TECHNOLOGICAL CAPABILITY ANALYSIS OF COCONUT BASED ENTERPRISES

By

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(2019-11-156)

DEPARTMENT OF AGRICULTURAL EXTENSION

COLLEGE OF AGRICULTURE

VELLANIKKARA, THRISSUR – 680656

KERALA, INDIA

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KERALA, INDIA

2021

DECLARATION

I, hereby declare that the thesis entitled "Technological capability analysis of coconut based enterprises" is a bonafide record of research done by me during the course of research and that it has not previously formed the basis for the award to me of any degree, diploma, fellowship or other similar title ,of any other University or Society.

Vellanikkara
06/11/2021

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CERTIFICATE

Certified that this thesis entitled **"Technological capability analysis of coconut based enterprises"** is a record of research work done independently by **Ms. Shilpa P. (2019-11-156)** under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma ,fellowship or associateship to her.

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SHILPA P.

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Introduction

CHAPTER 1
INTRODUCTION

"Coconut palm alone is sufficient to build, rig and freight a ship with bread, wine, water, oil, vinegar, sugar, and other commodities" - Anonymous

Coconut referred to as *the tree of life*, is nature's gift to mankind. It serves as a source of food, beverage, oil, fiber, timber, and health products to mankind from time immemorial. The versatility of the crop emerging from its high adaptability and multiple uses of its products, have earned coconut palm the eulogy of *kalpavriksha* (Tree of Heaven). Botanically, coconut is *Cocus nucifera* Linn., a monocotyledon that belongs to the plant taxonomical order Arecaceae and family Palmae. The adaptability of coconut palm to grow under varying soil and climatic conditions makes it a prominent crop of the tropical coastal areas worldwide. Genetic studies indicate that the Central Indo-Pacific region where greatest genetic diversity is recorded as the center of origin of coconut. It is domesticated in these regions both as a plantation crop and as a member in homestead gardens. It is also integrally connected with culture and auspice of many communities across the world.

1.1. World coconut economy

The worldwide demands for coconuts are for both edible and non-edible purposes. As a crop it has gained considerable importance in many national economies as a potential source of nutrition, rural employment and income generation. There are millions of farm families in the world depending on coconut for their livelihood either directly or indirectly. A growing coconut tree provides direct sustenance to many. The processing activities centered around it producing products such as coir pith, shell charcoal and shell powder made from its waste employ lakhs of people. The crop assumes considerable importance in the national economy of major coconut growing countries in view of rural employment and income generation (Sairam *et al.,* 2018). The global production of coconut is 62.46 million metric tonnes (Statists, 2019). The world coconut cultivation area is broadly scattered in majority of tropical tracts and is grown in 93 countries across

the world. However, the 10 out of 12 million hectares under the crop are distributed among four Asian countries, namely, Indonesia, Philippines, India and Sri Lanka (APCC 2016). Indonesia holds the largest area in coconut cultivation (30%) followed by the Philippines. India stands at third position in area of coconut (16.5%) and first in production (28%). As far as the productivity is concerned, Brazil holds the top position (11,630 nuts ha^{-1}) followed by India (11,481 nuts ha^{-1}). According to estimates, Indonesia (19 M tonnes) leads among the countries in coconut consumption, followed respectively by Philippines (14 M tonnes) and India (12 M tonnes). These together make an aggregate share of 72 per cent of the total global consumption (APCC, 2018). The area, production and productivity of major coconut producing countries are presented in. Table 1.1

Table 1.1 Area, production and productivity of major coconut producing countries

Sl. No	Country	Area (in 1000 Ha)	Production (Million nuts)	Productivity (Nuts/Ha)
1.	F.S Micronesia	18	60	3333.333
2.	Fiji	64	159	2484.375
3.	India	2,082	23,904	11481.27
4.	Indonesia	3,544	14,356	4050.79
5.	Jamaica	16	126	7875
6.	Kenya	79	268	3392.405
7.	Kiribati	23	198	8608.696
8.	Malaysia	83	518	6240.964
9.	Marshall Islands	8	38	4750.00
10.	Papua New Guinea	221	1483	6710.407
11.	Philippines	3,612	14,049	3889.535
12.	Samoa	99	267	2696.97
13.	Solommon Islands	38	100	2631.579
14.	Srilanka	440	2450	5568.182
15.	Thailand	179	666	3720.67
16.	Tonga	26	56	2153.846
17.	Vanuatu	92	699	7597.826

18.	Vietnam	165	1,499	9084.848
19.	Other countries	1,291	7937	6147.947
	Total	**12080**	**68833**	**102418.6**

(Source: Asia Pacific Coconut Community (APCC), 2017)

1.2. Indian coconut economy

Coconut has an important status in the Indian economy and has been produced and processed here from time immemorial. Globally it is one of the leading producers of coconut and has its major production from small and marginal farms. The sector contributes about Rs.83,000 million annually which is about 2 per cent of the contribution of agriculture. Estimates suggest that more than 10 million farm families are dependent directly or indirectly on the crop for livelihood. Indian coconut sector has huge domestic demand, comparatively higher productivity, strong research support and technology delivery systems. The percentage share of world exports of coconut products from leading producer countries indicates huge domestic demand for the product. It is estimated that around 50 per cent of annual Indian production of 15.84 billion nuts is consumed domestically as raw nuts for culinary and religious purposes. About 35 per cent of the production is utilized for conversion to copra, while 11per cent is used as tender nuts and 2 per cent for seed purposes. Hardly 2 per cent is utilized for value addition and industrial purposes. In fact, this trend in domestic needs have limited the scope of India to emerge as a major export player in international market. As such, there is a need for the country to devote more intensive research, development and technology transfer on utilization and product diversification in both food and nonfood uses of coconut. This holds larger significance in remodeling the practice of fixing the price of coconut based on the existing market price of coconut oil (Muraleedharan and Jayasree, 2012). However, consequent to the liberalization of Indian economy, the domestic coconut market economy has also been pushed towards a situation of competition, where coconut oil has to compete with other low price vegetable oil and fats in the international market.

1.3.Coconut in Kerala economy

Coconut forms an important crop in the southern states of India. The four southern states of Kerala, Tamil Nadu, Karnataka and Andhra Pradesh are the leading coconut

producing states in India and account for 90 per cent of total area and production (Table1.2). Kerala tops in terms of annual production of coconut with 5,384 million nuts and cultivated in a total area of 760946.63 ha (APEDA, 2018). However, the state productivity is 6964 (nuts ha^{-1}) which is lower compared to other states and stands at sixth position among the coconut producing states. Actually the literal meaning of Keralam means the "Land of Coconut Trees". District wise production statistics showed that the production is highest in Malappuram district (9120 lakhs nuts) followed by Kozhikode. Kozhikode district holds the first position in area under cultivation (115706.20 ha). The productivity is highest in Kasaragod (9849 nuts/ha) (KSPB, 2019). In order to gain competitive advantage in trade of coconut products Kerala needs to intensify the entrepreneurship development activities in the state. Product diversification and value addition holds the key in achieving this goal.

Table 1.2 Production of coconut in major coconut producing states of India

Sl. No	State	Production (000 tonnes)	Percentage share (%)
1.	Kerala	5,829.00	35.14
2.	Karnataka	4,326.75	26.08
3.	Tamil Nadu	4,152.01	25.03
4.	Andhra Pradesh	963.37	5.81
5.	West Bengal	260.45	1.57
6.	Orissa	235.66	1.43
7.	Gujarat	166.32	1.00
8.	Assam	116.01	0.70
9.	Maharashtra	88.22	0.53
10.	Bihar	52.8	0.32
	Total	16,190.67	97.61

(Source: Agricultural and Processed Food Products Export Development Authority *(*APEDA), 2018)

1.4. Coconut enterprises

There is a wide range of products with functional uses that can be derived from different parts of a coconut tree which gives it the credentials of a sunrise sector globally. This has resulted in rapid growth of enterprises in the sector and the products are in significant demand. These enterprises have proven to generate greater economic returns for the coconut producers across the world. Thus, most of the leading coconut producing countries

including India are heavily dependent on a single crop-based industry for commercial returns. There are hundreds of reputed and established private firms involved in manufacturing and marketing of various coconut products across the major coconut producing states in India. Copra processing, coconut oil extraction and coir manufacturing are the traditional coconut-based industries in the country. India owns the position of premier coir producing country in the world. The country also owns a prestige position in producing best grade milling copra yielding high grade coconut oil known for its aroma and flavor. There is a remarkable presence of large number of farmers' cooperative societies in primary coconut processing and marketing. Government agencies such as Kerafed (Kerala *Kerakarshaka Sahakarana* Federation Ltd), State Trading Corporation, Kerala State Marketing Federation and Karnataka State Marketing Federation etc. are also manufacturing and marketing branded coconut oil. This has enabled a wide range of coconut products, both food and non-food-based products, available for export. Technical know-how and trained manpower are critical for the sustainability these enterprises. Availability of research support and services from reputed research organizations such as Council of Scientific and Industrial Research (CSIR), Indian Council of Agricultural Research (ICAR) and Defence Research & Development Organisation (DRDO) and institutions like Coconut Development Board (CDB), Central Plantation Crops Research Institute (CPCRI), Agri Business Incubators (ABIs) are also important.

1.5. Value addition of coconut in Kerala

Coconut, which is the most popular homestead crop in Kerala is considered both as food crop and oil seed crop. Value addition in coconut, which is known as 'super food', has the potential to give more income to farmers and great scope for entrepreneurs in the state. In fact, the coconut processing and value addition has evolved very fast with high growth rates and has the presence of many start-ups. This has been attributed to society's increased health consciousness and also the gaining popularity of ecofriendly products. The various edible products from coconut includes coconut milk, dried coconut or copra, desiccated coconut, coconut oil, coconut water, Nate-de-coco, coconut flour, vinegar, jaggery etc. Apart from these products, a series of non-food products such as activated carbon, shell

powder, fibre, charcoal, handicrafts, furniture etc are also made from coconut. The changing product preferences of different sections of society which are inclined towards value added products such as desiccated coconut, readymade coconut milk and coconut powder are gaining prominence in recent years. Another advantage of a coconut-based unit is that the by-products are also useful in some way. The recycling of products and by-products can improve the firm's viability. Except some spoilage issues, coconuts are safe to handle and store in large rooms and dormitories, and it do not require complicated storage conditions before processing. Moreover, promotion of value-added products serves as the vital link between agriculture and industry and enhances the export potential of the sector. Supporting innovations, product quality and packaging technologies are considered essential in facilitating the development of products meeting consumer needs and also quality standards of international and national markets. These have favoured the emergence of a competitive entrepreneurship scenario in the state with the predominant presence of Micro, Small and Medium Enterprises (MSMEs) in coconut sector.

1.6. Micro, Small and Medium Enterprises (MSMEs)

Last five decades have seen the emergence of Micro, Small and Medium Enterprises (MSMEs) as a highly dynamic sector of the Indian economy. MSMEs have decisive role in providing employment opportunities at comparatively lower capital cost and help in industrialization of rural and remote area of the country. Taking cognizance of the importance of MSMEs in the country a separate Ministry for Micro, Small and Medium Enterprises formed merging the erstwhile Ministry of Small-Scale Industries and the Ministry of Agro and Rural Industries under the Government of India in 2007. It serves as the apex body for the formulation and administration of rules, regulations and laws relating to micro, small and medium enterprises in India. The Micro Small and Medium Enterprises Development (MSMED) Act of 2006 provide the first-ever legal framework for the definition of the concept of "enterprise" which comprises both manufacturing and service entities. It also defined medium enterprises for the first time. It integrated the three tiers of these enterprises and classified into micro, small and medium based on investment in plant and machinery; and turnover of the enterprise.

1.6.1. Categorization and definition of MSMEs

Ministry of Micro, Small and Medium Enterprises, revised definition of MSME in its notification dated June 1, 2020. The definition classified the enterprises by inserting a composite criterion for both investment in plant and machinery and annual turnover of enterprises. As per the new classification micro enterprises were defined as an enterprise where the investment in plant and machinery or equipment does not exceed one crore rupees and turnover does not exceed five crore rupees while in small enterprises where the investment in plant and machinery or equipment does not exceed ten crore rupees and turnover does not exceed fifty crore rupees. And medium enterprise where the investment in plant and machinery or equipment does not exceed fifty crore rupees and turnover does not exceed two hundred and fifty crore rupees.

The MSME sector is a significant contributor to the economic growth processes of a country. The importance this sector in the socio economic development of country attracted government of India to encourage and enrich this sector. It shows consistently high growth rate than rest of the sectors within a short period of time. The sector has great scope for growth and expansion in future and to become the unavoidable section of our economy. The following features makes the sector remarkably important than other sectors.

1.6.2. MSMEs in coconut sector

Micro Small and Medium enterprises (MSMEs) dominate among the coconut enterprises. However, with the liberalization process, coconut MSMEs have been facing stiff competition in the global market in terms both quality and cost. Challenges faced by entrepreneurs in the competitive scenario arise mainly from shortage of working capital and unavailability of skilled workforce. Apart from these operational challenges, low investment in research and development is also posing impediments in the progress of coconut MSMEs. Absence of appropriate technology can reduce the potential of MSMEs arising from low demand for the products. Switching to superior quality production has not always been economically feasible for these enterprises because of lower profit

margin. Hence there is a need for strong focus on implementing advanced new age technology, through better awareness of best practices as well as technological collaboration with research and development units. The Government of India has been launching several MSME schemes related to technology upgradation. The agencies like Coconut Development Board have been involved in providing support for different ventures with coconut and helps the enterprises in technology adoption. ICAR-Central Plantation Crops Research Institute (CPCRI), Kasaragod has been developing new technologies in value addition which could strengthen the coconut-based enterprises. The Coir Board also offer support to coconut ventures, especially related to coconut fiber (Sairam *et al.,* 2018). Apart from these, institutions like Agri Business Incubators (ABI) are also facilitating entrepreneurship development in coconut sector. These suggest that though there exists a promising future for the coconut based MSMEs in our country, their technological capabilities need to be strengthened. These warrant for specific extension activities to be undertaken considering the technological capabilities persistent within these enterprises.

1.7. Technological capability (TC)

Technological capability (TC) includes the knowledge, information and skills available in an enterprise that allow productive utilization of available equipment and technology. It serves as a tool to analyze performance and support investment decisions. The UN technology and innovation report (2021) suggest that the lower-income and least developed countries find more difficult to support people and businesses through crisis periods mostly because, they have fewer resources, lower technological capabilities and less productive industries and agricultural sectors. The Industry activity related to technological capabilities of a country is path-dependent and based on existing capabilities (Hidalgo *et al*., 2007). Thus for a country to get full economic benefit from an enterprise they have to make investments and developments in the offshoots of technological capability. This bring technical, managerial and institutional dimensions as applied to an enterprise and increase the enterprise performance. Technology capability measures of coconut enterprises can also be used to ensure successful technology management in

enterprises for appropriate selection of equipment and operating protocols, so that the resource use and product quality can be optimized.

Therefore, an understanding of the interplay of technological dynamics and social capability of these enterprises hold great significance in terms of entrepreneurship development. Hence the study attempts to decode the factors that form the basis the technological capability of coconut enterprises that can effectively redefine the entrepreneurial ecosystem of the state.

Keeping these in view, the present study entitled *Technological capability analysis of coconut-based enterprises* was undertaken with the following specific objectives.

1.8. Objectives of the study

- Documentation and categorization of coconut enterprises based on major products and services
- Mapping of the technology use pattern in the delineated enterprise categories
- Evaluation of the technological capabilities of the selected enterprises
- Propose a conceptual model for sustainable entrepreneurship development for coconut enterprises

1.9. Scope of the study

Technological capability is a determining factor in the efficiency and effectiveness of enterprises. Therefore, an understanding of technological capability, of coconut-based enterprises hold great significance for Kerala economy in terms of entrepreneurship development. Skill gap analysis and scaling readiness as components of technological capability helps to promote sustainable entrepreneurship development. Thus technological capability analysis help enterprises to improve its capacity to absorb, use, adapt, develop, transfer and disseminate technologies for quality output and better income. The results help in the development of a framework to suggest technologies and related skill for different coconut enterprises. It can be used to provide competitive advantage and innovativeness to an enterprise. The results aid to have a realistic proposal regarding the financial requirement for the revival of the enterprises based on the market value of suitable technologies. A conceptual design suggested based on

research help sustainable entrepreneurship development in the MSME categories of enterprises.

1.10. Limitations of the study

Systematic and scientific approach have been made to conduct the research in a comprehensive manner. However, the innate limitation of being a student research project as noted below could not be avoided.

1. The limitation of time, finance and other resources were felt from being a student research project.
2. The results of the study can be generalized only in enterprises having similar socio economic and technological contexts as the study covered only a small percentage of enterprises in the state.
3. The results of the study were based on the expressed responses of the respondent's perception. So it is subjected to the effects of individual bias and prejudice. A complete neutrality cannot be assumed.

1.11. Organization of the thesis

The thesis is organized under these following sections of five chapters that help easy handling and report writing. It includes Introduction, Review of literature, Research methodology, Results and discussion and Summary and conclusion.

The first chapter covered a brief introduction, objectives, scope and limitations of the study. Chapter two covered the observations from earlier research works related to the objective of the study. The third chapter methodology outlined the study location, research design, selection of sample, methods of data collection, selection and measurement of variables and the statistical tools used. The results from the study are given in the fourth chapter *i.e,* results and discussion. Finally the fifth chapter includes summary and conclusion followed by the references and appendix. In the end abstract and appendix are presented.

Review of literature

CHAPTER 2

REVIEW OF LITERATURE

The chapter on review of literature gives a comprehensive account of the previous research studies that have been conducted in the topic and related areas of investigation. It helps to provide a theoretical basis in understanding the research problem and deciding the methodology to be followed in the study. The chapter includes relevant studies conducted in the area related to the objectives and the methodology selected. The review of important literature is presented under the following sub-heads.

2.1 Studies related to entrepreneur and entrepreneurship

2.2 Coconut processing enterprise scenario

2.3 Socio - economic and psychological attributes related to entrepreneurship

2.4 Technology use in coconut enterprises

2.5 Concept of technology capability

2.6 Measurement of technological capability of enterprises

2.7 Skill gap in enterprises

2.8 Studies based on Analytical Hierarchy Process (AHP)

2.1 Studies related to entrepreneur and entrepreneurship

2.1.1 Definition of Entrepreneur

Cantillon (1730) first introduced the term 'Entrepreneur' in 18 th Century. He defined entrepreneur as an 'undertaker' who bears the risk of buying at one price and selling at another.

Drucker (1985) called entrepreneur as one who always searches for change, responds to change and also exploit it to make use of the opportunities. They were innovative and their innovations are regarded as an important instrument in entrepreneurship.

Bolton and Thomson (2000) viewed entrepreneur as an individual who consistently created and invented to build something of recognized value around the recognized opportunities.

Rao (2008) defined entrepreneur as a person who had the capability to identify the actual market for a product or service and could price it economically in order to make the enterprise sustainable.

Zwan *et al.* (2016) demarcated entrepreneur as a person who created a new business venture facing the risks and uncertainties for achieving profit and growth. Entrepreneurs are also competent in identifying the opportunities and bring together the necessary resources.

According to CAE (2020) an entrepreneur is an individual or group which arranges the means of production to engage in entrepreneurship, often under significant uncertainty and risk.

2.1.2. Definition of entrepreneurship

Suresh (2004) argued that entrepreneurship as a set of skills with a mix of many qualities and traits. It also included constructs like imagination, risk taking mentality, and an ability to accumulate other factors needed for production. The factors of production comprise capital, land, labor and the talent to use scientific and technological developments.

According to Onuoha (2007) entrepreneurship is an action of beginning new ventures or re- energizing the existing organizations, especially for new businesses with response to available opportunities.

Hisrich *et al*. (2010) viewed entrepreneurship as a process of creating an innovation by dedicating necessary time and effort, considering the financial, psychological and associated risk. The end result gives economic benefits, Independence as well as personal satisfaction.

Rehman and Elahi (2012) defined entrepreneurship as a composite process and entrepreneurs are individuals who create new business are innovative and venturesome.

Ogutu and Kihonge (2016) opinioned that entrepreneurial success has been achieved by entrepreneurs who had a competitive attitude and creative mindset.

Neumann (2020) tried to define entrepreneurship in terms of its impact on the economy. The author found that entrepreneurship positively affected social welfare and also the short-term self-employment reduced poverty in rural and urban areas.

2.2 Socio-economic and psychological attributes related to entrepreneurship

2.2.1 Age

Bhagyalaxmi *et al*. (2003) in their study found that majority (60.00%) of the entrepreneurs in diary sector belonged to middle age group; the old age category was 21.67 per cent and 10 per cent entrepreneurs belonged to young age category.

Meena (2015) found that 78.30 per cent of the entrepreneurs who attended training programs from KVKs were belonging to middle age (36 to 55 years) followed by 18.30 per cent in the young age group and the elderly group (above 55 years) were only 3.3%.

Bhupendra (2016) in the study related to women entrepreneurship in agro based enterprises observed that 72.85 % belonged to the age category of 36 to 55 years old. Only 27.15 per cent comprised in old age group i.e, greater than 50 years old and no women entrepreneurs below 35 years were found.

Kumar (2017) indicated that 66.67 per cent entrepreneurs belonged to middle age followed by 17.50 per cent old age entrepreneurs and 16.25 per cent accounted for young age category of entrepreneurs.

Raju (2017) in his research identified that 47 per cent of the agripreneurs in middle age category, 39 per cent of old age agripreneurs and remaining 14 per cent of young age.

Ashwini (2019) revealed that majority of the entrepreneurs facilitated by ABI's were in the age group of 36 to 50 years (58%) while 24.00 per cent belonged to the age group of less than 35 years. And only 18.00 per cent of entrepreneurs belonged to age group above 50 years in the study.

2.2.2 Gender

According to the report of Global Entrepreneurship Monitor (2007) there existed a gender gap in entrepreneurship. Women representation in entrepreneurship was very less and men were more recognized as entrepreneurs.

Engelbrecht *et al*. (2011) observed that 64.00 per cent of the entrepreneurs were males and only 36.00 per cent belonged to females in their study.

Sulaja (2013) in the study of diary entrepreneurship revealed that 59.00 per cent of dairy farmers were males and only 41.00 per cent belonged to females.

Armaghan and Ariash (2015) in their study reported that 71.00 per cent of the manufacturers in rural area were males and only 29.00 per cent were women.

Ekerete and Ekanem (2015) identified that 58.88 per cent of the agro based processors were male and 41.12 per cent were female processors.

2.2.3 Educational status

Abdolhamid *et al*. (2008) found that, among the rural entrepreneurs 58.00 per cent had high school diploma and 30.00 per cent of them had received bachelor degree and rest 12.00 per cent are illiterates.

Stephan *et al*. (2012) revealed that 20.37 per cent of women entrepreneurs received lower junior level of education followed by those with education up to the matriculation level. Among the respondents 16.67 per cent had got degree and 14.81 per cent received diploma. About 4.11 per cent studied up to middle school, 8.11 per cent had got post graduation and inter junior 7.41 per cent.

Malikadas (2013) reported that 50.00 per cent of the women entrepreneurs under study were degree holders while 25.00 per cent of them were with intermediate followed by matriculation (15.00%) and middle school (10.00%).

Nagalakshmi and Sudakar (2013) reported that the majority of agripreneurs were graduates (48.00%) while 32 per cent were educated up to tenth standard level and only 12 per cent received post graduation. And remaining 8 percent of them were illiterates.

Anandashankar and Upendranath (2014) observed that 20.00 per cent of the entrepreneurs from tribal community were educated up to primary school while 15.00 per cent of them had studied up to high school and 10.00 per cent received college education. The study found that the remaining 55.00 per cent were illiterates.

Ashwini (2019) reported that 62 per cent of the entrepreneurs facilitated by ABI's had received technical education form universities while remaining 38.00 per cent had received general education from colleges.

Gayathri (2020) indicated that 60 per cent of the participants of entrepreneurship programs organized by KVKs of Kerala had acquired high school level of education while 34.00 per cent of them possessed educational qualification up to college level and remaining 6 per cent had acquired middle school education.

2.2.4 Occupational status

Shehrawat (1998) stated that among the 120 respondents studied 31.67 per cent had farming along with business as their occupation. About 26.67 per cent had service oriented business and 22.50 per cent were involved in business alone.

Phillips (2002) opined that the specificity and quality of occupational experiences gained by an entrepreneur are significant in determining his success in self-employment and entrepreneurship.

Deepthi (2016) observed that 55.00 per cent of the entrepreneurs had business as their primary occupation. While 32.50 per cent had enterprise with agriculture as main occupation and around 12.50 per cent had enterprise and service as their occupation status.

Koster and Anderson (2018) reported labor market experience as a critical component of entrepreneurial success. He observed relation between the industry in which the entrepreneurs previously worked and the industry in which they started their firm.

Gayathri (2020) reported that majority of the respondents (61%) had business as their primary occupation and was not involved in farming activities While 35 per cent of the respondents had business along with farming as their occupation. And remaining 4 per cent of the respondents were involved in service oriented jobs along with farming activities.

2.2.5 Extension contact

Upadhyay (2010) in his study found that 65.83 per cent of the diary entrepreneurs had a medium level of contact with various extension agencies. There were 22.50 per cent of the entrepreneurs who showed high level of extension contact and 11.67 per cent who had low level of contact with extension agencies.

Gade (2011) observed that 71.88 per cent of the entrepreneur's studied were of medium level of extension contact. There were 15.62 per cent of the respondents who showed high level of contact with extension agencies followed by 12.50 per cent with low level of contact.

Shahjar *et al.* (2018) reported that 73.33 per cent of entrepreneurs had medium contact with extension agency while 11.66 per cent had high level of contact.

Gayathri (2020) revealed that 53 per cent of the entrepreneurship development program trainers had medium level of extension contact while 25.00 per cent of the trainees had high level of extension contact. And more than 22.00 per cent of the trainers had low contact with extension agencies.

2.2.6 Mass media exposure

Kamaraddi (2011) reported that 64.17 per cent of the entrepreneurs were having a medium level of mass media exposure. There were also 20.00 per cent with a low level of exposure and 15.83 per cent who had high media exposure.

Deepthi (2016) stated that 48.66 per cent of the entrepreneurs had medium mass media exposure and majority of them were updated through newspapers, television and social media.

Pandey *et al*. (2017) observed that, among the respondents who attended entrepreneurship development programs in diary sector, 36.66 per cent entrepreneurs had medium level of exposure and 31.67 per cent had high exposure of mass media.

Shahjar *et al.* (2018) revealed that 56.66 per cent of dairy entrepreneurs studied had medium level of exposure to media through television and radio which were found easily accessible to all. Their findings also revealed that 28.33 per cent of the entrepreneurs had low mass media exposure and only 15 per cent of them showed high media exposure.

