pattern, it can be concluded that there is demand for mushrooms in Tumkur Taluk, but in Bangalore they are supplied by distributors despite the presence of growers and retailers. Further analysis revealed that the reasons for this pattern were: Demand in this area was directed towards the Botanhekitake variety, and producers usually grew oyster mushrooms. Demand and supply differ in kind and quantity. Protecting small holder farmers from exploitation by middlemen requires an efficient marketing system with central sourcing and processing units around potential/growth areas. Moving a farmer from production level to enterprise level requires proper integration of all parties in the value he chain through social media. Social media also helps connect points of supply and demand and improve customer relationships with farmers. More research, financial support, appropriate mushroom policies and legislation, and efficient value chain governance systems are now needed.

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