Ashwini (2019) revealed that majority (78%) of the entrepreneurs facilitated by ABI's belonged to medium mass media contact while 12.00 per cent showed high mass media contact and 10.00 per cent showed low mass media contact.

Gayathri (2020) reported that majority (54%) of the entrepreneurship development program trainers had medium exposure and 25.00 per cent had high exposure to mass media while 21.00 per cent of the trainees who showed low mass media exposure.

2.2.7 Social participation

Singh *et al*. (2012) stated that entrepreneurs were having medium and high levels of social participation of the order 36.67 per cent and 26.66 per cent respectively.

Raghunath (2014) observed that entrepreneurs had 43.33 per cent included medium level of social participation. And 14.67 per cent have low social participation and 15.00 per cent had high level of participation.

Krishnan (2017) studied that 61.66 per cent of the entrepreneurs had participation in at least two organizations and 33.33 per cent of the entrepreneurs were the members of atleast one organization. And five per cent of have membership in three organizations.

Raju (2017) in his study revealed that 73 per cent of the respondents had medium participation while 11 per cent of the entrepreneurs indicated high participation.

Ashwini (2019) reported that significant majority (66 %)of the entrepreneurs facilitated by ABI's had medium level of social participation while 18.00 showed high level of social participation and 16.00 per cent showed participation in organizations.

2.2.8 Entrepreneurial orientation

Covin and Slevin (1989) stated that entrepreneurial orientation is the extent to which top level managers show interest to take risk, their orientation towards change and innovation. They argued that an enterprise more inclined towards relatively high levels of risk taking, innovativeness, and proactiveness show entrepreneurial orientation while those with relatively low levels of these factors have conservative orientation.

Stevenson and Jarillo (1990) inferred that entrepreneurial orientation was not the proclivity of top management alone as it is also exhibited by multiple layers of management in an enterprise.

Wang (2008) defined entrepreneurial orientation as the tendency of a firm's top management to take risk, become proactive and competent towards rivals.

According to Ullah *et al*. (2011) entrepreneurial orientation served as an important measure of performance of an enterprise. It has been defined as a processes in the decision making activity of a firm related to its entrepreneurship development.

Bedi (2016) revealed entrepreneurial orientation as a multidimensional construct with innovativeness, proactiveness, risk taking, competitive aggressiveness and autonomy as its dimensions. The study also pointed out that there was no significant association between age of an enterprise and the level of entrepreneurial orientation. Thus, a mature enterprise and an enterprise in nascent stage could have equal level of entrepreneurial orientation.

2.2.9 Managerial competency

Gabriela (2016) defined managerial competencies as a set of features necessary to perform some specific tasks to achieve organizational positions. The possession and efficient use of such competencies bring effective staff management and aid fulfillment of goal in an enterprise.

Ashthana and Jain (2018) identified the relationship between managerial competencies and the performance of a firm. The competencies like leadership, problem solving, strategic competency and the customer focus showed a positive relationship with the performance of enterprise.

Yusuf and Suseno (2020) stated that managerial competencies in non-family businesses had significant influence on the enterprise performance while in the family-owned companies the consideration for managerial competencies were less. The family-owned businesses maintained a harmony in both business and performance.

Yu and Yan (2020) observed that for efficient development of the managerial competency, enterprises have to identify the requirement of managers in different levels. The evaluation of competency of individual managers in each level helps enterprises to figure out the strength and weakness in targeted way.

2.2.10 Annual income

Shehrawat (1998) stated that 83.33 per cent of the respondents belonging low to medium income group turned to entrepreneurs and thus he proposed financial and institutional support from government and allied institutions to promote entrepreneurship.

Rajini and Sarada (2008) in their study on entrepreneurship in women and their support system explained annual income from enterprises aided increase in family income and this was the most motivating factor for women to start a venture.

Mamata and Renuka (2012) revealed that 31.00 per cent of the women entrepreneurs who received training had a stable source of income. While 40.00 per cent expressed a hike in their income after training and 29 per cent expressed no change in income status.

Jayarani *et al.* (2013) observed that majority of the entrepreneurs had high income above two lakhs, while respondents with annual income below one lakh were only 15.40 per cent.

Raju (2017) reported that 82.00 per cent of the agripreneurs belonged to medium income category while 10 per cent of them were in the high income category and only 8 per cent had low income levels.

2.2.11 Asset ownership

Kumari and Singh (2004) reported that the ownership of assets and control over the assets increased the responsibilities of individuals in family and group enterprises. However, it also increased self-esteem and confidence of the members.

Kumar (2008) observed that an entrepreneur's ability to access ownership over assets from different sources is depended on the management skills and also income from the enterprise.

Kapoor (2019) in the study related to entrepreneurship for economic and social empowerment of women, reported that women involved in social enterprises had more access and ownership over the assets compared to the women in profit-oriented enterprises

2.2.12 Scale readiness

Hermans *et al*. (2017) studied social network analysis of multi-stakeholder platforms in agricultural research and development on the basis of opportunities for scaling of innovations. The study found multi-stakeholder platforms were less geared towards the out scaling of knowledge intensive innovation and their adaptation in local environments with diverse end-users .The study also suggested that these platforms could act as blueprint vehicle for supporting scaling innovations in agricultural research and more research were needed in this area.

Schut *et al*. (2020) stated scaling readiness as a tool to measure how 'ready' innovations are for scaling. He suggested that scaling readiness could help researchers to take appropriate actions that accelerate scaling.

According to Sartas *et al.* (2020) scaling readiness was an approach provided action-oriented support for the characterization of the innovations and innovation systems. It helped the researchers for the diagnosis of the current readiness and use of innovations , the development of strategies to overcome bottlenecks for scaling, facilitation and negotiation of multi-stakeholder scaling process and also navigation and monitoring the implementation process to allow for adaptive management.

2.2.13 Market competitiveness

Paridar (2013) defined market competitiveness as the ability of a firm to improve continuously the marketing process capabilities and deliver better value to customers than the competitors. He pointed out competitiveness as a measure of performance of a firm in comparison to the performance of other rival firms in the market.

Yee *et al.* (2013) studied the impact of market competitiveness on employee satisfaction, service quality, and customer satisfaction in service-oriented industries. The results confirm that market competitiveness had direct impact on service quality and not on employee satisfaction

Thasnimol and Prema (2017) stated that competitiveness of enterprises was indicated by their ability to export more value-added products than their imports without much external interventions

Fudjaja *et al.* (2020) reported that competitive power of coconut oil industries in market were based on supplier and consumers bargaining power. Factors that determined the competitiveness of the coconut oil industry were human resources, natural resources and the environment, technology, number of buyers and also the demand and supply of oil. Author suggested that with proper training and mentoring programs and use of latest technology in production and promotion increased competitiveness of industries.

2.3 Coconut processing sector scenario

Babu and Sebastian (1996) examined seasonal price behavior of coconut and its products in Kerala. He reported a distinct seasonal difference in the price from November to February for coconut and from August for copra and coconut oil. The lowest phase was from March to October for coconut and February to June/July for copra and coconut oil. It was found that the seasonal price behavior of coconut was being influenced by the seasonality in copra and coconut oil costs, which indicated the prevalence of a distorted market within the state.

Rani (2007) suggested that skilled human resources, traditional and modem production and processing technologies together provided coconut processing sector a great status in Indian agriculture.

Joseph (2008) in his study on technology linkages of coconut oil milling industry in Kerala indicated strong raw material and labour linkages that succeeded in creating employment opportunities across the state. But forward production linkage was very weak and the backward linkages were negligible with respect to both capital and technological support.

Murgesan (2008) observed the prevalence of high price fluctuations in coconut products like other agricultural commodities in the state of Kerala.

Coconut Development Board (2010) in its study conducted as a part of coconut technology mission found the food processing industries had not paid necessary attention for the diversification and value addition in coconut.

Poduval (2011) studied the importance of quality standards in world market of coconut products. He found that the standards were available only for a few coconut products like copra, coconut oil, oilcake, desiccated coconut and vinegar. The global level codex standards confined only to virgin coconut oil, desiccated copra and aqueous coconut products such as coconut milk and coconut cream.

Banu (2013) analyzed issues of desiccated coconut powder enterprises. The size wise analysis of the desiccated coconut powder enterprises showed higher profit of the large scale production units. This was attributed to their large scale of operation and maximum capacity utilization. Small units operated by maximizing their capacity and by increasing efficiency to maximize the profits.

Mannekote and Kailas (2013) examined diversified uses of value-added products from coconut oil. They highlighted the potential new uses such as the use of coconut oil for metal working fluid, two and four stroke oil, grease, transformer insulation oil and also as a bio fuel.

George (2014) in his study on neera supply chain suggested the setting up of an apex body that could bring together all the coconut producer companies under a single umbrella.

Jayanth and Begum (2015) revealed that value added coconut products had high demand in domestic markets. The products like desiccated coconut, coconut milk and milk powder were being used regularly by households. Both the traditional as well as the innovative products from coconut had high acceptance among the people.

Ashwini *et al*. (2020) reported that in enterprises facilitated by ABIs, virgin coconut oil (VCO) was the major product in 40 per cent of enterprises followed by coconut chips (20%), coconut chocolates (10%), desiccated coconut (07%), neera and tender coconut water-based drinks (07%).

2.4. Technology use in coconut sector

Hyman and Patterson (1991) studied the new approaches for developing small and medium scale coconut processing enterprises. The study assessed that most of the products yielding good revenue could be available to small producers with innovative technologies and this can be achieved though new form of business organization.

Halos (1999) attempted to study the trend in agricultural technology acquisition, development and dissemination. He argued that research and development activities are more to the particular technology when it is giving more relative advantage to the seller and user of the technology.

Rammohan (1999) studied the coir industries in Kerala and commented that the ongoing technological changes had more successful impact in improving the physical conditions of work and also in reducing the ecological consequences. But it was less effective in increasing productivity and income of workers.

Bawalan (2003) concluded that the most suitable coconut processing technology for producing a specific product was decided by the production capacity for the major product. It remained dependent on the market demand and the supply of resources. The processing technology selection depended on the type of equipment to be used and the corresponding degree of mechanization. The degree of mechanization in turn was determined based on the availability of power and cost of electricity in a particular region. Adoption of a technology process and equipment which did not match with the required production capacity resulted in high production costs and unprofitable operation.

Mendis (2010) reported that support of suitable technology use in coconut industry enhanced productivity effectiveness and cost efficiency of coconut sector in the Sri Lankan economy.

Jayasree (2013) reported that the implementation of Technology Mission on Coconut (TMoC) programme by Coconut Development Board (CDB) helped the coconut enterprises to solve the manufacturing constraints. Programme enabled large scale industrial adoption of many technologies in coconut product diversification.

Thamban *et al.* (2016) recommended strategies that stressed the implementation of a comprehensive coconut rejuvenation programme in Kerala to enhance productivity. They suggested for better technology integration and value addition along with a congenial policy environment.

Jaaffar *et al*. (2019) studied the strengths and weaknesses of coconut based furniture SMEs. They concluded that use of latest technologies increased the industry's ability to compete in the domestic market.

Tan *et al*. (2021) found the factors like economic association, application of science and technology, and cost-revenue ratio positively affected the technical efficiency level of coconut-based microenterprises. The authors also suggested that firms should have a reasonable scale-up plan in order to improve the technical efficiency.

2.5. Concept of technology capability (TC)

Lall (1992) stated that technological capability as a continuous process to imbibe and develop the knowledge related to technology from the interaction between environment and from experience and skill.

Bell and Pavitt (1995) opinioned that efficiency of a firm remained affected not only by external technology acquisition, but also depended on the capability of a firm to manage internal changes in technologies used in the manufacturing of products.

Panda and Ramanathan, (1996) defined the technological capability of a firm as the knowledge acquired by the enterprise through experience.

Lin (1997) analyzed technology management capability with focus on technology acquisition. A set of criteria were developed and indexes defined for the study. Based on these indexes, the firm's capability in transfer of technology was evaluated.

According to Pavitt (1998), firms developed their technological capability in an incremental manner. But the firms had limited options to continue with the knowledge they already knew. There was a cognitive limit to what a firm was capable of doing with new knowledge and learning.

Kumar *et al*. (1999) found that the factors like technological absorption ability, learning culture, government's role, and the mode of technology transfer affect the technological capability of the firm. The study also pointed out that the existence of a small research and development system for conducting research in firms would not be enough to generate technological capability in developing firms.

Calantone *et al*. (2002) concluded that learning leads a firm to innovate, which affects its performance. Accordingly, they argued that firms needed to focus on learning process to obtain competitive advantage in the market.

Schoenecker and Swanson (2002) described the best measure to calculate the technology capability of a firm was to find the firm's ability to introduce new products and upgradations made in the existing products. They pointed out that the new product announcements were a good representation of their technological capability.

Santhanam (2003) made critical observation in information technology capability and firm performance. The firm with higher technology showed sustainable performance compared to a medium performing industry.

Tsai (2004) defined technological capability (TC) as the ability of an enterprise to perform technical functions such as the development of new products, processes, and use of knowledge at improved levels of efficiency.

Hsieh and Tsai (2007) studied the relationship between technological capability, social capital and launch strategies for innovative products. They found that the social capital and technology capability had a positive correlation. But when market growth of firm increased the influence technology capability had on the launch strategy of innovative products became weaker.

Sirmon *et al*. (2007) described technological capability as the firms' ability to make maximum advantage to create value for customers and wealth for owners.

Renko *et al.* (2009) inferred in their study that technological capability had positive association with product innovativeness and also with capital invested in the company.

Zea *et al.* (2010) pointed out that with increase in networking capability and financial capability of an enterprise, the technology capability also increases and it contribute for greater internationalization of the firm.

Shamsuddin *et al.* (2012) observed that the technological capability was the ability of firms to undertake a range of productive tasks targeted to achieve specific objectives. But, there has been a large research scarcity in evaluating the concept and as such technological capability was not always considered in the measurement of a firm's performance.

Zawislak *et al.* (2012) concluded that enterprises that progressed in accumulating resources and competences developed higher technological capability than their competitors. Hence, technological capability helped those enterprises to get stable level of technical and economic efficiency.

Yu *et al.* (2013) in their research showed that technological turbulence improved the performance of network capacity and technology capability. Market turbulence increased network capacity performance, but had no significant negative impact on technology capacity.

Ahamad *et al.* (2014) reported technological capability to play a significant role in deciding the success of a company. It helped an organization to endure the dynamically changing market turbulence over a long period. Therefore, manufacturing companies have started to assess their level of technological capability and upgrade their current level.

Reichert and Zawislak (2014) reported that there was a positive relationship between the performance of a firm and the investments in technological capability. This holds well in case of smaller and medium firms while the larger firms invested more on research and development instead of technological capability.

Sobanke *et al.* (2014) found that both internal and external factors contributed to technological capability of a firm. Major internal factors included the in-house training of technical employees while technical collaboration with industrial associations was an important external factor.

Su *et al.* (2015) found that technological capability and marketing capability had synergistic effects in the performance of individual firms. Technological capability was suitable for responding to technological turbulence, whereas marketing capability could be used to respond to market turbulence. Besides these two, innovative capability and operational capability also influenced a firm's success.

Mori *et al*. (2016) suggested that technology capability helped the companies to understand their technology use behavior and potentials. It served as a tool to analyze performance and supported decision making. Technology capability also helped in constructing references for the technology dynamics of companies within an industry or region.

Lee *et al.* (2018) showed that there existed a positive linear relationship of technology capability on internationalization, market resource, human resource, customer satisfaction and annual sales growth rates. They studied the technology development ability and technology development career as the two aspects of technology capability and both were positively associated with the firm's performance.

Poudel *et al*. (2018) in their study related to technological capability and firm's growth over time, found entrepreneurial orientation was also positively related to technological capability of a firm.

Yi *et al.* (2018) in their study on the effect of entrepreneurship on corporate life found that marketing and operational capabilities of a firm supplemented early corporate life cycle and could maximize the technological performances.

Ahmed *et al.* (2019) argued technological capability as a critical factor which helped in the promotion of competitive advantage of firms along with other capabilities.

Lin and Lai (2020) suggested that technological capability is the principal factor in increasing competitive advantage of Small Medium Enterprises (SMEs). They proposed that the factors like knowledge sharing, talent training, cooperative relationships, innovation, and government support were critical in improving a firm's technological capability.

2.6. Measurement of technological capability (TC) of an enterprise

A compilation of different techniques used in the measurement of technological capability (TC) by different researchers is presented in the following table. It depicted the method employed in the measurement of TC along with the indicators used in the quantification.

Table 2.1 Methods adopted by researchers to measure technological capability

Sl. No	Authors	Method adopted	Variables / indicators used
1.	Katz (1987)	Proposed analytical framework for the measurement of TC	• Man hour • Quality improvement techniques • Addition of new technology • Raw material used for production *etc*.
2.	Lall (1992) and Figueiredo (2002)	Analysed the evolution of accumulation of TC and its rate with respect to the complexity of technology and firm's position	• Investments • Production • Advanced skill sets • Economic connections *etc*.
3.	Panda and Ramanathan (1996)	Used auditing methodology and matrix of indicators to categorize into low, medium and high	• Production • Marketing • Sales and service • Skills *etc*.
4.	Tremblay (1998)	Used comparative descriptive cases based on the variables selected	• Motivation and commitment towards changes • Leadership quality • Decision making ability

			• Communication channels • Information flow • Organizational structure *etc.*
5.	Biggs *et al.* (1995)	Analysis of individual indicators with respect to different class of workers	• Productivity • Technology efforts • Mechanism of learning *etc.*
6.	Neves (2000)	Developed an index based on technology development and production control	• Technology development • Qualification of the workforce • Planning • Process • Product engineering *etc.*
7.	Guan and Ma (2003)	Used a seven-point scale and average of each capability was calculated ,	• Learning capabilities of firm • Resource allocation • Production • Marketing • Strategic planning • Organizational planning *etc.*
8.	Jonker *et al.* (2006)	A comparative descriptive study of indicators	• Networking • Process efficiency • Process differentiation *etc.*
9.	Lu *et al.* (2007)	An index was made and the weights were assigned using Analytical Hierarchy Process (AHP)	• Innovativeness • Collaborations

			• Knowledge sharing • Market share and Investment • Introduction of new products *etc*.

2.7. Skill Gap in enterprises

Gabaly *et al*. (2003) discussed the role of Information and Communications Technology (ICT) in reducing skill gap in MSME sector. ICT is a crucial tool for industrial development and productivity improvement. Installation of an IT based units is critical as gap exists in this aspect. Setting up of proper educational institutes which provide IT training facilities in this sector can get sufficient supply of manpower for various kinds of innovative programs.

According to International Labour Commission (2008) skill development has been the most important factor in addressing the opportunities and challenges to meet the growing demands of changing economies in the era of globalization. There existed an urgent need to develop higher level skill sets related to professional, technical and human resource requirements.

International Labour Conference Report (2008) mentioned that skill development was the core idea for improving productivity. This helped to improve the living standard of the workforce and resulted in a positive effect on growth as the labours tend to perform in a more productive manner. An effective skill development system helped to create better employment opportunities which stimulated the growth of the country. It suggested that the education and training program needed periodic upgradation to improve productivity.

Skill Gap Report (2012) published by the National Skills Development Corporation (NSDC) discussed the skill gaps in the state of Punjab. Only a specific part of the state showed growth opportunities in MSME sector and the rest of the state was to capitalize the existing resources for future. Since the demand for skilled manpower was

on the rise, a proper mechanism needed to be developed to keep the workforce updated within the state. These efforts would surely improve the economic condition and the brain drain in the state.

Grimm *et al.* (2013) opinioned that the main objective of the governments of various developing and less developed countries was to create employment opportunities, but it was less implemented in their policy decisions. Hence, MSMEs in these countries were facing severe problems both socially and economically. Lack of credit, skills, expertise, lack of capacity building programs affected the expansion of business opportunities for MSME to a great extent and are restricting their growth in market.

Mehortra *et al.* (2013) in his paper reported that India may face decline in the growth of nonagricultural output because of non-availability of skilled manpower. Assessment of the skill gap is of greater importance before developing the skill development programmes in the country. The Vocational Education Training (VET) system in India is not sufficient to manage 5 million personnel a year. The public sector dominated the vocational skilling programs while private sector institutes were reluctant to train rural youth.

Chowdhury (2014) suggested for the collaboration of the existing vocational and general curricula with the involvement of industries in skill assessment. Further, she added the need of coordination among trainers, NGOs, government and policy makers in designing skill up-gradation policies so that the 'skill mismatch' in labour pool can be reduced.

Comyn (2014) proposed a broad platform for skill development activities to help people who wish to develop and upgrade their skills. He also put forward the idea of targeting the most vulnerable and less confident youth for special training programs supplemented with special programmes.

India Skills Report (2014) pointed out that skill is an important ingredient for any industry. Adequate supply of workforce will impact the future market potential. But the case of MSME is different, they have less the resources but it has the potential. Some of MSMES may have direct link with the market but understanding the market dynamics is not easy as this requires expertise and guidance.

Sanghi *et al* (2014) highlighted the skill challenges of MSMEs in India. According to them the biggest problem faced by the coconut sector was the lack of availability of skilled labour. The labour quality was mainly affected by poor education and lack of adequate vocational training.

MSME Report on Skill Development (2015) focused on various skill development initiatives implemented by the government of India with the help of various stakeholders. As the government tried to give more importance to skill development, the individuals as well as entrepreneurs got equal weightage in the skill development activities.

Padhi (2015) based on the observations in his paper stated that the responsibility of skill formation lies with the enterprises. The firms had to retain skilled workers by paying higher wages and the division of labour made the firms to target for larger volume of output and more profits. Skill gap could be reduced by enhancing firms' ability to pay higher wages and encouraging the skilled workers. Author also suggested that in-house training by firms could be more profitable than depending an outside entity for training and capacity development.

Survey report of the Skill Development India (2015) found that the skill development atmosphere in India has been more interested in the formal education system with less vocational training. The survey pointed out that there existed a huge gap between the industry requirements and the skills available with the workforce. The reasons identified for this gap were the lack of training infrastructure, outdated curricula, imbalance between employability skills and education system and also high industry reference standards.

2.8. Studies based on Analytical Hierarchy Process (AHP)

Wind and Saaty (1980) revealed the applications of AHP in marketing. They suggested AHP as an efficient tool for the allocation of resources and marketing management. AHP also supplement the researchers to decide the direction of new product development and in the evaluation of marketing mix strategies.

Triantaphyllou and Mann (1995) examined some of the practical and computational issues involved when the AHP method was used in engineering applications. They found Analytic Hierarchy Process (AHP) as an effective approach in dealing with problems of decision making.

Bhutta and Hug (2000) provided a comparison of the two approaches and attempted to look at how AHP could be modeled to take advantage of Total cost of Ownership (TCO) in finance management and make it more robust.

Sanjay *et al.* (2000) developed AHP model based upon the views of various experts. A well researched methodology has been adopted for the synthesis of priorities and the measurement of consistencies. A consistency ratio has also been calculated. Industries have been classified into small scale, medium scale and large scale. Various criteria for vendor selection process as received from the experts were identified. These criteria have been compared using average matrix, priority matrix and overall priority matrix. After analysis of the results it has been found that for large scale industries, vendor reliability, product quality and vendor experience were the top three vendor selection problems that needs to be taken up on priority for effective vendor selection.

Ahmad and Raja (2006) addressed the multi-objective criteria pertaining to supplier selection process by a combination of Quality Function Deployment (QFD), Analytical Hierarchy Process (AHP) and Preemptive Goal Programming (PGP) techniques. QFD facilitates in blending the requirement for suppliers and supplier evaluating criteria. AHP was then used in systematically prioritizing the relative importance of the requirements enumerated as part of the QFD. Finally, PGP aided in the

formulation to maximize the value proposition and to minimize the cost involved by exploiting volume discounts

Noorul Haq *et al.* (2006) proposed a structured model for evaluating vendor selection using the analytical hierarchy process (AHP) and fuzzy AHP.

Xu and Li (2007) proposed a multiple phase supplier sorting model based on the supplier development orientation. The model had been classified into three phases viz. selection phase, preselection phase and evaluation and development phase. They proposed the methodology including AHP to evaluate the supplier performance and supplier capacity.

Bai (2008) proposed a vendor selection multi-criteria problem emboding the subjective evaluation of decision-makers. It has been widely used to ascertain the weights of rules for vendor selection. He also developed a new general evaluation method based on the method of AHP and fuzzy AHP.

Tahriri *et al* (2008) discussed different selection methods concerning supplier selection and the advantages and disadvantages of selection methods, especially the Analytic Hierarchy Process (AHP), are illustrated and compared. Among the other methods AHP was more efficient in supplier selection.

Kumar and Mahapatra (2009) used a fuzzy approach to deal with the supplier selection problem in supply chain. The method is based on hierarchical Multiple Criteria Decision Making (MCDM) using fuzzy approach to select suitable supplier. In such problems of decision-making, all the decision makers are assumed to be equally important resulting in impractical aggregation of decision. Therefore, an analytic hierarchy process (AHP) which is based on Eigen value has been proposed to derive the weightages of decision makers. Then, the weightages of decision makers are incorporated with fuzzy decision-making paradigm to arrive at robust selection of suppliers.

Pang (2009) proposed fuzzy comprehensive method for evaluating the suppliers based on AHP. The method combines AHP and fuzzy theory and provides a comprehensive evolution method for choosing partner of supply chain.

Qureshi (2009) proposed a methodology based on combined approach of Analytic Hierarchy Process (AHP) and Graph theory. With this he suggested solutions to solve a real case problem of multinational companies (MNCs) in their logistic outsourcing assignments and become a vital in the logistics outsourcing.

Wang (2009) developed a model based on the AHP method which was applied to provide a framework for the organization to select a supplier that satisfied the customer specifications. They also could change the assessment indicator system slightly to apply the framework supplied by the selection model in any other industry.

Zhenhua (2009) proposed an AHP based method for supplier selection process. Firstly he constructed a comparison matrix to assess the alternatives using AHP. In this method the known data was fully used and the influence of personal factor was avoided.

Chan and Chan (2010) studied the fast-changing fashion market where adaption was the key to survival. The study used AHP in problem selection of the industry by checking their operational performance indicators like flexibility, cost, and delivery. The AHP model was used for solving the supplier selection problem in the apparel industry.

Paramasivam *et al.* (2010) conducted a study in selecting the factors affecting decision making in equipment selection. The selection process was a difficult a task because the equipment features varied consistently from one manufacturer to another. The quality, cost, and reliability of a product were considered in proper equipment selection. The study used Analytical Hierarchical Process (AHP) in decision making along with two other decision-making procedures. AHP provided selection basis on different alternatives considered and helped the selection of equipments with respect to the manufacturing environment requirements.

Bhandari *et al*. (2018) in their study related to the use of advanced manufacturing technologies (AMT) in small and medium enterprises (SMEs) used AHP. They made a comparison between traditional manufacturing systems and inferred SMEs could improve their performance by judicious application of AMTs in their manufacturing processes.

Sulistiyowati and Jakaria (2018) studied the methods for determining the level of technological content through the components of technology in small and medium enterprises (SME). They used Technometrics and Analytical Hierarchy Process (AHP) for deriving the results. Technometrics was used to assess the contribution of technological components and AHP method was used to assess the normalization of the weighting of each criterion under the component.

Research Methodology

CHAPTER 3

RESEARCH METHODOLOGY

Research methodology is described as the scientific techniques and procedures applied for the systematic theoretical analysis in research studies. The chapter on research methodology comprises the research design, locale of the study, selection of sample, method used for data collection, selection and measurement of variables, development, pre-testing and use of the data collection tools, and the statistical methods used in the analysis of the collected data for result interpretation.

The present study is focused on the analysis of technological capability of coconut-based enterprises in selected districts of Kerala and the chapter includes the methods and procedures adopted in the conduct of the research work. The details are systematically organized and presented under the following sub-headings.

3.1. Research design of the study

3.2. Location of the study

3.3. Selection of study sample

3.4. Selection and measurement of variables

3.5. Methods of data collection

3.6. Statistical tools used in the study

3.1 Research design of the study

Kerlinger (1986) defined research design as a plan, structure and strategy of investigation purporting to answer research questions and control variances.

According to Kothari (2017) research design form a plan, a roadmap and blueprint of investigation strategies conceived to obtain answers to research questions within the time frame and available resources.

In the present research study, ex-post facto research design was used as the researcher did not have any direct control over the studied variables as their manifestation had already occurred and as such could not be further manipulated (Kerlinger,1964)

3.2. Location of study

In the state of Kerala, the study was carried out in the three randomly selected districts of Thrissur, Ernakulam and Kozhikode (Figure3.1). The three districts were selected based on the presence of maximum number of registered Micro, Small and Medium enterprises (MSMEs) in coconut compared to other districts of Kerala. The details of registered MSMEs in coconut were collected from the District Industries Centres (DICs) and Coconut Development Board (CDB) for the period 2019-20 and is presented in Table 3.1.

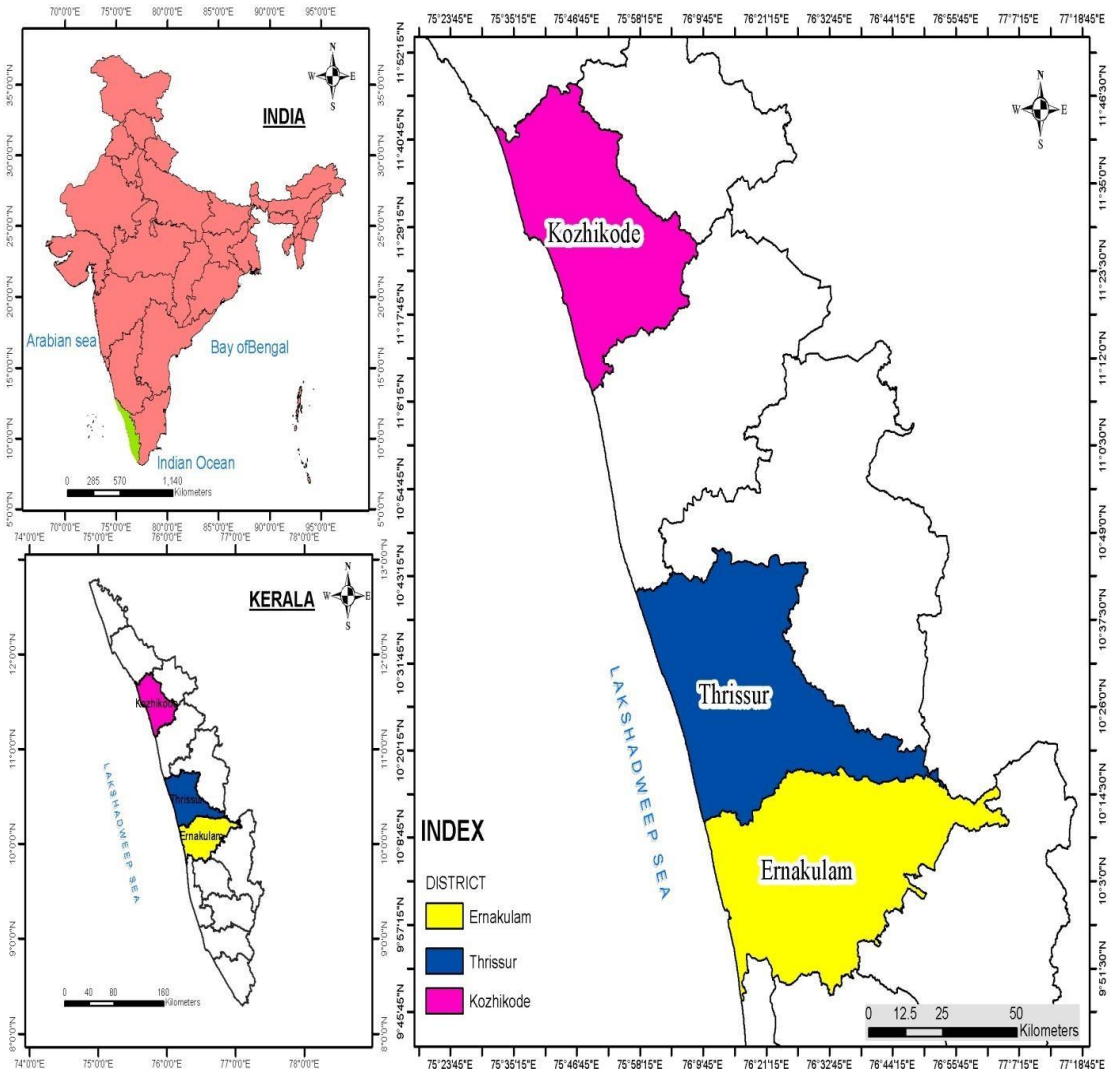

Figure 3.1 Location of study

3.3. Selection of sample

Registered coconut enterprises were recorded from all the 14 districts of the state. The three districts viz. Thrissur, Kozhikode and Ernakulam which had the largest number of registered coconut processing enterprises were selected as the study area (Table 3.1). Details of MSMEs collected from the respective District Industries Centres were used for the purposive selection of these districts. The enterprises under farmer collectives using the technological support from Coconut Development Board functioning in these districts

were also included under the study. The criteria followed in the selection of enterprises were minimum three years' experience in coconut entrepreneurship and market presence of the products. The total sample size of enterprises was fixed as 45 following the ratio of 20:10:15 in proportion to the number of registered coconut MSMEs in the selected districts of Thrissur, Ernakulam and Kozhikode respectively. Additional eight social enterprises run by farmer collectives in the selected districts were also selected from these districts following the selection criteria. A total of 100 skilled workers involved in technology use in these enterprises were also selected as respondents in the study. Thus, the total sample size of the study was 153 comprising of the 45 MSME coconut entrepreneurs, 08 FPO CEOs and 100 skilled workers. The flow diagram showing the sample selection is presented in Figure 3.2.

3.4. Methods of data collection

Quantitative survey design for data collection has been employed in the study. Two separate pretested interview schedules made specifically for entrepreneurs and for the technology operators in an enterprise was used for the data collection **(Appendix I**). In Thrissur and Kozhikode districts data was collected through personal interviews in the months of January-March 2021. However, due to the Covid 19 pandemic and lock down restrictions imposed, data collection from Ernakulam district was done using prefixed telephonic interview, video calls and online survey forms (Google forms).

3.5. Selection and measurement of variables

Based on review of literature and expert consultancy variables were selected for each of the specific objectives set for the study. The selected variables were categorized into dependent variables, and independent variables and are presented under the following sub-heads.

Table: 3.1 Number of coconut based MSMEs registered in different districts of Kerala

Sl. No	Name of districts	No. of registered MSMEs in coconut
1.	Thiruvananthapum	50
2.	Kollam	17
3.	Alappuzha	13
4.	Pathanamthitta	5
5.	Kottayam	15
6.	Idukki	9
7.	**Ernakulam**	**86**
8.	**Thrissur**	**125**
9.	Palakkad	24
10.	Malappuram	32
11.	**Kozhikode**	**77**
12.	Wayanad	6
13.	Kannur	29
14.	Kasaragod	15

(Sources: District Industries Centres and Coconut Development Board (2019-20))

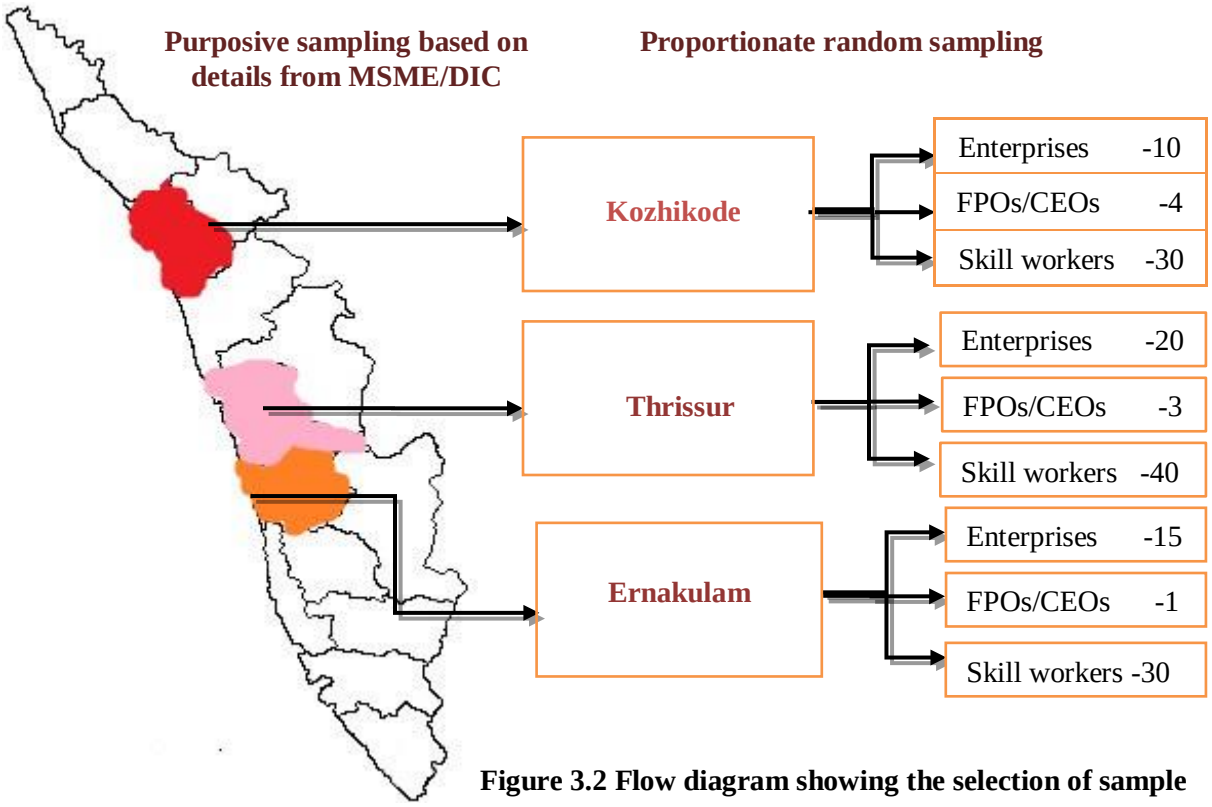

Figure 3.2 Flow diagram showing the selection of sample

3.5.1. Dependent variables

The dependent variables selected under the study based on the objectives were as follows:

1. Technological capability of coconut-based enterprises
2. Technology use pattern in coconut-based enterprises

3.5.1.1 Technological capability

Technological capability has been conceptualized as the ability of a firm to execute any relevant technical function that include the ability to develop new products, processes, technological knowledge and skill in order to obtain higher levels of entrepreneurial efficiency (Tsai, 2004).Variables used by Mori *et al.* (2016) in the technology capability index (TCI) was adapted with suitable modifications to measure the technological capability of the selected enterprises in the study.

3.5.1.1.1. Technology capability index (TCI): The technology capability index (TCI) was used in the measurement of the technological capability of coconut enterprises selected under the study. The index used multiple attributes related to the macro and meso level indices which was adapted from Mori *et al.* (2016) and is presented in Figure 3.3. The adapted model used four macroindexes that covered (1) Resources (R); (2) Level of technology use (TU); (3) Market competence (MC); and (4) Coordination and accessibility (CA). These four macroindexes in turn consisted of mesoindexes measured using specific indicators. The mesoindices related to Resources (R) were Investment (I), Human Resource (HR), Infrastructure (IS) and Asset position (AP). The macroindex of Level of Technology Use (TU) had the mesoinexes related to Preprocessing (PP), Processing (P), Packaging Technology (PT) and Distribution (D). The macroindex, Market competence (MC) had the mesoindex comprising of Branding (B), Packaging (Pkg), Certification (C) and Promotion of the product (PM). The macroindex Coordination and accessibility (CA) was composed of Technology Information access (TI), Facilitating Services (FS), Skill Upgradation (SU) and Risk and Safety amenities (RS). The indicators of each mesoindexes and the scores are given in **Appendix II**. The indicators and abbreviations are presented in Table 3.2

Table 3.2 Indicators and abbreviations used in Technological Capability Index (TCI)

Sl. No	Indicators	Abbreviations
1.	Percentage share in innovative activities	**I_1**
2.	Percentage spent for training per year	**I_2**
3.	Technically qualification of workers	**HR_1**
4.	Years of experience in technology use	**HR_2**
5.	Introduction of new technology/innovation in last three year	**IS_1**
6.	Power facility	**IS_2**
7.	Distribution amenities	**IS_3**
8.	Networking	**IS_4**
9.	Ownership	**AP_1**

10.	No. of buildings	**AP_2**
11.	Quality check in preprocessing stage	**Pp_1**
12.	Type of preprocessing technology used	**Pp_2**
13.	Number of processed products	**P_1**
14.	Type of processing technology used	**P_2**
15.	Use of green technology	**P_3**
16.	Waste management system	**P_4**
17.	Type of packaging technology used	**PT_1**
18.	Availability of vehicles	**D_1**
19.	Channels for distribution	**D_2**
20.	Branding status of products	**B_1**
21.	Trade mark	**B_2**
22.	Type of packaging material used	**Pkg_1**
23.	Use of eco friendly packaging material	**PKg_2**
24.	Compilation of registration standards	**C_1**
25.	Method of promotion	**Pm_1**
26.	Market position	**Pm_2**
27.	Contact with R&D agencies	**TI_1**
28.	Contact with training centers	**TI_2**
29.	Recipient of grants/subsidies	**TI_3**
30.	Contract with suppliers	**FS_1**
31.	Visit to similar industries	**FS_2**
32.	Participation in seminar,conferences *etc*	**FS_3**
33.	In house skill upgradation facilities	**SU_1**
34.	No. of training programmes attended	**SU_2**

35.	Incentives for skill upgradation	**SU_3**
36.	Insurance coverage	**RS_1**
37.	Safety amenities	**RS_2**

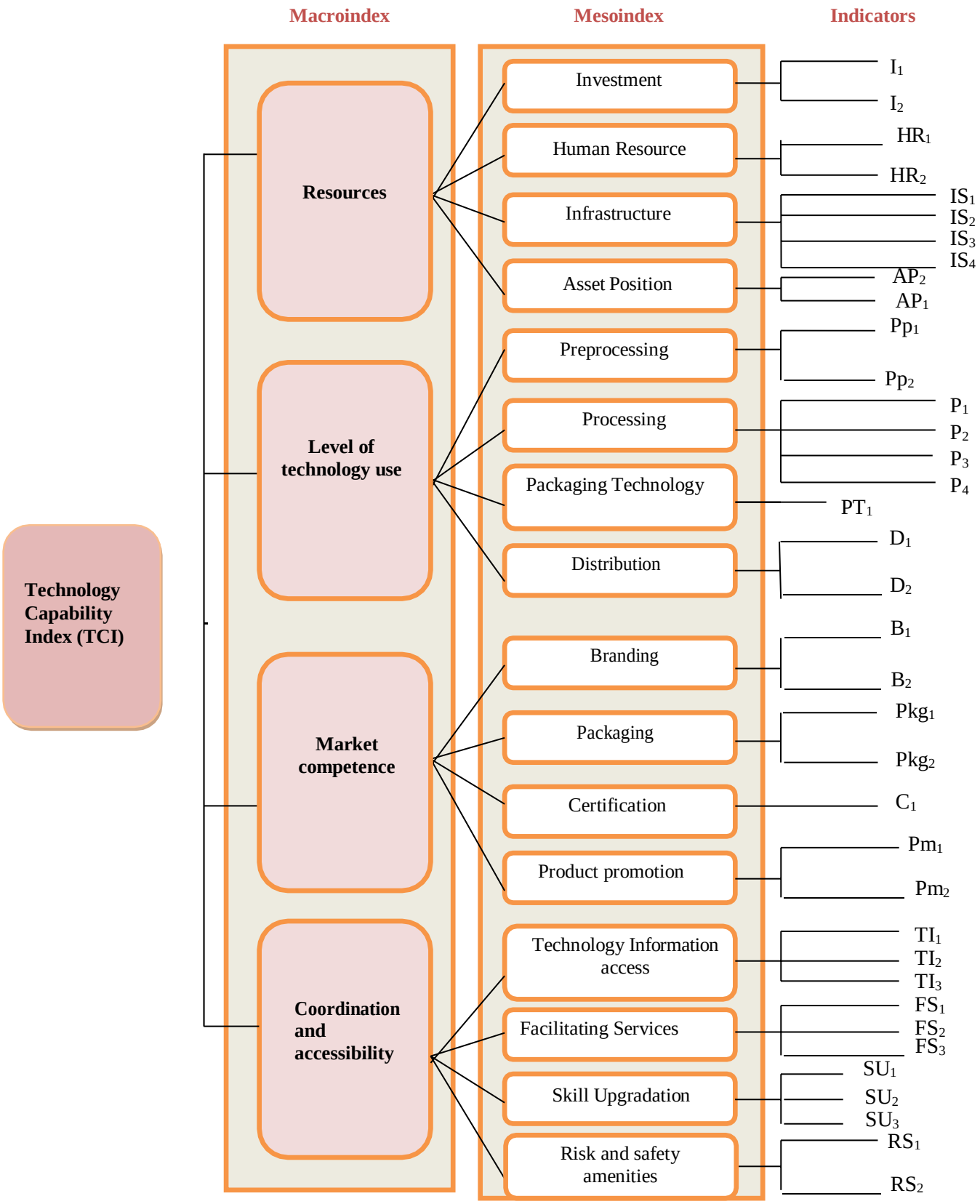

Figure 3.3 Measures used in Technology Capability Index (TCI)

The calculation of index was characterized by a one-dimensional score by embedding the standardized indicators based on a set of weights using the equation (1) adopted from Lu *et al*. (2007).

$$TCI = \sum_{i=1}^{n} \square_i \bar{\square}_i \text{ ----------(1)}$$

where TCI is the Technology Capability Index, X_i the normalized variable, w_i the weights of X_i, $\sum_{i=1}^{n} \square_i = 1$ and $0 \leqslant wi \leqslant 1$, and i = 1, …, *n*.

Determination of weights using Analytical Hierarchical Process (AHP)

The determination of the weight set was made based on the results from Analytical Hierarchy Process (AHP) proposed by Saaty (1991). The steps followed in the establishment of weight sets according to the AHP procedure is presented as follows:

(1) Formulation of index architecture

A hierarchy was made based on the thorough evaluation of related literature and interviews conducted with experts from the field of research as given in Figure 3.4

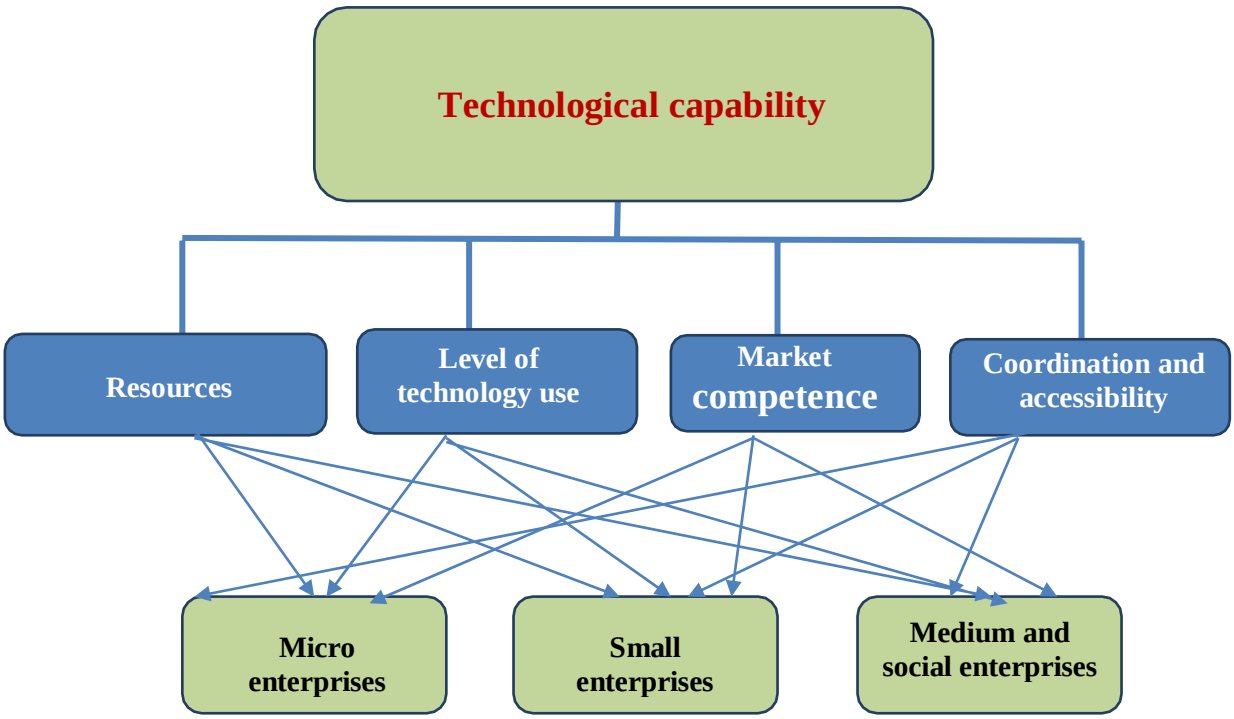

Figure 3.4. Index architecture developed for AHP

(2) Pairwise comparative judgments on the selected components:

Establishment of the priorities among parameters or criteria among the hierarchy by making a series of judgments based on pair wise comparisons. In this step the preference among the parameters were rated on the Saaty scale rating on 1-9 continuums as presented in Table 3.3. Pair wise comparison matrices were constructed and based on the similarities and average values of these judgments a final synthetic judgment matrix which decided the set of weights was constructed.

Table: 3.3 Saaty scale for pair wise comparison

Sl. No	Definition	Scale
1.	Equal importance	1
2.	Moderate importance of one over another	3
3.	Essential of strong importance	5
4.	Very strong importance	7
5.	Extremely important	9
6.	Intermediate values between two judgments	2,4,6,8

(3) Calculation of priority vectors:

In this step with respect to the synthetic judgment matrices constructed the eigenvector (equation 2) and the maximum eigen value (equation 3) was calculated.

$$W_i = [\prod_{j=1} a_{ij}]^{1/n} / \sum_{k=1}^{n} [(\prod_{j=1} a_{ij})^{1/n}] \quad \text{---------- (2)}$$

Where, aij is elements of pairwise comparison matrix between indicator i and indicator j

n is matrix size w_i is weight of indicator i

$$\lambda_{max} = 1/n(\sum_{i=1} \lambda' / \lambda_i) \quad \text{----------(3)}$$

Here λ' is the largest eigenvalue of the pair wise comparison matrix and λ_i is the eigen value of indicator i.

(4) Consistency assessment:

After performing pairwise comparison the consistency of the evaluations made by the judgements were checked. The consistency degree was obtained by dividing the consistency index (CI) (equation 4) and randomness index (RI) values from Saaty table

presented as Table 3.4. According to Saaty (1991) RI values are calculated by the average CI value obtained by randomly generated reciprocal matrices. If the degree of consistency (CR) is greater than 0.1 (10.0 %), it is advised to recheck the pairwise comparison matrix.

$$CI = \lambda_{max} - n / (n-1) \text{ ----------(4)}$$

Where λ_{max} is the maximum eigen value and n is the matrix size

Table 3.4 Random Index (RI) values for small problems

n	2	3	4	5	6	7	8	9	10
RI	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.51

1.5.1.2 Technology use pattern in coconut enterprises

Theoretical generic typology of knowledge, skill and competences (KSC) developed by Bloom and colleagues in the 1960s, generally known as Bloom's taxonomy, was adopted to assess the technology use pattern of the enterprises in the study. The typology is based on three domains of educational activities viz. cognitive, affective and psychomotor. The cognitive domain related to the cognitive skills (knowledge), the affective domain related to the feelings or emotional areas (attitudes), and the psychomotor domain concerned with manual or physical skills (performance skills). Based on this theoretical frame, the technology use pattern of an enterprise was operationalized as the skill gap of workforce competence which served as the key source of its performance and competitive advantages. Thus, the socio-psychological concept of technology use followed in the study enabled the integration of the soft and hard skill competencies of the users.

3.5.1.2.1 Measurement of skill gap

As a psychological construct skill formed an inherent part of learning and was defined in terms of the complexity of the activities involved with respect to production processes as perceived by the workers or the management of an enterprise (Attewell, 1990). It formed a complex ability to reinforce positive traits and socially accepted behavior that promoted interactions among the members (Libet and Lewinsohn,1973).

These conceptualizations of skill integrated soft skill competencies related to communication, interpersonal relations along with hard skills like technical competence, problem solving and decision-making, part of the required skill set competencies for workers. Thus, the technology use pattern in an enterprise was operationalized in terms of the skill gap in workforce competences of the enterprise. This prevented the enterprise to grow or to remain competitive as its employees to fit into the specific job. Thus, the performance of the enterprise will be hindered by skill gap due to low productivity and lack of quality (Bennett and McGuinness, 2009).

Based on these conceptualizations, the study adopted the skill gap analysis scale developed by Manjunath *et al.* (2019) in the study. It was used to identify the relationship between skills of work force and technological capability of the enterprises studied. The skill gap scale consisted of 17 items related to communication skill (CS), technical skill (TS), problem solving skill (PSS), interpersonal skill (IPS) and decision-making skill (DMS). The reliability of the selected scale constructs was measured using Cronbach's Alpha on a pretest sample of 30 selected from the non sampling area in Malapuram district. The alpha value derived for the scale items was 0.90, which indicated that all the constructs were reliable to give consistent results for further analysis. The validity of the scale was also checked based on content validation by expert judgments.

The data on skill gap was collected on a five-point Likert scale with responses strongly agree (5), Agree (4), neutral (3), disagree (2) and strongly disagree (1) using the schedule included as **Appendix I.** The minimum and maximum possible scores were determined as 17 and 85 respectively and had the percentage equivalent at 20 and 100 respectively. The scale was used to collect the skill perception of both entrepreneurs (expected) and workers (actual). Based on the summated scores calculated from the data the skill gap was calculated using the following equation.

Perceived skill gap = Perceived skill competence of workers – Expected skill competence as perceived by entrepreneurs

1.5.1.3. Mapping of technology use pattern in coconut enterprises

As conceptualized based on theoretical perspectives, technology use pattern of an enterprise was mapped based on the skill sets of the workers related to communication skill (CS), technical skill (TS), problem solving skill (PSS), interpersonal skill (IPS) and decision-making skill (DMS). These skill sets determined the level of technology use and in turn the performance of the enterprise. The perceptual mapping tool of correspondence analysis proposed by Bendixen (1995) was used in the analysis. It is a multivariate graphical technique designed to explore the relationship among the categorical variables studied. In the study it enabled to learn which attributes workers associated with perceived skill gap in a particular category of enterprise. In this the matrix scores were considered proportional to the independence of Chi square statistics.

3.5.2. Independent variables

Based on the objectives of the study, the independent variables were selected through extensive review of relevant literature and expert consultancy. Each selected variable was operationalized in relation to the requirements of the present research The independent variables selected under the study and the measurement techniques employed are discussed under the following sub-heads.

3.5.2.1. Socio economic profile of coconut entrepreneurs

Variables selected to profile the socio-economic characteristics of coconut entrepreneurs selected in the study included personal, socio-economic and psychological variables. The selected variables along with their measurement techniques followed in the study are presented in Table 3.5 (A).

Table 3.5 (A). Measurement tools used to profile coconut entrepreneurs

Sl. No.	Independent variables	Measurement tools
A.	**Socio-personal attributes**	
a)	Age	Chronological age
b)	Gender	Schedule developed
c)	Education	Chandargi (1994)
d)	Occupational status	Sahu (2014)
e)	Extension contact	Mohammad (2006)
f)	Mass media exposure	Narayan (2005)
g)	Social participation	Sundaran (2016)
B.	**Economic attributes**	
a)	Asset ownership	Schedule developed
b)	Annul income	Schedule developed
C.	**Psychological attributes**	
a)	Managerial competency	Adapted use of scale by Gabriela (2016)
b)	Entrepreneurial orientation	Modified use of scale by Covin and Wales (2012)

3.5.2.1.1. Socio-personal attributes

a. Age

Age of coconut entrepreneurs was estimated in terms of their completed chronological age as reported by them during the study. The collected data was

categorized into three groups following the method used by Census of India as youth (up to 35 years), mid age (36 to 50 years) and senior age (above 50 years) (Government of India, 2011). The scoring pattern adopted for the different categories has been given as follows.

Sl. No.	Age group	Score
1.	Youth (Upto 35 years)	1
2.	Mid age (36 - 50 years)	2
3.	Senior age (> 50 years)	3

b. Gender

Gender was conceptualized in terms of male or female by birth with socio-cultural differences in adopted roles and functions. It was recorded as directly stated by the respondent at the time of data collection. It was hypothesized to have effect in the different capabilities and skill needed in coconut processing sector and was grouped into two categories with scores as indicated below.

Sl. No	Gender	Score
1.	Male	1
2.	Female	2

c. Education

Education was defined as the manifestation of desirable changes in the behavior of a person which influenced his knowledge, skill, attitude and action. It was measured as the number of years of completed schooling as reported by him. The procedure adopted by Chandargi (1994) was used and the entrepreneurs were categorized as described below.

Sl. No	Educational level	Score
1.	Illiterates	1
2.	Primary school	2
3.	Middle school	3
4.	High school	4
5.	College/JOC	5

d. Occupational status

An individual would depend on different primary as well as secondary sources of income for livelihood in his life. Occupation status of an individual can be defined as the major employment source from which he gained his income for livelihood. The method of scoring followed by Sahu (2014) was modified for the study and the respondents were classified into following groups with the respective scores detailed below.

Sl. No.	Occupational categories	Score
1.	Only business	4
2.	Farming and service jobs	3
3.	Farming and business	2
4.	Agriculture (Farming)	1

e. Extension contact

Extension contact covered both the connection of respondents with extension personnel of different ranks and frequency of contact with them. It was assessed using the scale followed by Mohammad (2006). The scale measured extension contact in

terms of the frequency with which the entrepreneurs met the MSMEs offices in respective districts, DICs, Industrial Extension officer, Officials in CDB, scientists of Centre for plantation crops and Research Institute (CPCRI) and agricultural scientists of the University/ research stations and also with Agri Business Incubators (ABIs). The scoring system adopted was 5, 4, 3, 2, 1 and 0 for weekly, fortnightly, monthly, half yearly and yearly contacts respectively as presented below. Based on the distribution of the scores on quartile range, the entrepreneurs were classified into three groups viz. Low contact (Below Q1.) Medium contact (Below Q2) and High contact (above Q3).

Sl. No.	**Extension personnel/ agency**	**Weekly 5**	**Fortnightly 4**	**Monthly 3**	**Half Yearly 2**	**Yearly 1**
1.	District MSME					
2.	DICs					
3.	Industrial					
4.	Coconut					
5.	Centre for					
6.	Agricultural					
7.	Agri Business					

f. Mass Media exposure

Mass media exposure is referred as the degree to which mass media platforms like radio, television, newspapers, magazines etc. are utilized by the entrepreneurs. The technique followed by Narayan (2005) was adopted and the response was noted on a three-point continuum scale with responses regularly, occasionally and never with scores of 2, 1, and 0 respectively as given below. Based on the distribution of the scores on

quartile range, the entrepreneurs were categorized into three groups viz. Low mass media exposure (Below Q1.) Medium mass media exposure (Below Q2) and High mass media exposure (AboveQ3).

Sl. No.	Mass media sources	Regularly 2	Occasionally 1	Never 0
1.	Newspaper, magazines, leaflets, bulletins			
2.	Radio			
3.	Television			
4.	Exhibitions			
5.	Seminars			
6.	Social media			

g. Social participation

The extent of participation of the respondents in various formal organizations is considered as the measure of social participation. The frequency of meetings attended by the respondents was recorded in terms of regular participation, occasional participation and non-participation with scores 2, 1 and 0 respectively as was followed by Sundaran (2016). The respondents were categorized based on quartile range into Low participation (Below Q1.), Medium participation (Below Q2.) and High participation (Above Q3).

Sl. No	Frequency of participation	Score
1.	Regular participation	2
2.	Occasional participation	1
3.	Non participation	0

3.5.2.1.2. Economic attributes

a. Asset ownership status

Asset ownership includes the legal rights related to ownership of different assets that are detained by an enterprise. This was assessed in terms of the number of buildings owned by the enterprise for its operation and the entitlement of ownership over the land and buildings. Varying scores were assigned for leased or rent (1), conversion within owned household (2) or separate facility on owned land (3) recorded from the entrepreneurs. Also, separate scores of 1, 2 and 3 were given based on the number of buildings owned as presented below. The summated scores for ownership status and number of owned buildings together gave the measure of asset ownership status.

Sl. No	Asset ownership status	Score
I	**Ownership**	
1.	Leased or rent	1
2.	Conversion with owned household	2
3.	Separately owned	3
II	**Number of buildings owned**	
1.	Only one	1
2.	Two to three buildings	2
3.	More than three buildings	3

b. Annual income

Annual income is regarded as the additional income to the respondent's family from different sources like farming, other businesses etc. during a financial year indicated in terms of rupees. The annual income respondents were classified in to seven groups and scores are allotted based on the method developed by Sinha (2016).

Sl. No	Annual income (in Rs)	Score
1.	100000 to 150000	1
2.	150000 to 200000	2
3.	200000 to 250000	3
4.	250000 to 300000	4
5.	More than 300000	5

3.5.2.1.3. Psychological attributes

a. Managerial competency

Managerial competency was defined as a set of qualities necessary to perform specific tasks to achieve organizational performance. The possession and efficient use of such competencies bring effective staff management and aid the fulfillment of goals within an enterprise. The scale used by Gabriela (2016) was adopted with suitable modifications in statements and measurement to suit the study. The scale consisted of ten statements measured on a five-point continuum of strongly agree (SA), agree (A), Neutral (N), disagree (D) and strongly disagree (SD) and the weights of 5,4,3,2 and 1 respectively for positive statements and scoring were reversed for negative statements. The scale used for the assessment is included in **Appendix I.** The summation of the score for the individual statements gives the managerial competency of the entrepreneurs. The distributions of the scores were measured on the quartile range. The respondents were categorized in to three groups of Low managerial competency (Below Q1), medium managerial competency (Above Q2) and high managerial competency (Above Q3).

1. Entrepreneurial orientation

Entrepreneurial orientation is the extent to which entrepreneurs show interest to take risk, their orientation towards change and innovation. The scale used by Covin and Wales (2012) was used with suitable modifications. Entrepreneurial orientation was studied as a multidimensional construct with innovativeness, proactiveness, and

risk taking as its dimensions. The scale consisted of eighteen statements measured on a seven-point continuum of strongly agree (SA), agree (A), Partially agree (PA) Neutral (N), disagree (D), Partially disagree (PD) and strongly disagree (SD) and the weights of 7,6,5,4,3,2 and 1 respectively for positive statements (given as **Appendix**). The scoring was reversed for the negative statements. The result was calculated as an average value for the items included in a given dimension.

1.5.2.2. Socio economic profile of coconut enterprises

The coconut enterprises surveyed were profiled based on identified socio-economic variables related to economic characteristics and product attributes of the enterprise. The identified parameters and the measurement tools used in the study are depicted as Table 3.5.(B).

Table 3.5 (B). Socio-economic variables of coconut enterprises and its measurement

Sl. No.	Independent Variables	Measurement tools
A.	**Economic attributes**	
a)	Age of enterprise	Scoring based on schedule developed
b)	Type of enterprise ownership	Scoring based on schedule developed
c)	Annual turnover and investment	Scoring based on schedule developed
d)	Number of employees	Scoring based on schedule developed
e)	Credit availability	Sharma (2013)
f)	Infrastructure facilities	Scoring based on schedule developed
g)	Supply and value chain competence	Scoring based on schedule developed
h)	Economic feasibility measures	B:C ratio, IRR and NPW

B.	**Product attributes**	
a)	Product diversity	Scoring based on schedule developed
b)	Quality assurance standards	Scoring based on schedule developed
c)	Product diversification potential	Product diversification index
d)	Market competitiveness	Based on price spread and time lag

A. Economic attributes

a) Age of the enterprise

The age of an enterprise is calculated in terms of years. It is the difference between the year the enterprise opened for business to the year the study is conducted. The enterprises are grouped in to three categories and scores were allotted as given below.

Sl. No	Age of the enterprise	Score
1.	Less than 5 years	1
2.	5 to 15 years	2
3.	15 to 25 years	3
4.	More than 25 years	4

b) Type of enterprise ownership

The type of business ownership was operationalized as the number of persons who legally serve as owners of the enterprise and manage its operations. The enterprises were categorized based on three basic forms of ownership viz. sole proprietorship, partnership and social enterprises run by farmer collectives (FPCs and cooperatives). The scores allotted for the respective category is presented below.

Sl. No	Type of ownership	Score
1.	Social enterprises	1
2.	Partnership	2
3.	Sole proprietorship	3

c) Investment and annual turnover

Investment is referred to as the allocation of money expecting a benefit in future and annual turnover is calculated in terms of yearly sales or yearly receipts in business activity. The composite criteria based on (i) investment in plant and machinery; and (ii) turnover of the enterprise. by MSMEs (2020) were adopted for categorizing the enterprises and scoring pattern adopted is presented below.

Sl. No	Investment	Turnover	Score
1.	Less than Rs.1 Crore	Less than Rs.5 Crore	1
2.	Less than Rs.10 Crore	Less than Rs.50 Crore	2
3.	Less than Rs.20 Crore	Less than Rs.100 Crore	3

d) Number of employees

Employees are the ones who contribute productively for the success of an enterprise. The number of employees in an enterprise is a measure of the size of the enterprise. The number of employees in enterprises is classified in to three groups and scores were allotted as given below.

Sl. No	Number of employees	Score
1.	Less than 5	1
2.	5 to 20	2
3.	More than 20	3

e) Credit availability

Credit availability of an enterprise is conceptualized as the easiness in the accessibility of credit from various financial institutions or other sources of credit. In the study the credit availability was measured using the scale developed by Sharma (2013). The entrepreneurs were asked to rate the sufficiency of their credit availability from different sources on a three-point rating scale of available, partially available and sufficiently available with credit scores of 1, 2 and 3 respectively as given below.

Sl. No	**Credit support**	Score
1.	Not available	1
2.	Partially available	2
3.	Sufficiently available	3

f) Infrastructure facilities

Infrastructure facilities of enterprises was assessed in terms of the basic physical structures and facilities (eg. buildings, roads, power supplies) needed for the efficient operation of an enterprise. It includes the latest technology, uninterrupted power supply, distribution amenities owned by the enterprise and also the method by which the enterprise is networking with its customers. Based on the responses from the respondents the infrastructure facilities available in enterprises are noticed and scores are given as below.

Sl. No	Infrastructure facilities	Score
1.	Introduction of new technology/innovation in last three year	1
2.	Power back up facility	1
3..	Distribution amenities	1
4.	Networking	
a.	Only land line	1
b.	Troll free Number	2
c.	Email	3
d.	Website	4
e.	Social media	5

g) Supply and value chain competency

The supply and value chain competency include the skills, knowledge and the forward and backward linkages practiced by an enterprise to effectively transfer the products to the consumer. This was studied in terms of price spread and time lag. The intermediates in the supply channel were noted based on the responses from entrepreneurs and the share margin in each channel was recorded. The average lag time was also taken into account. Based on the secondary data on production cost and selling price the efficiency of each channel was calculated.

h) Economic feasibility measures

The economic feasibility of enterprises were measured using the feasibility measures viz. benefit- cost ratio (B:C ratio), internal rate of return (IRR) and net present worth (NPW). Based on secondary data the economic feasibility of enterprises was

calculated using the formulae given below.

a. B-C Ratio = $\dfrac{\sum_{t=0}^{n} \frac{B_t}{(1+r)^t}}{\sum_{t=0}^{n} \frac{C_t}{(1+r)^t}}$

Where,

B_t = Benefit of the t^{th} year

C_t = Cost of the t^{th} year

r = Discount rate

t = 1. ....n years

n = total no. of years of the enterprise

b. IRR = [Lower discount rate] + [Difference between the two discount rates] ×

$$\left[\frac{\text{Present Worth of the cash flow at lower discount rate Absolute difference}}{\text{between the present worths of the cash flows at the two discount rates}}\right]$$

c. NPW = $\dfrac{P1}{(1+i)^1} + \dfrac{P2}{(1+i)^2} + \ldots\ldots\ldots\ldots + \dfrac{Pn}{(1+i)^n} - C$

Where,

P1 = Net cash flow of first year

Pn = Net cash flow of nth year

i = Discount rate

C = Initial cost of the investment

B) Product attributes

Product attributes were assessed based on product type, product diversity, quality assurance standards practiced by the enterprise, product diversity potential and the market competitiveness

a) Product diversity

Product diversity has been operationalized in the study as a summated measure of the type and number of the products and the services manufactured and marketed by the enterprise**.**

A. Type of products: In the study the coconut-based products manufactured by the enterprises were documented and categorized as inflorescence based, water based, kernel based, shell based, wood and husk-based products. Each product documented from an enterprise was assigned a score of one and the summated score was taken.

B. Number of products: The number of coconut-based processed products having market presence for each enterprise are identified. They are categorized into four groups as given in the following table with scores that ranged from 1-4 as indicated below.

Sl. No	Type of coconut products	Score per product of the enterprise	Number of products marketed	Score
1.	Husk based products	1	1-2	1
2.	Shell based			
3.	Kernel based		3-5	2
4.	Water based			
5.	Inflorescence based		5-7	3
6.	Others		>7	4

b) Quality assurance standards

Quality standards are meant to motivate the entrepreneurs for the adoption of safer and quality assured production of products. The quality standards followed in coconut-based processing enterprises in terms of branding, packaging and certifications were studied

and scored as given below. The enterprises fulfilling the minimum standards of branding and packaging specifications in marketing of their products were assigned a score of one, for adoption of national level higher standards were given two and enterprises successful in achieving quality standards for export were given a score of three.

Sl. No	Quality standards followed	Score
1.	Minimum standard for the marketing of the produce	1
2.	National level higher standards	2
3.	Quality standards for exporting	3

c) Product diversity potential

The product diversity potential can be defined as the capacity of an enterprise to diversify the products to increase profitability and higher sales growth for new products. It was studied in terms of product diversity index. The ratio of number of products in each enterprise to the average number of products in the enterprise category was calculated using the following equation.

□□□□□□□ □□□□□□□□□□ □□□□□ = □□□□□ □□ □□□□□□□□ □□ □□□□□
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d) Market competitiveness

Market competitiveness is defined as the degree of the competitiveness of the operating environment in which the enterprise operates. It was calculated on the basis of average annual sale of the major product of the enterprise and was compared with the average annual sale of the product in the districts. The fraction of average annual sale of the product to the average annual district sale gave the degree of competitiveness in its operating environment

3.5.2.3. Variables related to technology capability analysis of coconut enterprises

Technology capability of coconut enterprises was assessed in relation to independent variables selected based on literature review and expert consultancy. The independent variables selected and the tools used in the measurement are presented in Table 3.5.C.

Table 3.5 (C). Independent variables used to analyze the technology capability of coconut enterprises and their measurement tools

Sl. No.	Independent Variables	Measurement tools
a)	Production capacity	Secondary data sources
b)	Scaling readiness	Scale by Sartas *et al*.(2020)
c)	Technology facilitation support	Scoring based on schedule developed

a) Production capacity

Production capacity was conceptualized as the maximum production or output, which could be produced in an enterprise with the help of available resources. The entrepreneurs were asked about the average production capacity of their enterprise for a man day and categorized and scored as below.

Sl. No	Production capacity	Score
1.	Less than one tone	1
2.	One to five tones	2
3.	More than five tones	3

b) Scaling readiness

Scaling readiness as conceptualized following Sartas *et al.* (2020) which was related to the innovations practiced in an enterprise. A measure of scale readiness of technologies / innovations in an enterprise gave the degree to which the enterprise was ready for wider adoption of similar innovations at a minimum additional cost. As such the variable assumed great significance in the context of entrepreneurship development especially because the upscaling of a technology will also lead to down scaling of many practices followed in an enterprise as reported by Wigboldus *et al*. (2016). Therefore, assessment of scaling readiness broadened the scope of technology use and helped in balancing complexity associated with application contexts. Thus, it aided in identifying bottlenecks in innovation adoption and enabled better decisions on investments, activities, and partnerships that were required to overcome the obstacles in scaling.

The scaling readiness was measured for the purpose of the study using the scale adapted from Sartas *et al.* (2020). Accordingly, scale readiness formed a critical process in the growth of an enterprise that encompassed all the pre-work required to enable the enterprise to reach a state that will allow them to grow significantly without incurring high additional costs or investments. It involved putting in place necessary systems and processes for the enterprise to run efficiently and effectively from the start accommodating all future growth prospects. The study operationalized it in terms of the robustness of team, the infrastructure and the finance to validate the readiness for successful innovation implementation in future to meet any emerging growth prospects. Based on the scale, scaling readiness was measured as a function of innovation readiness and innovation use. The scale consisted of items that measured innovation use and innovation readiness with score range 1-9 which is presented in **Appendix I.** The scores were combined using the formula given below.

Scaling readiness = Innovation readiness * Innovation use

Based on the distribution of scores on a quartile range the enterprises were classified into Low scaling ready enterprises (Below Q1.), Medium scaling ready enterprises (Below Q2.) and High scaling ready enterprises (Above Q3).

c) Technology facilitation support

The Technology facilitation support was conceptualized as the capacity building, skill enhancement and technical assistance received by the enterprises on technology development, transfer and deployment from allied agencies and institutions. It was measured in terms of source of technology facilitation support received and scored as given below.

Sl. No	Technology facilitation support sources	Score
1	Private agencies	1
2	Institutions like CDBs, CPCRI, KAU ABIs etc	2
3.	Agencies institutions related to local government	3
4.	National institutions associated with MSMEs	4

3.6. Statistical tools and mathematical models used in the study

In accordance with the objectives of the study, the data was subjected to different statistical analysis. Frequencies, percentages, quartiles, Correspondence Analysis, Kruskal- Wallis test and Karl Pearson correlation coefficient method were the major statistical tools adopted in the study. Analytical Hierarchical Process (AHP), a multi criterion decision making tool based on pair wise comparison was also used in the study.

3.6.1. Percentages

Percentage analysis was used for the finding out the distribution of entrepreneurs and enterprises according to different variables for making comparisons and interpretations.

3.6.2 Quartiles

The entrepreneurs were categorized in to low, medium and high groups based on quartile groups. The number of respondents less than Q1 was included in "low" category, respondents between Q1 and Q3 belonged to "medium" category and the respondents above Q3 were grouped in "high" category. Based on the scores allotted the number of entrepreneurs in each category were also calculated.

3.6.3 Correspondence Analysis (CA)

Correspondence Analysis (CA) or reciprocal averaging is a multivariate graphical data analysis technique designed to explore relationship among nominal categorical data. The tool was proposed by Herman Otto Harlley and later developed by Jean Paul Benzecri. The method allowed to study the association between two or more qualitative variables. Conceptually the technique was similar to Principal Component Analysis but could be applied to categorical than continuous data. It enabled to display the results in dimensional graphical form. Maps obtained helped to visually observe the distances between the categories of the qualitative variables and between the observations. In the study CA was used to map which attributes of skill gap the respondents associated with the technology use pattern in different types of coconut enterprises. The correspondence between different categories of enterprises and the skill competence gap was delineated using CA in the study. It compared the different categories of enterprises on the perceived skill gap of workforce competence.

3.6.4 Kruskal –Wallis test

The Kruskal –Wallis non parametric test is equivalent to one-way ANOVA. It is called one-way ANOVA on ranks. In the study the test was used to compare the skill gap components of the workforce on different enterprise categories.

3.6.5 Spearman correlation coefficient

Spearman's rank correlation coefficient is a non parametric test used to measure statistical dependence between the rankings of two variables. The test help us to assess how well the relationship between two variables can be described using a monotonic function. It is the non parametric version of the Pearson product moment correlation. Spearman's correlation coefficient (rsp) measuresthe strength of association between two ranked variables.

Correlation analysis was used to find out whether there exists any linear relationship between dependent variable and selected independent variables and also its nature if such a relationship existed. The association between selected independent variables and technological capability was assessed by Spearman's Correlation.

3.6.6 Analytical Hierarchical Process (AHP)

AHP is a multi-criteria optimization methodology developed by Thomas L. Saaty in the 1970s. Ever since it has been widely adopted in complex scenarios of decision making that involve human perceptions, and judgments having long-term consequences (Bhushan and Rai, 2004). It aids to transform the empirical data of comparisons, both qualitative and quantitative, into mathematical models. It involved decomposition of a problem into a hierarchy of criteria that enable easy analysis and comparisons in an independent manner. Once the logical hierarchy is constructed, the decision makers assess the alternatives systematically by making pair-wise comparisons on a scale that varied from 1-9 for each of the chosen criteria. This comparison used concrete data from the alternatives or human judgments as a way to input subject to the information (Saaty, 2008). The relative weights between each of the criteria to be evaluated were established and the numerical probability of each alternative was calculated. The n x n dimension matrix that corresponded to the total of the productive alternatives were compared to determine the probable likelihood that the alternatives fulfilled the expected goal. The higher probability scores indicated better chances the alternative had to satisfy the final goal. The tool was used for determining the weightage for indicators, mesoindexes and

macroindexes in Technology capability Index. AHP analysis was done five times in three different stages. The pair wise comparisons were based on expert judgments and the Consistency Index (CI) in all the analysis attempted were less than the stipulated 0.1 (10 %).

Results and discussion

CHAPTER 4

RESULTS AND DISCUSSION

The data collected were analyzed with respect to the specific objectives of the study using tools and techniques mentioned in the methodology. The findings from the analysis and the discussions based on related results from literature and the existing theories are presented here. The results in the chapter are comprehensively arranged under following sub-headings.

4.1 Profile of entrepreneurs in coconut sector

4.2 Profile of coconut-based enterprises

4.3 Characterization and documentation of major coconut products and services

4.4 Technology use pattern in coconut enterprises

4.5 Perceived skill competence of workers in coconut enterprises

4.6 Technology use capability of coconut-based enterprises

4.7 Sustainable entrepreneurship development framework for coconut sector

4.1. Profile of entrepreneurs in coconut sector

The entrepreneurs in coconut sector were profiled based on selected socio-economic and psychological characteristics as presented below. The entrepreneurs were distributed under different categories using descriptive statistics such as frequency, percentage and quartiles.

4.1.1 Age

The age wise distribution of coconut entrepreneurs presented in Table 4.1 showed that majority of the entrepreneurs (49.05%) belonged to middle age group of 36 to 50 years. It was followed by the young aged group of below 35 years (32.08%) and there was 18.87 per cent who came under the senior age category of above 50 years. When micro enterprises were considered, the entrepreneurs belonging the middle age group dominated at 53.33 per cent and was followed by the young group (26.67%). Only six per cent of the micro entrepreneurs in the sector belonged to the senior age group. Similar trend was observed in small enterprises also where more

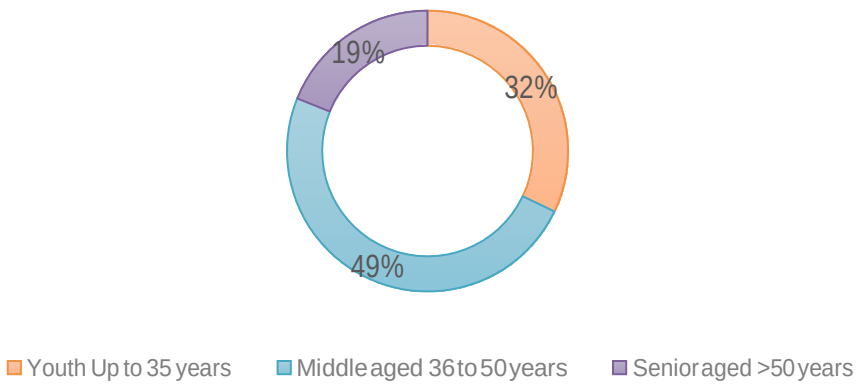
than the half of the entrepreneurs belonged to the young category, with only 30 per cent and 20 per cent in the middle and senior age categories respectively. But the entrepreneurs in medium and social enterprises together again showed the significance of middle-aged group. The middle age group were the majority (53.8 %) followed by young age group (30.76%) and the elderly respondents were only (15.38%). The results represented the overall significant presence of middle-aged population in coconut sector and the young entrepreneurs also showed prominent presence, especially in micro and small enterprises (Fig. 4.1). The involvement of enthusiastic and innovative youth and the experienced middle-aged entrepreneurs assumed significance in providing the much-needed positive dynamics to the sector. The results were in conformity with the results of Ashwini (2019).

Table 4.1 Distribution of different categories of coconut entrepreneurs on age (n=53)

Sl. No	Category	Age	Micro entrepreneurs (%)	Small entrepreneurs (%)	Medium and social entrepreneurs (%)	Total (%)
1.	Youth	Up to 35 years	26.67	50.00	30.76	32.08
2.	Middle aged	36 to 50 years	53.33	30.00	53.86	49.05
3.	Senior aged	>50 years	20.00	20..00	15.38	18.87

Mean= 45; Standard Deviation= 11.9

Fig.4.1 Distribution of coconut entrepreneurs on age



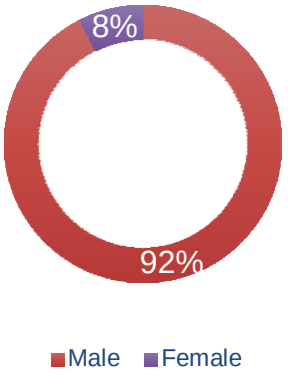
4.1.2 Gender

The gender wise distribution of coconut entrepreneurs was studied (Fig. 4.2) and the results based on the type of enterprises are presented in Table 4.2. The results showed lower presence of female entrepreneurs (7.55%) in the coconut enterprise sector which remained dominated by an overwhelming 92.45 per cent of male entrepreneurs. The trend remained almost similar in micro, and medium social enterprises with female entrepreneurs making just 6.67 per cent and 15 per cent respectively. It was also observed that the small enterprises were devoid of the presence any female entrepreneurs and consisted of 100 per cent male entrepreneurs. The results suggest the existence of a huge gap in motivating women entrepreneurs to take up opportunities in coconut sector and developing inclusive entrepreneurial ecosystem in the state. The results were in agreement with the MSME (2018) report which testified that the percentage of women entrepreneurs in small scale industry sector of Kerala was only 13 per cent. This warrant policy measures and actions taken in a targeted way to nurture women entrepreneurship in coconut-based enterprises.

Table 4.2 Distribution of different types of coconut entrepreneurs on gender (n=53)

Sl. No	Category	Micro entrepreneurs (%)	Small entrepreneurs (%)	Medium and social entrepreneurs (%)	Total (%)
1.	Male	93.33	100	85	92.45
2.	Female	6.67	0.00	15	7.55

Fig.4.2. Distribution of coconut entrepreneurs on gender (%)



4.1.3 Education

The result in Fig. 4.3 indicated that the majority of coconut entrepreneurs (43.40 %) had acquired high school level of education. There were 39.62 per cent of the entrepreneurs who possessed educational qualification up to middle school level. The respondents who received college education were 9.43 per cent and the minimum level of education among the coconut entrepreneurs was primary school (7.55 %). The educational categorization of entrepreneurs based on the type of coconut enterprise is presented in Table 4.3. The results showed that 50 per cent of the entrepreneurs among the micro enterprise category studied upto high school level and 36.67 per cent up to middle school level. While only 10 per cent had received college level education. In the case of small-scale enterprises 46.67 per cent of respondents had high school education and 40 per cent were with middle school education. There were 13.33 per cent among the small entrepreneurs who had received college education. Among the medium and social entrepreneurs, there were 51.15 per cent who were educated up to high school level. The percentage of the entrepreneurs in this category who possessed college and middle school education were 23.07 per cent each. The sector also had 2.71 per cent who studied only up to primary school. The results conform with the theoretical preposition that high level of education was not a mandatory prerequisite for entrepreneurship but knowledge and skills in their field can be of critical significance. The results were in concurrence with the observation of Pandey (2017) that higher level of educational status was associated with better entrepreneurial performance.

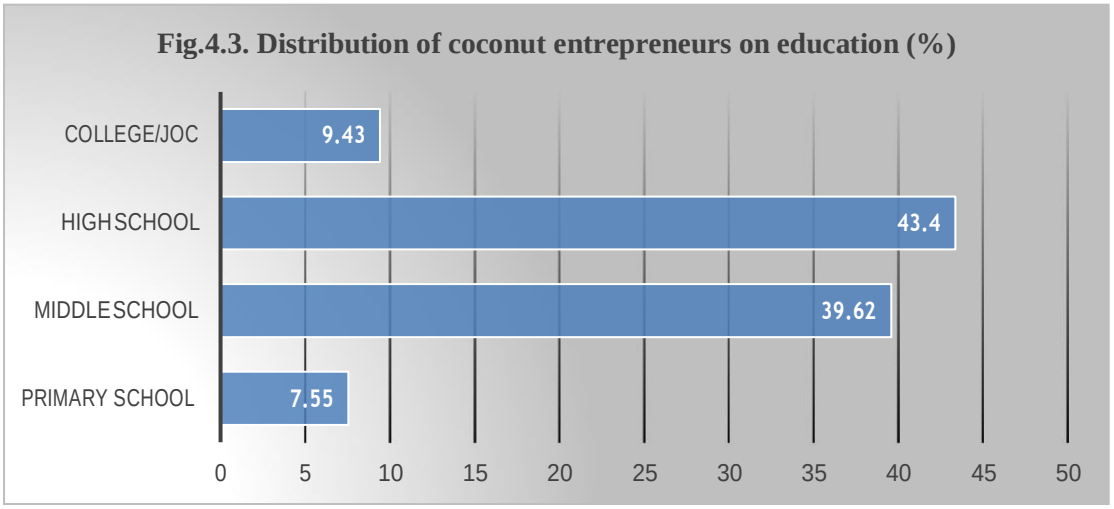


Table 4.3. Distribution of different categories of coconut entrepreneurs on educational status (n=53)

Sl. No	Level of schooling	Micro entrepreneurs (%)	Small entrepreneurs (%)	Medium and social (%)	Total (%)
1.	Primary school	3.33	0.00	2.71	7.55
2.	Middle school	36.67	40.00	23.07	39.62
3.	High school	50.00	46.67	51.15	43.40
4.	College/JOC	10.00	13.33	23.07	9.43

4.1.4 Occupational status

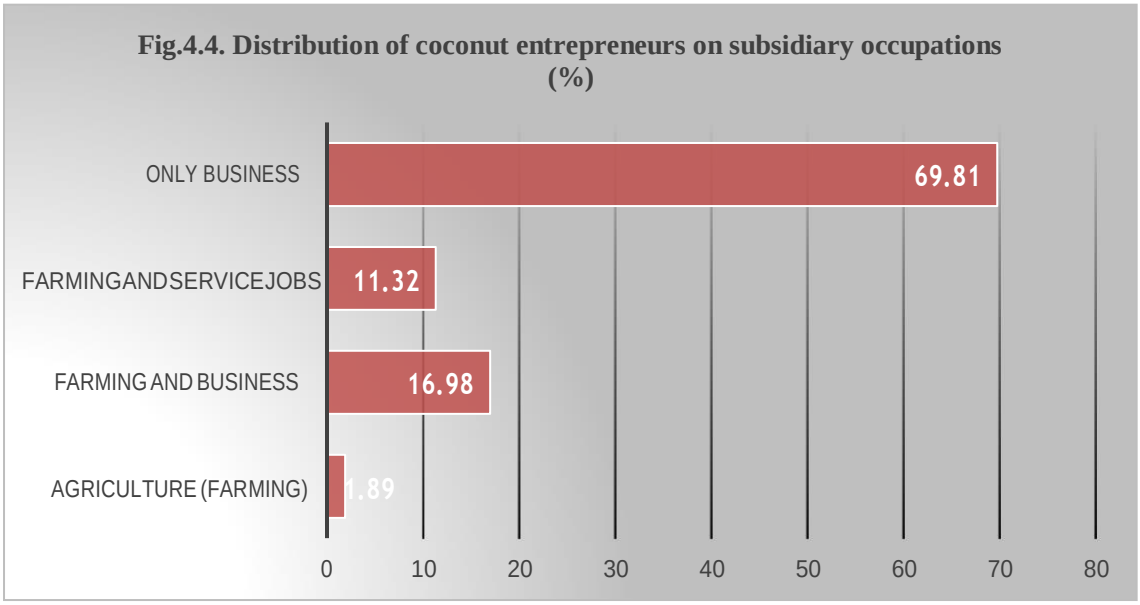
The results presented in Fig. 4.4 showed that majority of the entrepreneurs (66.67 %) had taken business as their primary occupation and were not involved in any form of subsidiary vocations. However, there were 16.98 per cent of the entrepreneurs who were engaged in farming along with the business. There were also 11.32 per cent of the entrepreneurs who had farming and service jobs in addition to the coconut enterprise. There was another 1.89 percent who depended on agriculture as a source of livelihood for their family. This minority group mostly served as economic partners of the enterprise run by friends or family or were members in the social enterprise.

The category wise distribution of entrepreneurs based on engagement in subsidiary occupations is reported in Table 4.4. The results showed that majority of the micro entrepreneurs (66.67 %) had business as their primary occupation while 20 per cent had farming and other service jobs and 13.33 per cent of the entrepreneurs were involved in

farming and business. In the case of small entrepreneurs, 80 per cent of them had business alone as the primary occupation and remaining 20 per cent had farming along with business. The medium and social entrepreneurs expressed a different trend which indicated 69.81 per cent as involved in business activities alone and 16.98 per cent in both farming and business. The results indicated that the business activities in which they were involved were capable of providing a source of livelihood for their families. However, with a remarkable percentage (28.30 %) of entrepreneurs engaged in farming and service jobs as subsidiary ventures along with business there need to be more institutional engagements to cover the risks in the sector. Moreover, the results are also indicative of the capacity of agriculture to buffer the entrepreneurial risks associated with the coconut sector. The results were in agreement with the results of Shehrawat (1998).

Table 4.4 Distribution of different categories of coconut entrepreneurs based on engagement in subsidiary occupations (n=53)

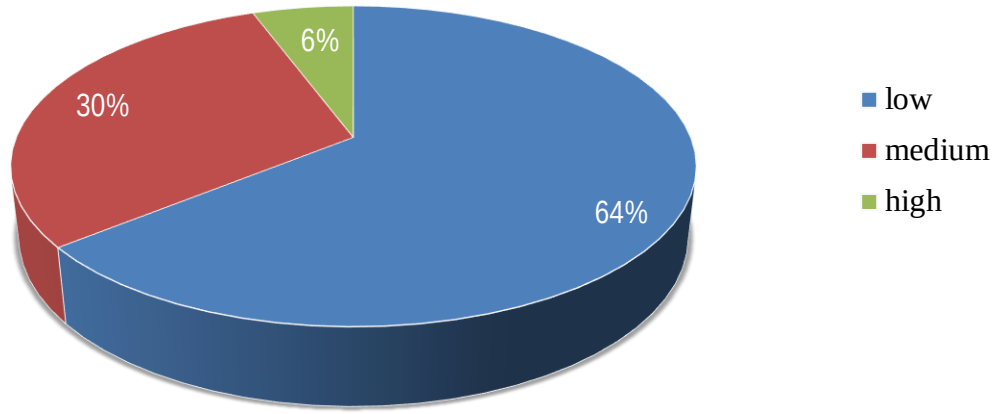
Sl. No	Subsidiary occupations	Micro entrepreneurs (%)	Small entrepreneurs (%)	Medium and social (%)	Total
1.	Agriculture (farming)	0.00	0.00	7.77	1.89
2.	Farming and Business	13.33	20.00	23.00	16.98
3.	Farming and service jobs	20.00	0.00	0.00	11.32
4.	Only business	66.67	80.00	69.23	69.81



4.1.5 Extension contact

The result presented in Fig.4.5 showed that majority (64%) of entrepreneurs under the study had low level of extension contact while 30 per cent had medium level of extension contact and only 6 per cent had high level of contact with various extension agencies like District MSME office, DICs, Industrial Extension officers, Coconut Development Board, Centre for Plantation Crops and Research Institute, Agricultural scientists in University/ Research stations and Agri Business Incubators. This made the enterprises lack in the updation of the knowledge and technology transfer from allied agencies. The probable reason for such a result could be the fact that most of entrepreneurs were not aware about the existence of extension agencies and the services provided by them in coconut based entrepreneurship development.. This was in-line with the findings of Joseph (2008) revealed that majority of the coconut oil milling entrepreneurs who were having low levels of extension contact with related agencies.

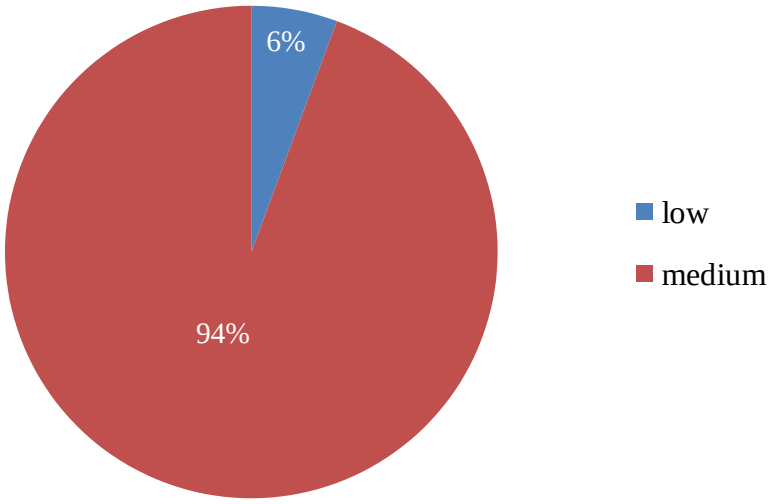
Fig.4.5. Distribution of coconut entrepreneurs on extension contact (n=53) (%)



4.1.6 Mass media contact

The results from the Fig. 4.6 revealed that among the entrepreneurs studied 94 per cent of them showed medium mass media exposure while only 6 per cent showed low mass media exposure. The entrepreneurs with high media exposure were not found and this critical observation has to be taken seriously in the context of the entrepreneurship development in this sunrise sector. The educational level of the entrepreneurs would have influenced their orientation to the use of mass media. There were only 9.43 per cent of entrepreneurs under the study received college level education and also the mass media sources like seminars, exhibitions were not did not receive the same acceptance as thatof TV, radio and print media. The result was found to be in agreement with the findings of Krishnan (2017) revealed that the majority of the entrepreneurs under the study expressed medium level of mass media contact and the entrepreneurs with high and low level of mass media contact were less.

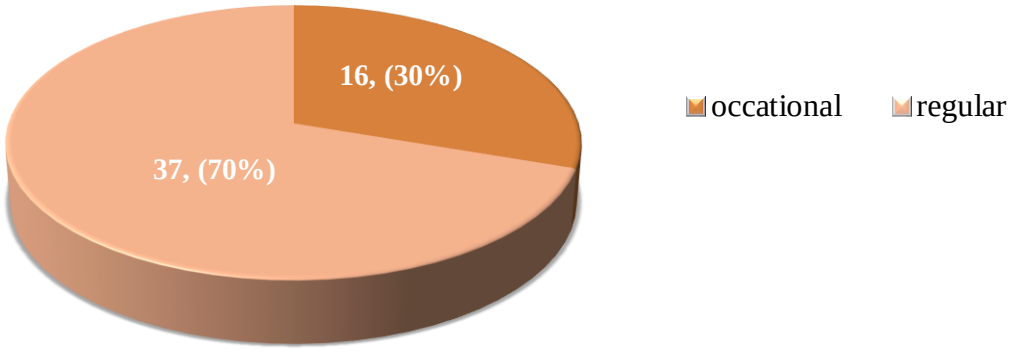
Fig.4.6. Distribution of coconut entrepreneurs on mass media contact (n=53) (%)



4.1.7 Social Participation

The results from Fig. 4.7 showed that majority (70%) the entrepreneurs under study showed regular participation in social organizations while 30.00 per cent showed occasional participation in social organization. The participation in social organization indicated the entrepreneurs to establish an interaction with the support system which can encourage the entrepreneurs and also aid them in gaining more acceptances from society. The occasional social participation of entrepreneurs may be due to lack of time or lack of perceived benefits and evading local politics could be the reasons. These results were in line with the findings of Krishnan (2017).

Fig.4.7 Distribution of coconut entrepreneurs social participation (n=53) (%)



4.1.5. Annual income

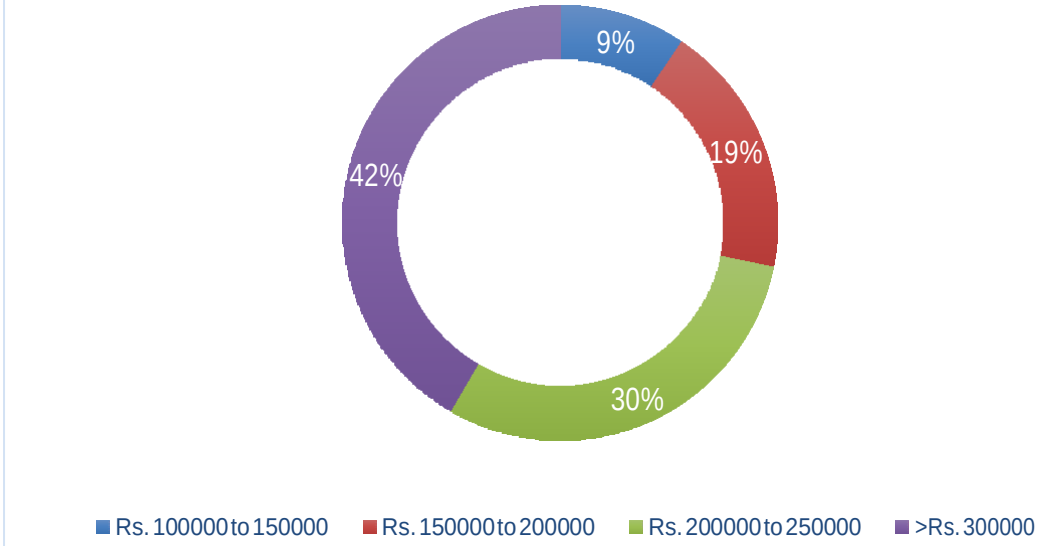
The results from Table 4.5 showed that the annual income of 41.5 per cent of the coconut entrepreneurs were more than three lakhs. It also revealed that there were 30.1 per cent who had annual income between rupees 2.0 and 2.5 lakh and 18.8 per cent who recorded income between 1.5 lakh to 2 lakh INR. The lower income category was only 9.43 % who reported income between rupees 1.0 to 1.5 lakhs. When micro enterprises alone were considered half (50%) of them had annual income in rupees that ranged from 2.0 to 2.5 lakhs while 33.3 cent per had income between 1.5 to 2.0 lakhs rupees and only 16.67 per cent belonged to lower income range of 1.0 to 1.5 lakhs rupees in the category. In case of small enterprises 90 per cent belonged to high income category (above three lakh rupees) and remaining 10 per cent had income between 2.0 to 2.5 lakhs. The annual income of all the social and medium enterprise was above three lakhs and belonged to high income category. The distribution of coconut entrepreneurs in different annual income levels is presented as Fig. 4.8.

Table 4.5. Distribution of different categories of coconut entrepreneurs based on annual income (n=53)

Sl. No	Annual income (Rs)	Micro entrepreneurs (%)	Small entrepreneurs (%)	Medium and social (%)	Total (%)
1.	100000 to 150000	16.67	0.00	0.00	**9.43**
2.	150000 to 200000	33.33	0.00	0.00	**18.82**
3.	200000 to 250000	50.00	10.00	0.00	**30.15**
4.	250000 to 300000	0.00	0.00	0.00	**0**
5.	> 300000	0.00	90.00	100.00	**41.6**

Mean= 397456.5; Standard deviation= 428542.1

Fig. 4.8. Distribution of coconut enterpreneurs based on annual income (n=53)



4.1.6. Managerial competency

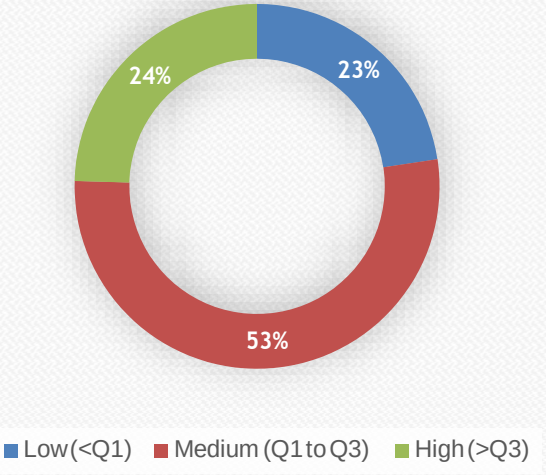
The normality assumption of distribution could not be applied as the mean and median did not coincide and quartile scores Q_1, Q_2, and Q_3 were used to categorize the respondents. The result from Fig. 4.9 revealed that majority of the respondents showed medium level of managerial competency (53.0 %) while 24.0 per cent and 23.0 per cent respondents had high and low levels of managerial competency respectively. Managerial competency has been reported as an indispensable quality for entrepreneurs by many researchers (Markman and Baron, 2003; Kyndt and Baert, 2015). Hence the results revealing medium managerial competency for majority of coconut entrepreneurs has confirmed that this quality was vital for entrepreneurial success as reported by Zarefard and Cho (2018).

Distribution of different categories of coconut entrepreneurs based on managerial competency is depicted in Table 4.6. When micro enterprises alone were considered, 67 per cent of entrepreneurs showed medium level managerial competence while percentage of respondents with low and high competencies were 20 per cent and 13 per cent respectively. In case of small entrepreneurs, majority of them also showed medium level of the competency (60%). The respondents showing high and low competencies were 20 per cent each in the category. Medium and social entrepreneurs had majority of respondents in medium level of managerial competency (54%) and with low and high level of competencies were 23 per cent each. Thus, from the results it could be inferred that moderate level of managerial competencies were observed in all categories of enterprises. This was essential in efficient staff management and coordination towards a common goal and enterprise performance. The results called for necessary actions to be taken to bring structured management skill development activities in these enterprises. The results were in agreement with the findings of Aliyu and Olowu (2015) that revealed small businesses to lack higher levels of managerial skills and competencies.

Table 4.6. Distribution of different categories of coconut entrepreneurs based on managerial competency (n=53)

Sl. No	Managerial competency (Micro entrepreneurs) (n=30)	Quartile scores	Percentage
1.	Low (<Q1)	23	20
2.	Medium (Q1 to Q3)	28	67
3.	High (>Q3)	30	13
Q1=23, Q3 = 30, Range = 12			
Sl. No	**Managerial competency (Small entrepreneurs) (n=10)**	**Quartile scores**	**Percentage**
1.	Low (<Q1)	33.7	20
2.	Medium (Q1 to Q3)	38	60
3.	High (>Q3)	41.25	20
Q1=33.7, Q3 = 41.25, Range = 18			
Sl. No	**Managerial competency (Medium and social entrepreneurs) (n=13)**	**Quartile scores**	**Percentage**
1.	Low (<Q1)	36	23
2.	Medium (Q1 to Q3)	39	54
3.	High (>Q3)	40	23
Q7=36, Q3 = 40, Range = 9			

Fig. 4.9. Distribution of coconut enterpreneurs based on managerial competency (n=53)



4.1.7. Entrepreneurial orientation

Entrepreneurial orientation was studied as a multidimensional construct with innovativeness, proactiveness, and risk-taking attitude as dimensions. The results from the analysis of data collected on it from coconut entrepreneurs are depicted as Fig. 4.10. It is evident from the graph that the overall entrepreneurial orientation was highest for the small entrepreneurs (36.83 %) compared to 19.3 and 20.0 percent respectively for the micro and medium social entrepreneurs. The findings found support in the study by Kiyabo and Isaga (2020) which reported that the entrepreneurial orientation positively and significantly influenced competitive advantage which in turn influenced the SMEs' performance. Thus, it could be inferred that the competitive advantage of a firm mediated the relationship between entrepreneurial orientation and SMEs' performance on both firm's growth and personal wealth performance measures. The category wise distribution of coconut entrepreneurs on entrepreneurial orientation is presented in Table 4.7. It is evident from the table results that the micro entrepreneurs showed 12.6 per cent innovativeness in their orientation towards entrepreneurship and 7.38 per cent risk taking ability while their proactiveness was only 4.35 per cent. When small

entrepreneurs were considered, they showed comparatively higher innovativeness score (26.9%) and 10.47 per cent proactiveness. However, their risk-taking abilities were only 9.04 per cent. The innovativeness score among the medium and small entrepreneurs was 33.8 percent of while the proactiveness and risk-taking ability were 16.1 and 9.76. per cent respectively. Innovativeness emerged as the dominant feature of all the entrepreneurs which found support in the classical innovation theory of entrepreneurship propounded by Schumpeter (Sweezy,1943). This also implied that efficient exploitation of new ideas was critical for the better performance of enterprises. Enterprises that were able to improve its existing processes, bring new and improved products and services to market could increase its efficiency and add competitive advantage. Hence the coconut entrepreneurs irrespective of enterprise category reflected innovativeness as an important attribute compared to risk taking and proactiveness. In higher level enterprises like small, medium and social enterprises proactiveness was more proficient than risk taking ability and micro entrepreneurs showed more risk-taking ability but were less proactive. The lower proactiveness of the entrepreneur increased the vulnerability of the enterprises to crisis. The less degree of pro activeness in smaller enterprise categories was the reason for their less precautionary actions and planning in adverse situations. Taking risks created more opportunity and progress to enterprises. When an entrepreneur was willing to take risks, they could emerge as leaders in their field which served as an indication of the entrepreneur's vision and leadership.

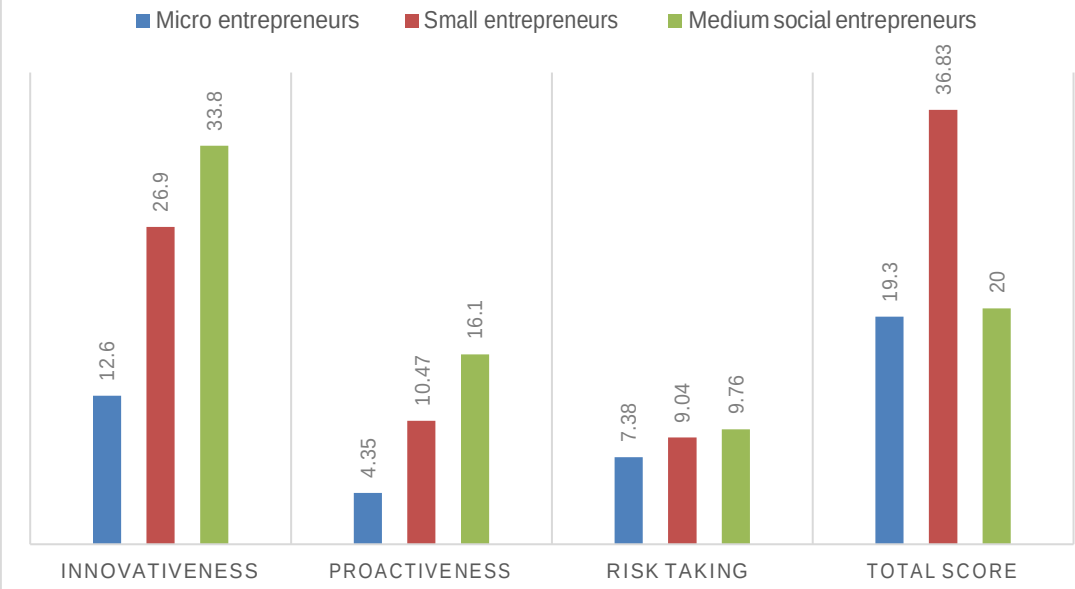
Table 4.7. Distribution of different categories of coconut entrepreneurs based on entrepreneurship orientation (n=53)

Sl. No	Entrepreneurial orientation attributes	Mean entrepreneurial orientation score (%)		
		Micro entrepreneurs (n=30)	Small entrepreneurs (n=10)	Medium -social entrepreneurs (n=13)
1.	Innovativeness	5.33 (12.6)	11.3 (26.9)	14.2 (33.8)

2.	Proactiveness	1.83 (4.35)	4.4 (10.47)	6.8 (16.1)
3.	Risk taking attitude	3.1 (7.38)	3.8 (9.04)	4.1 (9.76)
	Total score	**10.26 (19.30)**	**19.5 (36.83)**	**25.1 (20.0)**

(Score range= 17- 126)

Fig. 4 . 10 . Distribution of coconut entrepreneurs on entrepreneurial orientation



4.1.8. Asset ownership

Ownership of land and buildings were considered under the assets and the results are given as Table 4.8.A. The results showed that more than half (55%) of the coconut entrepreneurs had separately owned land for their enterprises. While 25.1 per cent were with leased or rent land, 19.9 per cent had made conversion within own household for the enterprise. In case of micro enterprises 53.3 per cent had separate owned land while 36.7 made conversion in owned household and 10 per cent were operating on leased or rent land. In the case of small enterprises 46.2 per cent were working on leased or rent land while 60 per cent had separate owned land. In case of medium and social enterprises, 53.8 per cent were operating on separately owned land while 46.2 per cent were in leased or rent land.

The results also indicated that the number of buildings owned by enterprises ranged from one to more than three. There were 69.8 per cent functioning on a single building while 22.6 per cent had two to three buildings for operations. There were only 7.6 per cent entrepreneurs who had more than three building under the ownership of the enterprise. All the micro enterprises were functioning in single buildings and 70 per cent of small enterprises in two building and 30 per cent had more than three buildings in their ownership. Statistics showed 69.23 per cent of medium and social enterprises had two to three buildings under their ownership while 30.76 were functioning in more than three buildings. It could be inferred from the results that the asset ownership among the entrepreneurs in coconut-based enterprises were directly related to the size of their enterprise and was in line with the results of Kapoor (2019).

Table 4.8. Distribution of enterprises based on land (n=53)

Sl. No	Category	Micro entrepreneurs (%)	Small entrepreneurs (%)	Medium and social entrepreneurs (%)	Total entrepreneurs (%)
A. Type of asset ownership					
1.	Leased or rent	10.00	40.00	46.2	25.1
2.	Conversion within own household	36.7	0.00	0.00	19.9
3.	Separate owned	53.3	60.00	53.8	55
B. Number of buildings owned					
1	Only one building	100.00	70.00	0.00	69.8
2	Two to three buildings	00.00	30.00	69.23	22.6

3	More than three buildings	00.00	00.00	30.76	7.6
	Asset ownership (average score)	3.5	4.4	4.84	4

4.2. Profile of coconut-based enterprises

Value addition through product diversification has emerged as an important strategy to enhance income from coconut sector. This has led to the development of coconut enterprises, especially in the MSME sector. The basic profiling of the enterprises was attempted in the study based on variables such as age of enterprise, type of ownership, investment and turnover of the enterprise and employment provided by the firm. The results on the selected characteristics of the enterprises viz. age of firm, type of enterprise ownership, investment and turnover and the workers employed are presented in Table 4.9.

4.2.1. Age of firm

The results from the Table 4.9 revealed that on age of enterprises, majority of the enterprises (40.9 %) belonged to the group of 15 to 25 years. Enterprises with more than 25 years of age and relatively new enterprises with less than five years comprised of 28.2 and 9.4 percent respectively. The category wise estimation of the age of enterprises could find a similar trend in all categories viz. micro enterprises, small enterprises and medium social enterprises as is evident from the table results. The age of micro, small and medium, social enterprises had majority in the category of 15 to 25 years. The results indicated the continued presence of relatively high percentages of coconut enterprises of over 25 years in all the three categories. This could be viewed as an indication of the sustainability of coconut enterprises attributed to the credibility they acquired among customers over the years. The results also revealed the presence of new enterprises and could be the result of the favorable policies and financial support for MSMEs in the present entrepreneurial ecosystem.

4.2.2. Type of enterprise ownership

In case of ownership most of the coconut enterprises came under the category of sole proprietorship (43%) and partnerships (41.14%). However, there were 15.86 per cent of firms under the farmer collectives which need to be seen as an emerging trend. Category wise analysis showed that each enterprise category had a distinct favored ownership style. In microenterprises, sole proprietorship was favored by 60 percent firms as the most popular ownership type which was followed by partnership firms (40%). However, in medium social enterprises ownership under farmer collectives (61%) was the popular ownership type. Partnerships were the preferred ownership type in small enterprise (70 %). The trend in the type of ownership indicated a direct relationship to the investments and managerial competencies required by the scale of enterprise. Thus, it could be inferred that for setting up of higher order business enterprises with social objectives farmer collectives need to be promoted under conducive government policies and support.

4.2.3. Investment and (turnover) of enterprises

The revised criteria published by MSME Ministry (2020) for the classification of enterprises which covered both investment and turnover were used in the study. The results reported in Table 4.8 was in agreement with the MSME (2020) classification. All micro enterprises studied had investment less than Rs.1 crore and the annual turnover less than Rs.5 crores and all small enterprises had investment less than Rs.10 crores and annual turnover less than Rs.50 crores. But in case of medium and social enterprises 61.5 per cent investment was less than Rs.10 crores and had annual turnover less than Rs.50 crores while the rest 38.5 per cent had investment and turnover in the order of Rs 20 and Rs.100 crores respectively. These suggest the presence of both small and medium categories of enterprises under the farmer collectives which include cooperatives and Farmer producer Companies (FPCs).

4.2.4. No. of workers employed

The results from the table indicated a progressive increase in the number of workers employed with rise in the scale of the enterprise. Majority of micro enterprises had (66.7 %) less than 5 employees and in small enterprises category 60 percent had five to twenty workers. Medium and social enterprises had more employment opportunities and majority of them (61.5%). had employed more than twenty workers. Thus, it could be inferred from the results that the number of employees working in an enterprise was directly related to its size. Moreover, the results also implied the potential of coconut-based enterprises in providing employment opportunities to the society.

Table 4.9. Category wise profile characteristics of coconut enterprises (n=53)

Enterprise attribute	Micro enterprises (%)	Small enterprises (%)	Medium and social enterprises (%)	Total (%)
4.2.1. Age of firm				
Less than 5 years	5	0	0	9.4
5 to 15 years	23	33	24	21.5
15 to 25 years	40	48	53	40.9
More than 25 years	32	19	23	28.2
Mean = 18.7; Standard deviation = 8.6				
4.2.2. Type of enterprise ownership				
Farmer collectives	0	0	61	15.86
Partnership	40	70	23	41.14
Sole proprietorship	60	30	15.3	43
4.2.3. Investment and (turnover)				
< Rs.1 Crore and (< Rs.5 Crore)	100	0.00	0.00	56.6
< Rs.10 Crore and (< Rs.50 Crore)	0.00	100	61.5	34

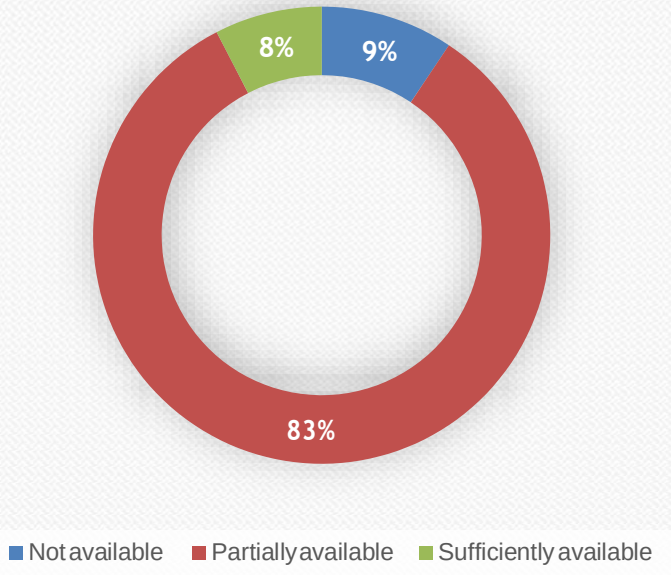
< Rs.20 Crore and (<Rs.100 Crore)	0.00	0.00	38.5	9.4
Mean Investment=5.4; Standard deviation= 5.1 Mean turnover =17.8 ; Standard deviation= 4.8				
4.2.4. Number of workers employed				
Less than 5	66.7	0	0	37.5
5 to 20	33.3	60	38.5	21
More than 20	0	40	61.5	41.5
Mean= 21.5; Standard deviation= 10				

The results were mostly confirmed by the findings of Ashwini *et al*. (2020) which reported that the majority of coconut enterprises (72%) employed 01-10 workers and had annual turnover less than 25 lakh. Also, they had found that the micro-enterprises (66%) functioned as sole proprietary firms, whereas small enterprises were registered as limited company/partnership firms (20%).

4.2.5. Credit availability

Finance for micro, small, and medium enterprises (MSMEs) has been remained a major concern for all stakeholders including policy makers, researchers and development specialists. Therefore, an overall evaluation of credit availability to coconut enterprises was assessed and the results are presented in Fig.4.11.

Fig. 4.11. Distribution of coconut enterprises on extent of credit availability



The results from the graph suggested that in terms of credit availability majority of coconut enterprises (83%) were running with partial accesses to credit requirements. Only 7.6 per cent reported to have sufficient credit availability and 9.4 per cent were not having any access to the required credit.

A category wise evaluation of the extent of credit availability among micro, small and medium social enterprises was attempted and the results are given as Table 4.10. The results indicated that there was acute credit shortage for the micro enterprises. It could be observed that 85 per cent and 15.5 per cent of the microenterprises suffered from partial and non availability of credit respectively. The results also revealed that there were only 14 per cent small entrepreneurs and 20 per cent social and medium enterprises who reported sufficiency in credit availability. The results reinforced the findings of Ambrose (2012) who reported the formal financial sources perception of MSMEs as high-risk unviable units for lending. Thus, it could be inferred that there existed an urgent need to make policy interventions that will ease the credit availability to enterprises, especially micro enterprises for maintaining the financial sustainability.

Table 4.10.Extent of credit availability among different categories of coconut enterprises (n=53)

Extent of availability	Micro enterprises (%)	Small enterprises (%)	Medium and social enterprises (%)	Total (%)
Not available	15	6	0	9.4
Partially available	85	80	80	83
Sufficiently available	0	14	20	7.6

4.2.6. Infrastructural facilities of coconut enterprises

The results of the analysis of infrastructure facilities available with coconut enterprises taken up under the study are reported in Table 4.11. The results showed that there were only 24.5 per cent of enterprises that had introduced any new technologies in the last three years. Among the different categories of enterprises, it was observed that only 6 per cent of the micro enterprises had introduced new technology in last three years compared to 56 per cent among social and medium enterprises. This could be viewed as a lack of innovativeness among micro entrepreneurs and also as the result of inadequacies in the infrastructural facilities. The infrastructural analysis found that the accessibility to uninterrupted power was available to 68.8 per cent of all the enterprise categories. Medium and social enterprises had the best uninterrupted power access (92 %) and micro enterprises the least (56%). The overall distribution facilities of the coconut enterprises were only 38.6 per cent. It was observed that only 10 per cent of the micro enterprises had the distribution facilities compared to 90 per cent among the small enterprises which was critical for tapping new market possibilities. The networking facilities of enterprises with customers and other stakeholders was studied and the results revealed that the traditional method of telephonic contact was the most prevalent mode which covered 95 per cent of micro enterprises. Only five per cent of microenterprises in coconut depended on emails. In small enterprises modern tools for networking such as emails (50%), websites (20%), and social media (20%) were widely

used. Moreover, majority of social and medium enterprises used websites (53.8) and social media accounts (38.4) to communicate their activities and programs. Thus, the networking methods had a great in influence on the treatment of customers and they preferred common methods that had high reach among the public. This held great significance for the micro enterprises which need to build digital networking facilities to catch customer attention and preferences for their products. Isohella *et al.* (2017) got similar findings that digital marketing improved relationships of micro enterprises with customers and encouraged company brand and cost efficiency.

Table 4.11. Infrastructural details of coconut MSMEs (n=53)

Facilities	Micro enterprises (n=30)	Small enterprises (n=10)	Medium and social enterprises (n=13)	Total
Introduction of new technology/innovation in last three year (%)	6	40	56	24.5
Uninterrupted power facility (%)	56	85	92	68.8
Distribution amenities (%)	10.	95	60	38.6
Networking facilities (%)				
a. Only land line	95	0	0	52.8
b. Toll free Number	0	0	7.6	1.8
c. Email	5	50	30	18
d. Website	0	20	53.8	16
e. Social media accounts	0	20	38.4	11.4

4.6.7 Supply and value chain competence

The analysis of forward linkages in coconut enterprises revealed that there were three significant channels supply chain channels identified among the micro enterprises. First

channel include retailer as intermediate between enterprise and consumer with a market efficiency of 8.54 and price spread of 8. The average lag time in this channel was found to be 3 days. The second channel include wholesaler followed by retailer between enterprise and consumer with a market efficiency of 8.23 and price spread of 8.37 and average lag time of 10 days. In the third channel there were distributors followed by wholesalers and retailers between enterprises and consumers. The market efficiency with 5.51 and price spread of 12.96. The time lag in this channel was identified 15 days. In case of small and medium-social enterprises only the third channel was identified. The market efficiency of value chain in small enterprises was found to be 6.22 and price spread was 11 and the average lag time was 15 days. The medium and social had market efficiency of 5.27 and lag time of 15 days. There were two prominent supply chain channels in enterprises. In the first channel there was no intermediate and enterprises were directly procuring from farmers and it had the highest market efficiency of 99 and price spread was zero. The second channels include traders as intermediate between farmers and enterprises with market efficiency of 8.7 and price spread of 9.37.

The major value channels identified in enterprises categories were shown below.

1. **Channel 1**

   Enterprise ⟹ Retailer ⟹ Consumer

2. **Channel 2**

   Enterprise ⟹ Wholesaler ⟹ Retailer ⟹ Consumer

3. **Channel 3**

   Enterprise ⟹ Distributor ⟹ Wholesaler ⟹ Retailer ⟹ Consumer

Table 4.12(A) Supply chain competence of enterprises

Micro Enterprises	Producers Selling Price	Consumers Price	Market Margin	Marketing Cost	Price spread	Market Efficiency	Average lag time (days)
Channel – 1	230	250	13.8	6.2	8.00	8.54	3
Channel – 2	230	251	14.8	6.2	8.37	8.23	10
Channel – 3	235	270	28.5	6.5	12.96	5.51	15

Small enterprises	Producers Selling Price	Consumers Price	Market Margin	Marketing Cost	Price spread	Market Efficiency	Average lag time (days)
Channel -3	190	213	16.50	6.50	11	6.22	15
Medium and social	**Producers Selling Price**	**Consumers Price**	**Market Margin**	**Marketing Cost**	**Price spread**	**Market Efficiency**	**Average lag time (days)**
Channel-3	141	160	12.50	6.50	12	5.27	15

The results from Table 4.12(A) revealed the supply chain different categories of enterprises. The micro enterprises used all the three channels identified and the marketing efficiency (8.54) was found to be more in channel 1 because of less number of intermediates and the efficiency was less in channel 2. In higher enterprise categories channel 3 was common and the marketing efficiency was higher for smaller enterprises than medium and social enterprises.

The major value channels identified in categories of enterprises were shown below

1. **Channel 1**

   Farmer ⟹ Enterprise

2. **Channel 2**

   Farmer ⟹ Trader ⟹ Enterprise

Table 4.12 (B) Value chain competence of enterprises

Channel	Producers Selling Price	Consumers Price	Market Margin	Marketing Cost/ Transportation Cost	Price spread	Market Efficiency
Channel 1	3000	3000	-30.00	30	0	99.00
Channel 2	2900	3200	270.00	30	9.375	8.70

The results from Table 4.12(B) showed that two important value channels in coconut enterprises. The channel 1 was found to be having more market efficiency as there were no intermediaries while channel 2 had less efficiency of 8.70. The results of

both supply and value chain competencies in enterprises showed that when the number of intermediaries reduce the market efficiency of channels increases.

4.6.8. Economic feasibility measures

The results from Table 4.13 revealed that the higher enterprise categories like medium and social enterprises had the highest economic feasibility measures under the study. There was only slight variation in the B:C ratio of medium and social enterprise with micro- small enterprise categories (1.09 and 1.06 respectively). But the IRR and NPW values of medium enterprises were significantly high compared to lower enterprise categories (43 and 40,46,96,947 respectively).The recent Covid pandemic and the associated economic crisis in market might be the probable reason for the lower B:C ratios in enterprises under the study.

Table 4.13 Distribution of enterprises on economic feasibility measures

Sl. No	Measures	Micro enterprises	Small enterprises	Medium and social enterprises
1.	**B:C**	1.06	1.06	1.09
2.	**NPW**	2,76610	28,72,200	40,46,96,947
3.	**IRR**	24	38	43

4.3. Characterization and documentation of coconut enterprises based on major products and services

An inventory of products and services from coconut enterprises was prepared and the enterprises were characterized based on selected product related parameters. The selected variables included major products based on production proportion, product diversity based on number and type of products manufactured, quality standards followed, product diversification potential and market competitiveness. The product and service profile of coconut enterprises based on the selected variables are discussed in the following subtitles.

4.3.1. Products from coconut MSMEs

An inventory of the main products and technology used by the coconut enterprises was elucidated. Major products comprised of those products that constituted more than 50% of total annual production of an enterprise. Accordingly, three major products were delineated for coconut enterprises based on production proportion viz. coconut oil (81.14%), virgin coconut oil (VCO) (9.43%) and coconut paste (9.43%) as presented in Table 4.14. Coconut oil was identified to have a production proportion of 80 per cent in micro enterprises while in small enterprises and in medium and social enterprises it had 90 and 76.93 per cent respectively. Thus, among all the enterprise categories coconut oil had a product proportion of 81.14 per cent and had dominated as the most significant product of coconut enterprises. This could be attributed to reasons related to input cost, low labour requirement in production and also the state's legacy in coconut oil production and processing.

Virgin coconut oil was comparatively a new product in commercial market which was less exploited earlier. However, the overall production proportion of virgin coconut oil was only 9.43 per cent and it served as the major product in 23.07 per cent of medium and social enterprises. The production proportion of virgin coconut oil in small enterprises was 10 per cent and in micro enterprises was 3.3 per cent. The uniformly low production proportion of VCO in micro and small enterprises could be linked to the conventional technology used and also the difficulty in establishing market presence in the highly competitive niche markets where quality of VCO will hold the premium.

Coconut paste formed a major product of 16.6 per cent of the micro enterprises, but was not a leading product in higher enterprise categories. Coconut paste manufacturing was less capital intensive and high-level machinery or skills were not related to its production which made the product popular among the micro entrepreneurs as evident from the results. Mendis (2010) also reported a similar funding

that use of less sophisticated technology with less capital investment enhanced productivity in coconut based micro enterprises.

Table 4.14. Distribution of coconut enterprises based on major products

Sl. No	Major products	Micro enterprises (%) (n=30)	Small enterprises (%) (n=10)	Medium and social enterprises (%) (n=13)	Total% (n=53)
a.	Coconut oil	80	90	76.93	81.14
b.	Virgin coconut oil	3.3	10	23.07	9.43
c.	Coconut paste	16.6	-	-	9.43

4.3.2. Technology use profile of coconut enterprises

The details related to the use of technology for the production of major products in coconut enterprises are reported in Table 4.15. The results showed that micro enterprises used 4 bolt or 6 bolt expeller machines for extraction of oil from copra. This technology had an average production capacity of 96-400 kg/day. In small enterprises 9 bolt or 12 bolt expeller machines were in use which had an average production of 10-20 tonnes/day. Medium and social enterprises were using high-cost combined expeller for the manufacture of coconut oil with an average production capacity of 100-150 tonnes/day. Micro entrepreneurs manufactured the virgin coconut oil using traditional technology that involved less sophisticated machines which could extract only 30 kg/day. However, the higher-level enterprises used the centrifugation process with a production capacity of 5-6 tonnes/day. Production of coconut paste was confined to micro enterprises and involved the use of grinders with motors for their manufacturing process and the average production capacity was 80kg/day. The results suggested that the technology use in coconut enterprises was intrinsically linked to the level of enterprise which determined the level of production. The result showed concordance with the observation of Bawalan (2003) that the production capacity for the major product in enterprises was decided by level of coconut processing technology in use and it varied across different enterprise categories.

Table 4.15. Technology use profile of coconut enterprises

Sl. No	Major product	Major technology in use	Average minimum production capacity/day
I. Micro enterprises			
1.	**Coconut oil**	4 bolt, 6 bolt expeller – extraction/milling technology	96-400 kg/day
2.	**Virgin coconut oil**	Traditional process	30kg/day
3.	**Coconut paste**	Grinder	80 kg/day
II. Small enterprises			
1.	**Coconut oil**	9 bolt, 12 bolt expeller - extraction /milling technology	10-20 tonnes/day
2.	**Virgin coconut oil**	Centrifuge process	5-6 tonnes/day
III. Medium and social enterprises			
1.	**Coconut oil**	Combined expellers	100-150 tonnes/day
2.	**Virgin coconut oil**	Centrifuge process	5-6 tonnes/day

4.3.3. Product diversity in coconut enterprises

The results of product diversity were in terms of number product and the type of products manufactured in enterprises. The inventory of coconut-based products recorded from the enterprises are listed as follows.

Coconut water-based Products

- Tender coconut water
- Tender coconut water based blended beverages
- Coconut squash
- Coconut water vinegar
- Nata-de-cocoa

Coconut kernel-based products	**Coconut inflorescence-based products**
● Coconut oil ● Virgin coconut oil ● Desiccated coconut ● Coconut skim milk ● Spray dried coconut milk powder	● *Neera* ● Toddy vinegar ● *Neerachakkara* ● *Neera* honey ● Coconut palm sugar

• Coconut jam • Ball copra • Coconut cream • Coconut chips • Natural coconut ice cream • Coconut biscuit • Coconut candy • Coconut cake and burfi	

The number of coconut-based products manufactured by majority of micro enterprises (80%) ranged from1-2 and 40 per cent of small enterprises had a product range between three to five. However, 30.76 per cent each of the medium and social enterprises had a product range of five to seven and more than seven respectively. The product diversity score of micro enterprises were found to be 3 while the scores of small and medium –social enterprises were found to be 4.1 and 4.8 respectively. The average product diversity statistics of the entire coconut enterprises (3.7) were showing more inclination towards the micro enterprises indicating that majority of the enterprises manufactured 1-2 products (26.04%) and most of the products were kernel based (77.3 %).And in micro enterprises 95 per cent were focused on kernel-based products and in small enterprise categories 60 per cent and in medium enterprises it was found to be 56 per cent. The enterprises manufacturing inflorescence-based products were 5.6 per cent shell-based products were 9.43 per cent, water-based products were to be 3.77 and husk-based product manufactures were only 3.01 per cent.

Table 4.16. Product diversity in coconut enterprises

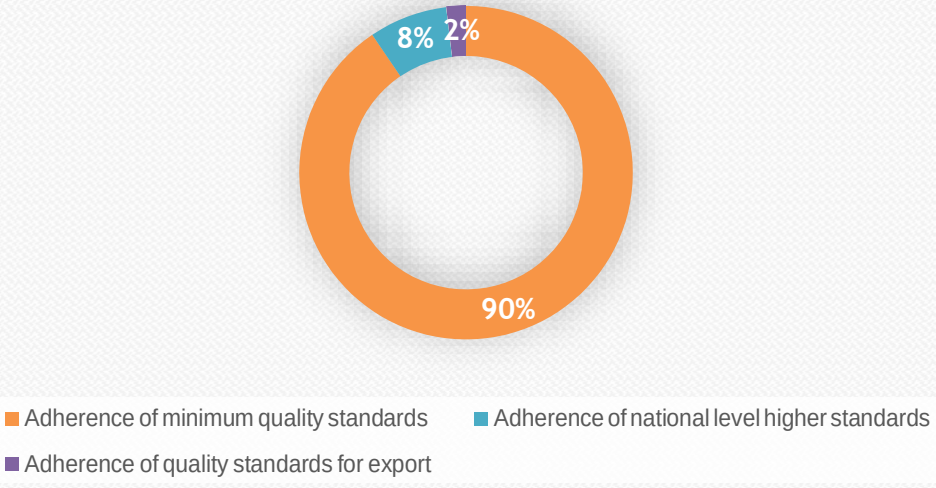
Sl. No	Major products	Micro enterprises (%) (n=30)	Small enterprises (%) (n=10)	Medium and social enterprises (%) (n=13)	Total% (n=53)
I.	**No. of products per enterprise**				
a.	1-2	80	30	15.3	26.05

b.	3-5	20	**40**	**23.07**	**24.5**
c.	5-7	-	**30**	**30.76**	**13.2**
d.	>7	-	**-**	**30.76**	**7.54**
Mean= 5.5; Standard deviation= 4					
ii.	**Type of products**				
a.	Husk based products	-	10	11	3.01
b.	Shell based	5	10	12.5	9.43
c.	Kernel based	95	60	56	77.3
d.	Water based	-	15	10	3.77
e.	Inflorescence based	-	5	10	5.6
	Average product diversity score (summated measure of the type and number of the products**)**	3	4.1	4.8	3.7

4.3.4. Quality assurance standards in coconut enterprises

The results of the quality standards followed by coconut enterprises has been depicted as Fig. 4.12. It could be inferred from the graph that among the coconut enterprises 90.5 per cent were having minimum quality standards while 8.0 per cent followed additional national level quality standards and two per cent had international quality standards.

Fig.4.12. Quality adherence standards of coconut enterprises



The category wise results presented in Table 4.17 showed that all micro enterprises followed the minimum quality standard prescribed for the manufacture of the produce. The results also indicated that 90 per cent of the small enterprises possessed minimum quality standards alone and only 10 per cent had the facilities to adhere to the additional national level higher quality standards. Also, among the medium and social enterprises 70 per cent had only minimum quality standard prescriptions for their produce. However, 15 per cent each possessed facilities to adhere to the national level quality standards and also international quality standards. The statistics of additional quality standards other than minimum standards was an indication of the reach of products outside the domestic market. Thus, it could be inferred that the export of coconut-based products from the enterprises was very low and proper measures have to be taken to improve the quality standards of products in order to expand to foreign markets.

Table 4.17. Adherence of quality standards in coconut enterprises

Sl. No	Quality standards	Micro enterprises (%) (n=30)	Small enterprises (%) (n=10)	Medium and social enterprises (%) (n=13)	Total % (n=53)
1	Adherence of minimum quality standards	100	90	70	90.5
2.	Adherence of national level higher standards	0	10	15	7.6
3.	Adherence of quality standards for export	0	0	15	1.9

4.3.5. Product diversification potential

The product diversity potential of the enterprise categories under the study was found to be high (94.3). The product diversity of enterprises was on par with the average product diversity score obtained by respective micro, small and medium-social enterprise categories. For micro enterprises it was 91.6% while for small enterprises it was 95 per cent. The product diversity potential of medium and small enterprises were found to be 98.5 %. The market competitiveness of enterprises was found to be 8.48 per cent. The medium and social enterprises were found to be most competent (6.2%) followed by small enterprises (2.2%) and micro enterprises were found to be least competent (1.04 per cent). Thus, the degree of competitiveness of the operating environment in which the enterprise operates is less and the enterprises have to restructure their market strategies and methods of marketing of the produce.

Table 4.18. Distribution of coconut enterprises based on product diversification potential

Sl. No	Major products	Micro enterprises (n=30)	Small enterprises (n=10)	Medium and social enterprises (n=13)	Total% (n=53)
1	Product diversification potential score	0.916	0.95	0.985	0.943
2	Percentage	91.6	95	98.5	94.3

4.3.6. Market competitiveness

The result of market competitiveness (Table 4.19) revealed that the enterprises under the study had 8.48 per cent average annual sale of coconut oil in comparison with average annual sale of the district. This share accounted the degree of competitiveness of the enterprises for the dominant product coconut oil. The micro enterprises showed least level of competitiveness (1.04%) while small enterprises showed 2.2 per cent of competitiveness with district market and medium social enterprises showed the highest level of competitiveness (6.2%) in comparison with the other enterprise categories. The technologies in use, skilled human resources and use of digital marketing tool i medium and social enterprises increased their level of competitiveness. Mukherjee *et al*. (2018) made similar observation with respect to higher business categories that advanced technology, higher usage of digital platforms for marketing, more investment in human resources, improved access to finance, reduced infrastructural gaps helped improving their competitiveness.

Table 4.19 Market competitiveness of MSMEs

Sl. No	Major products	Micro enterprises % (n=30)	Small enterprises % (n=10)	Medium and social enterprises % (n=13)	Total % (n=53)
1.	Market competitiveness	1.04	2.2	6.2	8.48

44. Technology use pattern in coconut enterprises

Evaluation of technology use pattern of coconut enterprises was mapped based on the skill sets of the workers related to communication skills (CS), technical skills (TS), problem solving skills (PSS), interpersonal skills (IPS) and decision-making skills (DMS). These skill sets were the determinants of the level of technology use and in turn the performance of the different category of enterprises. The perceptual mapping tool of correspondence analysis was used in the analysis.

Table 4.20. Correspondence matrix of skill attributes for different categories of coconut enterprises

	Skill attributes					
Type of enterprise	Comn. skill	Intpers. skill	Decmak. skill	Pbslv. skill	Tech. skill	Active Margin
Microenterprise	29	42	42	45	43	201
Small enterprise	35	53	55	55	57	255
Med social enterprise	38	53	44	46	42	223
Coco.MSME	47	54	59	56	57	273
Active Margin	149	202	200	202	199	952

The results indicated that in microenterprises problem solving skills with score value of 45 assumed greatest significance compared to other skill sets. However, with respect to small enterprises, technical skills and decision-making skills shared equal importance with score of 55 each over other skills. In medium and social enterprises, the interpersonal skills with score of 53 was of paramount importance over other skills.

Thus, the analysis enabled to understand which skill attributes were associated with the competence of workforce in a particular category of enterprise.

In the analysis, the matrix scores were considered proportional to the independence of Chi square statistics and is presented in Table 4.21. The statistics in the table showed that the extracted two dimensions with inertia values of 0.003 and 0.001 together explained 97.7 per cent of total variance.

Table 4.21. Correspondence analysis statistics

Dimensions	Inertia	Chi Square	Sig.	Accounted for	Cumulative	Standard Deviation
1	.003			0.686	0.686	.032
2	.001			0.291	0.977	.033
3	.000			0.023	1.000	
Total	.004	3.721	.988[a]	1.000	1.000	

The results represented graphically is depicted as Fig,4.13. The results from the figure explained the needed skill set of workforces in each enterprise category. The results in the graph clearly described how the various skill sets were associated to describe the technology use pattern of the enterprise category studied. It was evident from the graph that problem solving skills was associated with both micro and small enterprises. Also, decision making skills and technical skills were associated with small enterprises. The skill which assumed importance in medium and social enterprises was interpersonal skills and for coconut MSMEs in general was communication skills. Thus, the results, enabled to predict the needed skill set of workforces belonging to specific enterprise categories and through that decide the technology use pattern of the enterprises. Similar observations were made by Manjunath *et al*.(2019) and the study suggested that technical skills alone cannot improve performance of employees and interpersonal skill was found to be important for performance of frontline employees.

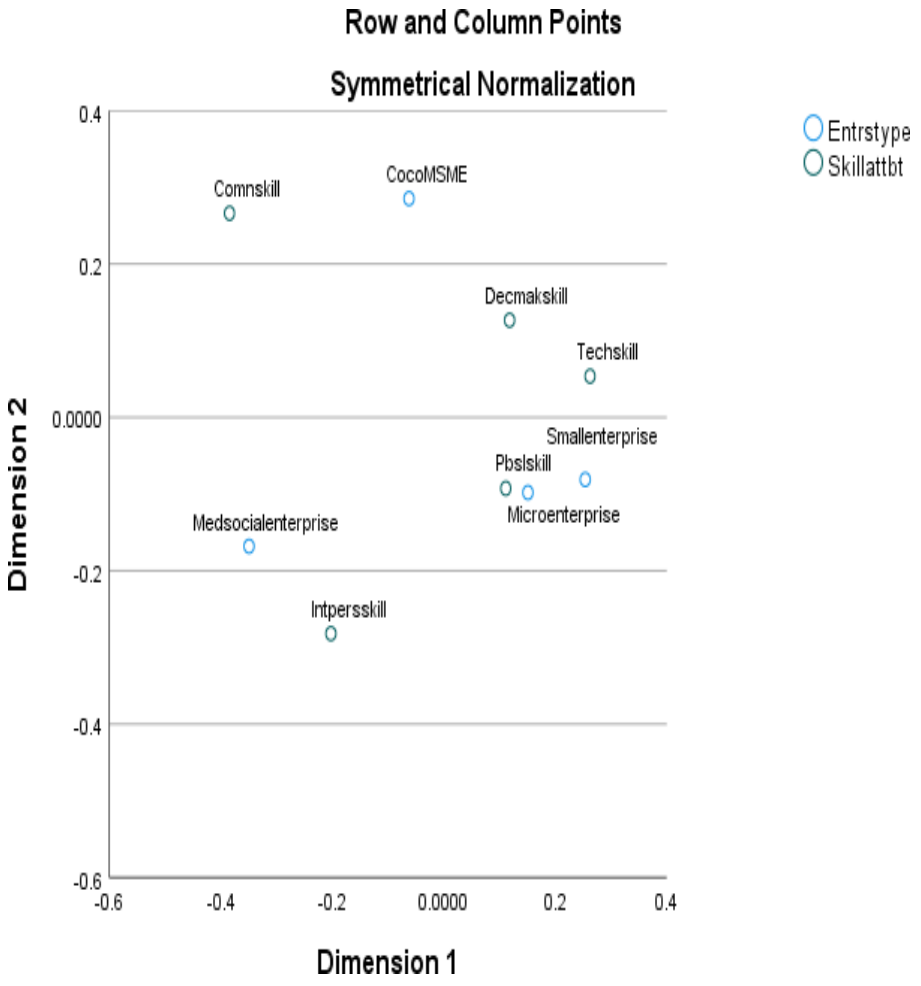


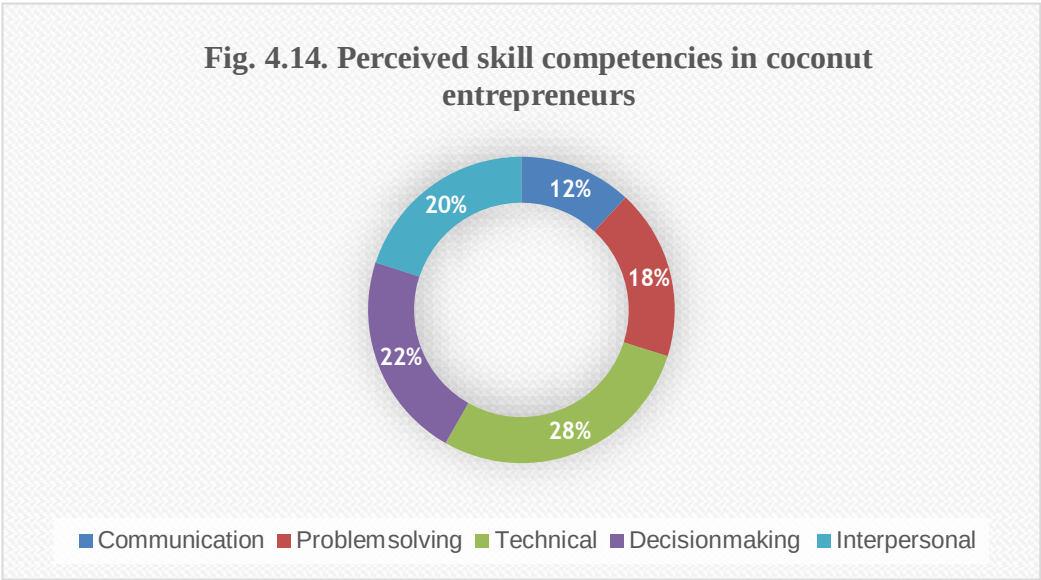
Fig. 4.13. Symmetrical normalized correspondence analysis graph

45. Perceived skill competence of workers in coconut enterprises

Perceived skill competence of workers in coconut enterprises was measured in terms of selected skill sets viz. communication skills (CS), technical skills (TS), problem solving skills (PSS), interpersonal skills (IPS) and decision-making skills (DMS). The perception scores on the different skill competencies of coconut enterprises depicted in Fig.4.14 showed that the workforce in different categories of enterprises had highest competency in technical skills (28.97%). It was reported that the workers were able to operate the machines efficiently in workplace and had sufficient knowledge in its operation. They were also aware about the latest technology trends and were capable of giving training and advices

to other workers. The least perceived competency among the workers was observed in communication skills (11.9). They reported difficulties in the presentation of ideas and concepts and also faced constrains in interacting with peers from different cultures.

Fig. 4.14. Perceived skill competencies in coconut entrepreneurs



The results of the perceived skill competencies analyzed in terms of different enterprise categories are presented in Table 4.22. When the work force in each category were separately analyzed the micro enterprise workers expressed highest competence in problem solving (31.5%) followed by interpersonal skills (28.4). They were found to be confident in negotiations, repair and maintenance of the machines and also knew the schedules for proper cleaning of machines, tools etc. They perceived their least competence in decision making skills (22.0%). The workforce in small enterprise category expressed more competencies in technical skill (26.1%) while they were less competent in interpersonal skill (22.4%). In case of medium and social enterprises the workers perceive their expertise in decision making (52.6%). They reported to be capable of making decisions affecting the quality of the products, job rotation in workplace, and management activities. But they had less perceived competency related to problem solving (46%). The results regarding the perception of skill competencies of work force in different categories of coconut enterprises assumed significance in framing

effective skill development programs. Programs could be planned according to the skill need of the work force. Similar suggestions were earlier proposed by Comyn (2014) in his study. He proposed to target the most vulnerable and less confident workforce for skill trainings supplemented with specialized programmes. These would facilitate in resolving the demand for skilled manpower in the coconut enterprises.

Table 4.22. Distribution of workforce based on perceived skill competence (n=100)

Sl. No	Skill competencies	Skill competency score (%)			
		Micro enterprises	Small enterprises	Medium and social enterprises	Total
1.	Communication	155 (24.3)	161 (25.2)	322 (50.5)	638 (11.9)
2.	Problem solving	300 (31.5)	215 (22.6)	437 (46.0)	952 (18.0)
3.	Technical	366 (23.4)	397 (26.1)	766 (50.4)	1519 (28.37)
4.	Decision making	258 (22)	297 (25.3)	616 (52.6)	1171 (21.8)
5.	Interpersonal	305 (28.4)	241(22.4)	528 (49.1)	1074 (20.0)
	Total mean score	277	262	534	5354

(Maximum possible total score = 1519; Minimum possible total scores = 241; Range of scores = 1278)

4.5.1. Perceived skill gap in coconut enterprises

The results from Table 4.23 revealed that the gap between the expected skill competence of the entrepreneurs and the perceived skill competence of the work force reduced with increase in the scale of the enterprise. The gap was more

pronounced in micro enterprises and least in the medium and social enterprises. The reason for low skill gaps in higher level enterprises could be attributed to the effective human resource development activities undertaken in these enterprises. Most of these enterprises had HR departments and in-house training facilities that were actively involved in the capacity and skill development of workers. The programs planned were mostly based on the work allotted and the skill sets needed in the job. Moreover, these enterprises also hired expert trainers and consultants in necessary situations and encouraged workers through incentives and promotions to meet goals. These enterprises had close association with the district MSMEs offices and other reputed organizations in coconut sector and the congenial work environment enabled facilitation of skill development. These observations were reported by Padhi (2015) who suggested that skill gap could be reduced by enhancing firms' ability to encourage the skilled workers through incentives. He also suggested that in-house training by firms could be more reliable for training and capacity development. However, in micro enterprises where scope for such facilitations were limited utilization of skill development programs of the state and national agencies would have great relevance to improve the skill competencies of workers. In such cases the government agencies could also act as a nodal agency for coordinating the skill upscaling activities.

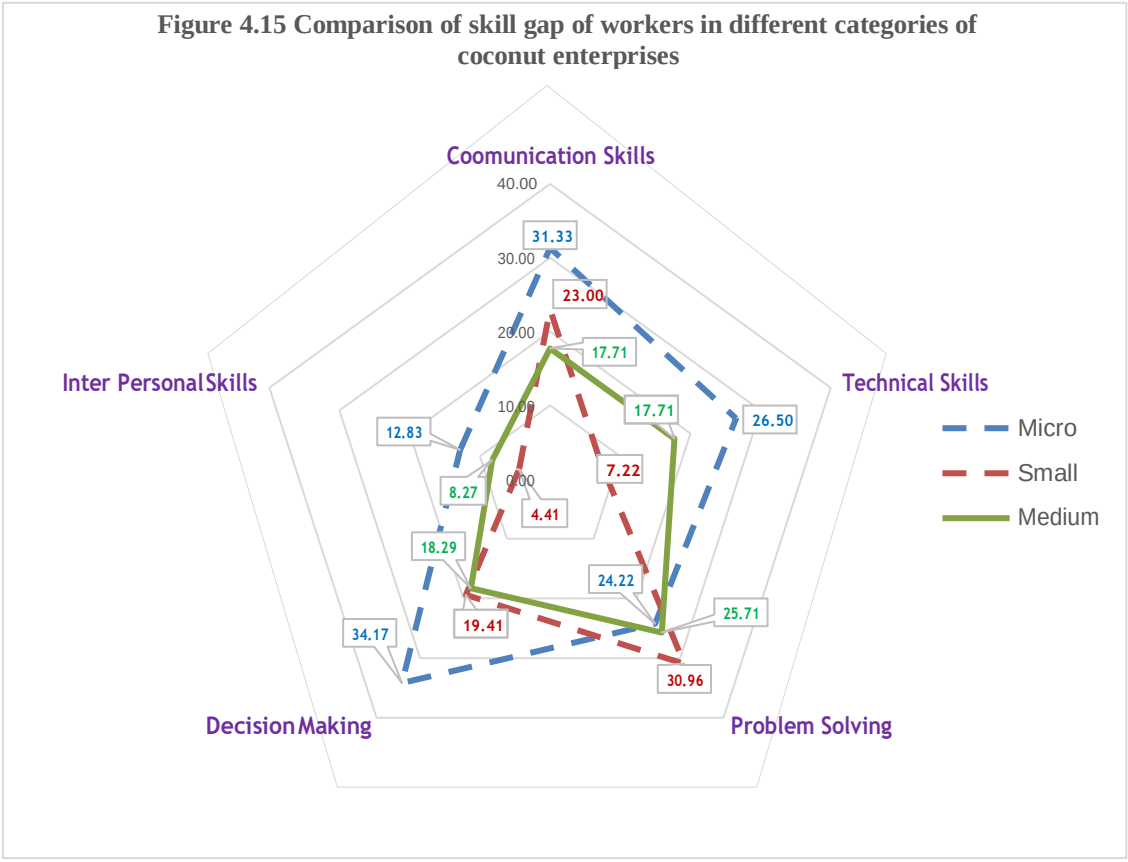
Table 4.23. Perceived skill gap of workers in coconut enterprises (n=100)

Sl. No	Enterprise category	Expected mean skill score	Perceived mean skill score	Perceived mean skill gap
1.	Micro	0.80	0.55	0.25
2.	Small	0.83	0.67	0.16
3.	Medium and social	0.86	0.73	0.13
4.	**Total mean score**	0.82	0.66	0.16

(Score range = 0.12 ; Standard Deviation = 0.052)

A comparison of skill gap competencies in communication, decision making, problem solving, technical and interpersonal of the workforce in different enterprise categories was analyzed and interpreted through radar graphs (Fig.4.15). The length of each axis is proportional to the gap existing in the represented skill competency, larger the gap longer the axis. The results from the figure indicated that there existed a larger skill gap among the work force of microenterprises compared to small, medium and social enterprises. Skill gap was highest in decision making (34.17) followed by communication skills (31.33) in micro enterprises and the minimum gap was recorded in interpersonal skills. When small enterprises were considered, it was found that they were lacking more in problem solving skills (30.96) and the least gap was in interpersonal skill (4.41). The observations from the figure also revealed that medium enterprises needed skill enhancement in problem solving skills (25.71) and they had expressed better competencies in the interpersonal skills with lesser gap (8.27). Thus, it could be concluded that the extent of skill gap in different competencies varied with the type of enterprise. In general, larger skill gap was observed with respect to problem solving in all types of enterprises and the least gap was recorded in interpersonal skills. This could be attributed to the frequent training and skill development programs from the agencies like CDB, CPCRI, ABI facilitated by universities etc. that enabled to reduce the skill gap, especially in technical aspects. All the enterprise categories were more competent in interpersonal skills as evident from lower recorded gap for this competency in all categories. The wider gaps in decision-making and problem-solving competencies in all types of enterprises could be attributed to less coverage of these topics in training programs. Similar observation was made by Sanghi *et al* (2014) who reported that the biggest problem faced by the coconut sector was the lack of availability of skilled labour. The labour quality was mainly affected by poor education and lack of adequate vocational training.

Figure 4.15 Comparison of skill gap of workers in different categories of coconut enterprises



4.5.2. Comparison of perceived skill competence of workforce among different categories of enterprises

Non parametric Kruskal-Wallis H test was used to determine whether any difference was there among the different categories of enterprises in the perception of skill competence. The results are presented in Table 4.24 which showed significant difference in the perceived skill competence of work force among the different categories of coconut enterprises. The results were significant at one per cent level. Perceived skill competence was compared based on mean ranks obtained using Kruskal-Wallis H test depicted in Table 4.25. The results from the table showed that the medium and social enterprises had the highest mean rank followed by the small enterprises with mean scores 63 and 51.04 respectively. The micro enterprises had the least mean rank score of 29.27.

Table 4.24. Kruskal –Wallis test statistics for perceived skill competence of workforce

Test statistics	Values
Chi-square	25.13
df	2
p value	0.00

Table 4.25. Mean ranks of enterprise categories on perceived skill competence of work force

Sl. No	Enterprise category	Sample size	Mean Rank
1.	Micro enterprises	30	29.27
2.	Small enterprises	24	51.04
3.	Medium and social enterprises	46	63.00

4.6. Technology capability of coconut-based enterprises

The technology capability of enterprises was estimated as a measure of technology capability index (TCI). TCI was operationalized as a function of the enterprise resources (R), level of technology use (TU)**,** market competence (MC) and coordination and accessibility measures (CA). The weights for each of these variables was estimated using AHP as described in the methodology. The estimates derived from AHP used in TCI calculation is presented in Tables 4.26(A-D) .From the results of Table 4.26(A), it was revealed that micro enterprises got an average TC score of 0.38 and these enterprises gave more importance to level of technology use in developing the technology capability of enterprise (0.47) followed by the resources (0.40). The market competency was given a tertiary importance and the least score was obtained for coordination and accessibility.

Table 4.26(A).Average TCI score micro-enterprises

Sl No	Particulars	Score	Min	Max	Standard deviation
1	Resources	0.40	0.30	0.53	0.06
2	Level of technology use	0.47	0.44	0.60	0.04
3	Market competency	0.33	0.30	0.52	0.04
4	Coordination and accessibility	0.17	0.10	0.32	0.08
5	TC Score	0.38	0.31	0.40	0.03

The results from the Table 4.26(B) explained the technology capability of small enterprises. The results showed that level of technology use was given more importance with a score of (0.84) followed by resources (0.54).But alike micro enterprises the small enterprises gave more importance to the coordination and accessibility (0.51) than to market competency (0.33)and their average TC score was found to be 0.63. From the results of Table 4.26(C)the average technology capability score of medium and social enterprises were found to be 0.78 and in these enterprises the level of technology use (0.94) was given more importance followed by coordination and accessibility (0.78) and the resources (0.72) were given more importance than the market competency(0.52). When the entire coconut enterprises in the study were considered (Table 4.26(D)) the enterprises got an average TC score of 0.34. The enterprise categories were giving importance for level of technology use (0.66) in developing their technological capability followed by resources (0.5). Enterprises were giving almost equal importance for the market competency and coordination and accessibility with scores 0.40 and 0.39 respectively. Thus the results revealed the level of technology use was critically important in the technological capability of enterprises. The level of technology use in the preprocessing, processing, packaging and distribution held significant role in the determination of technology capability of enterprises. The result showed agreement with the observation of Mori *et al*. (2016) that technology capability helped the companies to understand their technology use behavior and potentials. And also helped in constructing

references for the technology dynamics of companies within an industry or region. Thus the level of technology use is highly significant and more attention should be given in the viewpoint of technology capability.

Table 4.26(B). Average TCI score of small enterprises

Sl No	Particulars	Score	Min	Max	Standard deviation
1	Resources	0.54	0.39	0.98	0.16
2	Level of technology use	0.84	0.67	1.01	0.10
3	Market competency	0.33	0.30	0. 52	0.04
4	Coordination and accessibility	0.51	0.18	0.85	0.23
5	TC Score	0.63	0.48	0.80	0.10

Table 4.26(C) Average TCI score of medium and social enterprises

Sl No	Particulars	Score	Min	Max	Standard deviation
1	Resources	0.72	0.55	0.98	0.14
2	Level of technology use	0.94	0.81	1.11	0.09
3	Market competency	0.52	0.39	0.87	0.15
4	Coordination and accessibility	0.78	0.68	0.92	0.08
5	TC Score	0.78	0.67	0.95	0.53

Table 4.26(D). Average TCI score of coconut enterprises

Sl No	Particulars	Score	Min	Max	Standard deviation
1	Resources	0.50	0.30	0.98	0.16
2	Level of technology use	0.66	0.44	1.11	0.23
3	Market competency	0.40	0.30	0.87	0.13
4	Coordination and accessibility	0.39	0.10	0.92	0.29
5	TC Score	0.34	0.95	0.53	0.18

4.6.1 Scaling readiness

Scaling readiness of innovations in enterprises was measured as the product of innovation use and innovation readiness under three levels viz. technological, marketing and management. The results from the Table 4.27 (A) showed that enterprises were giving more importance for the innovation use related to technological level. And micro enterprises expressed the highest innovation use in technology and management (15.66 and 2.66 respectively). The enterprises were giving more importance in technological level in innovation use compared to marketing and management. When innovation readiness was considered (Table 4.27 (B)) it is revealed that the medium and social enterprises were giving more importance for the innovation readiness in technological and management levels. And the results from Table 4.27 (C) revealed that the average scaling readiness score was found be more for micro enterprise categories (with a score of 445.77) which implied that further interventions can be made in the existing technologies without much increase in the investment. The upgradations or interventions in the existing technologies in higher enterprise category required huge investment. This showed the suitability of existing technologies in the ecosystem of higher enterprise categories. It was evident from the results that the scaling readiness score of each enterprise category had significant role in the diagnosis of the current readiness and use of innovations and for the planning of the developmental strategies in enterprises.

Table 4.27(A) Distribution of enterprises categories on innovation use

Sl. No	Particulars	Micro enterprise (avg.)	Small enterprises (avg.)	Medium and social enterprises (avg.)	Total enterprises (avg.)
1.	Technological	15.66	15.33	15.07	15.43
2.	Marketing	4.55	4.6	4.54	4.54
3.	Management	2.66	1.9	1.6	2.28

4.	Total	22.86	21.8	21.23	22.06

Table 4.27(B) Distribution of enterprise categories on innovation readiness

Sl. No	Particulars	Micro enterprise (avg.)	Small enterprises (avg.)	Medium and social enterprises (avg.)	Total enterprises (avg.)
1.	Technological	6.67	6.7	6.84	6.77
2.	Marketing	6.13	6.2	5.6	6.01
3.	Management	6.66	7.9	8.3	7.3
4.	Total	19.5	20.8	20.76	20.09

Table 4.27(C) Distribution of enterprise categories on scaling readiness score

Sl.No	Scaling readiness	Micro enterprise (avg.)	Small enterprises (avg.)	Medium and social enterprises (avg.)	Total enterprises (avg.)
1.	Score	445.77	440.7348	443.1854	453.44
2.	Percentage	58.9	18.8	22.3	100

Table 4.27(D) Distribution of enterprise categories on scaling readiness

Sl.No	Scaling readiness	Micro enterprise (%)	Small enterprises (%)	Medium and social enterprises (%)	Total enterprises
1.	**Low** (less than 347.5)	6.666667	10	8.2	5.7
2.	**Medium** (between 347.5-555.8)	53.33333	50	38.46	49.05
3.	**High (**more than 555.8)	40	40	53.8	45.28

4.6.1. Relation between the technological capability and independent variables

In order to find out the relationship between the selected independent variables and the technological capability of enterprises Spearman correlation coefficient was used and the finding are presented in Table 4.28

Table 4.28 Correlation of independent variables on technological capability

Sl. No	Independent variables	Correlation coefficient (r_{sp})
1.	Age	-0.207
2.	Gender	-0.201
3.	Educational status	0.284*
4.	Occupational status	-0.025
5.	Extension contact	0.513**
6.	Social participation	0.689**
7.	Mass media contact	0.951**
8.	Managerial competency	0.793**
9.	Type of ownership	-0.478
10.	Level of technology use	0.830**
11.	Production capacity	0.826**
12.	Scaling readiness	-0.037
13.	Skill competence of workforce	0.296*

*Significant at 0.05 level, **Significant at 0.01 level

The results from table 4.28 revealed that the nature of relationship between the dependent variable and selected independent variables. The r_{sp} values indicated significant correlation of technological capability of enterprises with selected variables expect with age, gender, occupational status, type of ownership and scaling readiness. There was a significant positive correlation between technological capability and educational status, skill competence of workforce at 5% level of significance and a significant positive correlation between the level of Extension contact, mass media contact, social participation, managerial competency, level of technology use, and

production capacity at 10 per cent level of significance. The results indicated the relevance of these selected variables in the technology capability analysis of enterprises.

47. Sustainable entrepreneurship development framework for coconut sector

The model has been suggested for the development and utilization of merging entrepreneurial opportunities among the different types of coconut enterprises**.** Conventional entrepreneurship in coconut sector was focused mainly on profit maximization. But in order to sustain growth and development of enterprises in the sector, environmental and social externalities in the system need to be made an integral part of the entrepreneurial ecosystem. The sustainable entrepreneurship development in coconut enterprises has been defined as the function of technological capability of enterprises, skill competence of workforce, scale readiness of innovations and of efficient forward and backward linkages. The technology capability dimensions identified were resources, level of technology use, market competency and coordination and accessibility. The results indicated that level of technology use, the resources related to an enterprise such as human capital, infrastructure, investments etc should be given the highest weight (0.38) compared to other identified variables. The level of technology use in preprocessing, processing, packaging and distribution closely followed with a weight of (0.34). When coconut enterprises were considered coordination and accessibility and market competency held almost equal level of importance with weigh 0.14 and 0.12 respectively.

Skill competency of workforce was another important determinant that emerged significant and was included to define the sustainable entrepreneurship development framework. The skill competence determined the technology use pattern in coconut enterprises as evident from the significant relation with TC (Table 4.28). The analysis of skill competencies revealed that the coconut workers lacked communication competency in greater level followed by problem solving. The most competent skills were among the workforce were the technical and decision making skills. Innovation was another important attribute of technology capability which was analyzed in terms

of its scaling readiness. Scaling readiness measurement being a product of innovation use and innovation readiness defined the status of an enterprise to upgrade with technological innovations at different levels. Supply and value channels were having paramount importance in the development of sustainable entrepreneurship development. A frame work combining these selected dimensions was used to elucidate a sustainable entrepreneurship development framework for coconut enterprises as depicted in Fig. 4.16

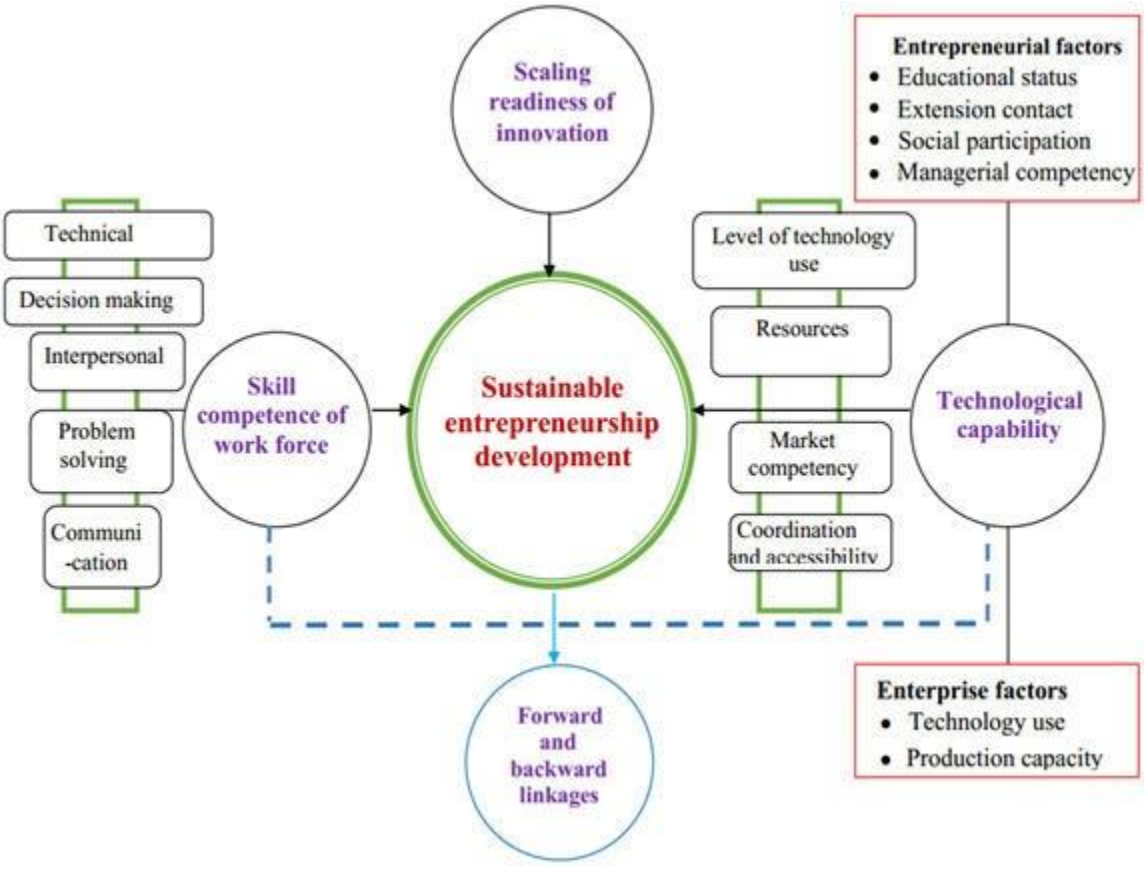


Figure 4.16. Conceptual models for sustainable entrepreneurship development

Summary and conclusion

CHAPTER 5

SUMMARY AND CONCLUSION

Coconut is intrinsically linked to the economy and culture of Kerala. Coconut processing and allied enterprises provide continuous employment to nearly 8 lakhs workers (Banu and Palanivel, 2019). Technology and innovation plays critical role in the efficiency and effectiveness of the enterprises based on coconut. The use and integration of new technologies and the up scaling of existing technologies suited to the physical environment assumes great significance in this context. The technological capability would determine the rates and patterns of development and competitive advantage of enterprises. These capabilities cannot be acquired overnight and that they will vary over time and space. Therefore an analysis of technological capability aid enterprises in enhancing its capacity to absorb, use, adapt, develop, transfer and disseminate technologies for quality output and better income. The study of factors that form the basis of the technological capability of coconut enterprises can effectively redefine the coconut based entrepreneurial ecosystem of the state.

It was in this back ground the study was conducted on analysis of technological capability of coconut based enterprises. Three selected districts from Kerala viz. Thrissur, Ernakulam and Kozhikode formed the study area. The districts were purposively selected based on the presence of maximum number of registered Micro, Small and Medium enterprises. The details of registered MSMEs in coconut were collected from the District Industries Centres (DICs) and Coconut Development Board (CDB). The total sample size of enterprises was fixed as 45 and additional eight social enterprises run by farmer collectives in the selected districts were also selected from these districts following the selection criteria. A total of 100 skilled workers involved in technology use in these enterprises were also selected as respondents in the study. Thus, the total sample size of the study was 153 comprising of the 45 MSME coconut entrepreneurs, 08 FPO CEOs and 100 skilled workers.

For primary data collection, each enterprise was visited with a pretested interview schedule prepared under the guidance of advisory committee and expert consultancy. Secondary data was collected from district MSME offices, CDB and the study entitled *Technological capability analysis of coconut based enterprises* was undertaken with the following objectives.

1. Documentation and categorization of coconut enterprises based on major products and services
2. Mapping of the technology use pattern in the delineated enterprise categories
3. Evaluation of the technological capabilities of the selected enterprises
4. Propose a conceptual model for sustainable entrepreneurship development for coconut enterprises

The data collected were analysed using appropriate statistical tools to derive the following major findings.

Profile of entrepreneurs in coconut sector

- Majority (49%) of the entrepreneurs under study belonged to the middle age group of 36 to 50 years, followed by 32.00 per cent and 19.00 per cent belonging to young and old age respectively
- The presence of women entrepreneurs in the coconut entrepreneurship sector was only 7.55 per cent compared to men (92.45%)
- The educational status of significant majority of entrepreneurs were up to high school level (43.4%) and 39.62 % was found to have received education up to middle school level. The entrepreneurs who were graduated or attended any job oriented courses were 9.43 per cent and those with primary education only were 7.65 per cent only
- The occupational status of majority (69.81%) of entrepreneurs showed that they were dependent only a business for the livelihood income. While 16.98 per cent dependent of both farming and business for income. Farming and service jobs were the occupation of 11.32 per cent of the respondents while 1.89 per cent dependent on agriculture as their main occupation

- Majority (64%) of entrepreneurs under the study had low level of extension contact while 30 per cent had medium level of extension contact and only 6 per cent had high level of contact with various extension agencies
- Among the entrepreneurs studied 94 per cent showed medium mass media exposure while 6 per cent had low mass media exposure
- Majority (70%) of the entrepreneurs under study showed regular participation in social organizations while 30 per cent showed occasional participation
- The annual income of majority (42%) of coconut entrepreneurs was above 3 lakh and 30 per cent had annual income between 2 lakh and 2.5 lakh. There were also 19 per cent of the entrepreneurs who had annual income between 1.5 lakh and 2 lakh and another 9 per cent with annual income between 1 lakh and 1.5 lakh
- Majority of the entrepreneurs (53%) expressed medium level of managerial competency while 24 per cent expressed high level of competency and 23 per showed low level of competency
- Entrepreneurial orientation studied in the three dimensions of innovativeness, proactiveness, and risk taking indicated that across the enterprises categories innovativeness was found to be high followed by risk taking abilities and proactiveness
- More than half (55%) of the coconut entrepreneurs had separate owned land for their enterprises. While 25.1 per cent were with leased or rent land, 19.9 per cent had made conversion within own household for the enterprise. In case of micro enterprises 53.3 per cent had separate owned land while 36.7 made conversion in owned household and 10 per cent were operating on leased or rent land. Majority of small enterprises (46.2 %) were working on leased or rent land while rest of them had separate owned land. In medium and social enterprise categories 53.8 per cent of enterprises were operating on separately owned land while 46.2 per cent were in leased or rent land

Profile of coconut-based enterprises

- Majority (42%) enterprises were in the age of 15 to 25 years while 28.00 per cent had age more than 25 years. There were also enterprises in the age category between 5 to 15 years and less than 5 years at 21 per cent and 9 per cent respectively
- The majority of enterprises (43%) had a sole proprietorship mode of ownership followed by 42 per cent in partnership mode of ownership. There were also 15 per cent with cooperative type of ownership
- There were a significant majority of enterprises (57%) with investment less than one crore and annual turnover less than 5 crore followed by 34 per cent with investment less than ten crore and annual turnover less than 50 crore. There were also 9 per cent of enterprises with investment less than 20 crore and annual turnover less than 100 crore in the study
- The majority (41%) of enterprises had more than 20 employees in their enterprise while 38.00 per cent of them had employees with less than five number of employees and 21 per cent of enterprises were having five to twenty number of employees in their enterprise
- There were three significant channels of value chains identified among the micro enterprises. The channel that included retailer as intermediate between enterprise and consumer had a market efficiency of 8.54 and price spread of 8. The average lag time in this channel was found to be 3 days. There were two prominent supply chain channels in the enterprises of which the channel with no intermediary that directly procured from farmers had the highest market efficiency of 99 per cent and price spread was zero
- The economic feasibility measures IRR and NPW values were significantly high for medium and social enterprise categories. While there were no much difference B:C ratios of enterprises. For medium and social enterprises it was 1.09 while for micro and small enterprises measured 1.06 in the study

Characterization and documentation of coconut enterprises based on major products and services

- Three major products were delineated as major product in coconut enterprises based on production proportion viz. coconut oil (81.14%), virgin coconut oil (VCO) (9.43%) and coconut paste (9.43%)
- Coconut oil was identified to have a production proportion of 80 per cent in micro enterprises while in small enterprises and in medium and social enterprises it had 90 and 76. 93per cent respectively. Thus, among all the enterprise categories coconut oil had a product proportion of 81.14 per cent and had dominated as the most significant product of coconut enterprises in the study
- The micro enterprises used 4 bolt or 6 bolt expeller machines for extraction of coconut oil from copra. This technology had an average production capacity of 96-400 kg/day. While in small enterprises 9 bolt or 12 bolt expeller machines were in use which had an average production of 10-20 tonnes/day. Medium and social enterprises were using high-cost combined expeller for the manufacture of coconut oil with an average production capacity of 100-150 tonnes/day
- Micro entrepreneurs manufactured the virgin coconut oil using traditional technology which could extract only 30 kg/day. But the higher-level enterprises used the centrifugation process with a production capacity of 5-6 tonnes/day
- The number of coconut-based products manufactured by majority of micro enterprises (80%) ranged from one to two while 40 per cent of small enterprises had a product range between three to five. Moreover, 30.76 per cent of the medium and social enterprises had a product range of five to seven and more than seven respectively
- In micro enterprises 95 per cent were focused on kernel-based products and in small enterprise categories 60 per cent and in medium enterprises it was found to be 56 per cent. The enterprises manufacturing inflorescence-based products were 5.6 per cent shell-based products were 9.43 per cent, water-based products were to be 3.77 and husk-based product manufactures were only 3.01 per cent

- In the study 90.5 per cent of enterprises were having minimum quality standards while 8.0 per cent followed additional national level quality standards and only two per cent had international quality standards
- The product diversity potential of micro enterprises was 91.6 per cent while for small enterprises it was 95 per cent and of medium and small enterprises was found to be 98.5 per cent
- The market competitiveness was found to be highest among the medium and social enterprises categories at 6.2% per cent followed by small enterprises (2.2%) and micro enterprises (1.04 per cent)

Technology use profile of enterprises

- The technology use pattern of coconut enterprises was mapped based on the skill sets of the workforce related to communication skills, technical skills, problem solving skills, interpersonal skills and decision-making skills
- In microenterprises problem solving skills were assumed to had greatest significance compared to other skill sets (score value of 45). While in small enterprises, technical skills and decision-making skills shared equal importance with score of 55 each over other skills. In case of medium and social enterprises, the interpersonal skills with score of 53 were of paramount importance over other skill sets
- Among the perceived skill competence of workforce across the enterprise categories it was evident that micro enterprise workers expressed highest competence in problem solving (31.5%) followed by interpersonal skills (28.4). The workforce in small enterprise category expressed more competencies in technical skill (26.1%) while they were less competent in interpersonal skill (22.4%). In case of medium and social enterprises the workers perceived their expertise in decision making (52.6%) and they had less perceived competency related to problem solving (46%)
- The perceived skill gap analysis revealed that in micro enterprises was highest gap was in decision making (34.17) followed by communication skills (31.33) and the minimum gap was recorded in interpersonal skills. When small enterprises were considered, it was found that they were lacking more in problem solving skills (30.96) and the least gap

was in interpersonal skill (4.41). In case of medium and social enterprises highest gap was in problem solving skills (25.71) and they had expressed better competencies in the interpersonal skills with lesser gap (8.27)

- There was a significant difference in the perceived skill competence of work force among the different categories of coconut enterprise**s**

Technological capability (TC) of coconut-based enterprises

- Technology capability index (TCI) showed that that micro enterprises had an average TC score of 0.38 and these enterprises gave more importance to level of technology use in developing the technology capability of enterprise (0.47) followed by the resources access (0.40)
- In small enterprises the level of technology use was given more importance with a score of (0.84) followed by resource access (0.54). Unlike micro enterprises the small enterprises gave more importance to coordination and accessibility (0.51) their average TC score was found to be 0.63
- In case of medium and social enterprises the average technology capability score was found to be 0.78 and in these enterprises the level of technology use (0.94) was given more importance followed by coordination and accessibility (0.78) and the resource access (0.72)
- The average TC score of entire coconut based enterprises were found to be 0.34 and the enterprise categories were giving importance for level of technology use (0.66) in developing their technological capability followed by resources access (0.5)
- In terms of scaling readiness to innovations the micro enterprises showed the highest innovation readiness with respect to technology and management. The average scaling readiness score was found be more for micro enterprise categories (score of 445.77) which implied that further interventions can be made in the existing technologies without much increase in the investment
- There was a significant positive correlation between technological capability and educational status, skill competence of workforce at 5% level of significance and a significant positive correlation between the level of extension contact, mass media

contact, social participation, managerial competency, level of technology use, and production capacity at 10 per cent level of significance.

Sustainable entrepreneurship development

- The sustainable entrepreneurship development framework for coconut enterprises integrated dimensions of technological capability, skill competence of workforce, scale readiness for innovations and forward and backward linkages of the enterprise
- The technology capability dimensions identified were resources, level of technology use, market competency and coordination and accessibility
- The skill competence determined the technology use pattern in coconut enterprises as evident from the significant relation with TC and the analysis of skill competencies revealed that the coconut workers lacked communication competency in greater level followed by problem solving. The most competent skills were among the workforce were the technical and decision making skills
- Scaling readiness measurement being a product of innovation use and innovation readiness defined the status of an enterprise to upgrade with technological innovations at different levels
- The forward and backward linkages in enterprise such as value and supply chain channels were also having paramount importance in the determining the sustainability of enterprises

Conclusion

Technological capability of enterprises formed the critical determinant factor in deciding the competitive advantages of enterprises. It was found to be primarily dependent on the level of technology use in an organization. Along with technological capability the skill competence of workers in technology use, scaling readiness for innovations and the forward and back ward linkage of enterprises frame a sustainable entrepreneurship ecosystem in an enterprise. Though the major product identified in delineated enterprise categories was coconut oil, the product diversification index of each enterprise category was found to be high. This indicated the potential of the enterprise to diversify the product and become more competitive. The technical skills were identified as the most important skill needed for the workforce in enterprise. In house training programs with government and related agencies can reduce the existing skill gap in technology use. Ease of availability of credit and targeted industrial extension services can attract more youth to this sunrise sector.

Recommendations for improving the technological capability and skill development of coconut MSMEs

- Design technology use pattern of specific enterprise categories based on skill of work force.
- Plan skill development programs according to the competence needs of the work force
- Including inhouse training programs in enterprises supplemented with specialized programs.
- National and state agencies can facilitate targeted capacity building programs for micro enterprises to improve the skill competencies of workers. Both public and private agencies could serve as a nodal agency for coordinating the skill upscaling activities at different levels.
- Targeted and continuous vocational training and skill development programs from the agencies like CDB, CPCRI, ABI facilitated by universities and other R&D institutions can enable the reduction of the skill gap in enterprises.

- ❖ Facilitation of suitable level of technologies in the preprocessing, processing, packaging and distribution stages of enterprises to the existing environmental ecosystem that can improve technological capability of enterprises.
- ❖ Participation in exhibitions and media programs will give exposure to B_2B and B_2C platforms which can widen their technology use capabilities.
- ❖ Preparation of data base on the technology dynamics of companies within an industry or region for entrepreneurs to aid in decision making.
- ❖ Support partnership and networking with other developmental organizations for credit services and research assistance.
- ❖ Targeted and category specific extension programs implemented through industrial and agricultural extension agencies
- ❖ Technological backstopping and training assistance programms to aid vulnerable categories of enterprises**.**

PLATE 1: PHOTOS TAKEN DURING SURVEY

Interview with entrepreneurs

Interview with skill workers

Innovative building construction to reduce labor shortage

References

REFERENCE

Abdolhamid, P., Zarafshani, K., Malekeh, T., and Madya, P. 2008. Determining factors influencing rural entrepreneurs success: a case study of Mahidasht township in Kermanshah province of Iran. *Afr. J. of Agric. Res.* 3(9): 597-600.

Ahmed, N., Othmam, N., and Lazim, H. M. 2019. A review of technological capability and performance relationship in manufacturing companies. In: *International Symposium on Technology Management Emerging Technologies*, 27-29 May 2014, Indonesia [online] Researchgate. Available: https//www.researchgate.net/publication/276295093.pdf [26 Feb. 2020].

Ahmad, R. and Raja, B. 2006. An integrated approach for supplier selection [abstract]. In: *Abstracts, International Conference on Industrial Informatics*; 16-18, August, 2006, Singapore. Institute of Electrical and Electronics Engineers, Singapore, p.438.

Ahamad, N., Lazim, H. M., Shamsuddin, A., Wahab, E., and Abu, N. A. 2014. The relationship between technological capability and manufacturing performance. *Int. J. Supply Chain. Manag.* 8(2): 930-933.

Aliyu, M. D. Y. and Olowu, I. 2015. Impact of managerial skills on small scale businesses performance and growth in Nigeria. *Eur. J. Bus. Manag. 7*(5):109-114.

Ambrose, J. 2012. Venture capital (vc): the all important MSMEs financing strategy under neglect in Kenya. *Int. J. Bus. Soc. Sci*. 3(21): 234-240.

Anandashankar, M. K and Upendranath, S. 2014. A study of socio- economic and entrepreneurial characteristics of tribals of Mayurbhanj district in sabai grass enterprise. *Int. J. Manage. Eng*. 5(3): 426-438.

APEDA [Agricultural and Processed Food Products Export Development Authority]. 2018. *Annual Report 2017-2018.* Agricultural and Processed Food Products Export Development Authority, New Delhi, 44p.

APCC [Asian and Pacific Coconut Community]. 2016. *Coconut Statistical Yearbook 2016*. Asian and Pacific Coconut Community, Jakarta, 288p.

APCC [Asian and Pacific Coconut Community]. 2017. *Coconut Statistical Yearbook 2017.* Asian and Pacific Coconut Community, Jakarta, 210p.

Armaghan, S. and Ariash, B. 2015. Investigation of the role of women's participation in sustainability of the rural economy. *Int. J. Soc. Sci. Econ. Res.* 9(4):6008-6013.

Ashthana, S. and Jain, S. 2018. Organizations performance in managerial competencies: a study. *Int. J. Recent Technol. Eng*. 8(4):243-246.

Attewell, P.1990. What is skill?. *Work and occupations.* 17(4): 422-448.

Ashwini, T. 2019. Performance analysis of coconut enterprises facilitated through agribusiness incubators. M.Sc (Ag) thesis, Kerala Agricultural University, Thrissur, 126p.

Ashwini, T., Bonny, B. P., and Lokesh, S. 2020. Performance analysis of coconut enterprises facilitated through agribusiness incubators. *J. Plant. Crops.* 48(3): 225-231.

Babu, S. K. and Sebastian, M. 1996. Seasonal price behaviour in coconut and coconut products: an economic approach. *Indian Coconut J.* 26(9): 14-16.

Bai, H. 2008. A fuzzy AHP based evaluation method for vendor selection. *Inst. Elect. Electr. Eng. Trans*. 200: 1077-1081.

Banu, A. 2013. Economics of production and marketing desiccated coconut powder in Karnataka. M.Sc (Ag) thesis, University of Agricultural science, Bengaluru, 125p.

Banu, B. R. H. and Palanivel, S. 2019. Problems of marketing practices of coconut products in Thiruvarur district. Adalya *J*. 8(8): 515-535.

Bawalan, D. D. 2003. Coconut processing modules for micro and village scale enterprises. In: Rethinam, P. (ed.), *Proceedings of the XL COCOTECH Meeting*, 1-5 July 2003, Colombo. Asian and Pacific Coconut Community, Jakarta, Indonesia, pp. 272-293.

Bedi, H. S. 2016. Are subjective business performance measures justified?. *Int. J. Prod. Perform. Manag* .65(5): 603-621.

Bell, M. and Pavvit, K. 1995. The development of technological capabilities. In: Haque, I.U.(ed.). *Trade, Technology and International Competitivenes* (4thEd.). Economic Development Institute of the World Bank, Washington. pp. 69-100.

Bendixen, M. T. 1995. Compositional perceptual mapping using chi-squared trees analysis and correspondence analysis. *J. Mark. Manag.* 11(6): 571-581.

Bennett, J. and McGuinness, S. 2009. Assessing the impact of skill shortages on the productivity performance of high-tech firms in northern Ireland. *Appl. Econ.* 41(6): 727-737.

Bhagyalaxmi, K., Gopalakrishnarao, V., and Sudarshanreddy, M. 2003. Profile of the rural women micro-entrepreneurs. *J. Indian Res.* 31(4): 51-54.

Bhandari, D., Singh, R. K., and Garg, S. K. 2018. Justification of advanced manufacturing technologies for small and medium enterprises from auto component sector: AHP approach. *Int. J. Prod. Qual. Manag.* 23(4): 473-491.

Bhupendra, K. 2016. Entrepreneurial behaviour of women entrepreneurs of Ima market Manipur. M.Sc. (Ag) thesis, Mahatma Phule Krishi Vidhyapeeth, Maharashtra, 126p.

Bhushan, N. and Rai, K. 2004. *The Analytic Hierarchy Process- Strategic Decision-Making and the AHP*. Springer, London, 172p.

Bhutta, K. S. and Huq, F. 2000. Supplier selection problem: a comparison of the total cost of ownership and analytic hierarchy process approaches. *Int. J. Supply Chain Manag*. 7(3): 126–135.

Biggs, T., Shah, M., and Srivastava, P. 1995. *Technology Capacities and Learning in African Enterprises*. World Bank technical papers African series No. 288, Westviewpress Washington D.C, 154p.

Bloom, B., Englehart, M., Furst, E., Hill, W., and Krathwohl, D. 1960. *Taxonomy of Educational Objectives: The Classification of Educational Goals. Handbook I: Cognitive Domain*. David mckay Co Inc, New York, 207p.

Bolton, W. K.. and Thompson, J. H. 2000. *Entrepreneurs: talent, temperament, technique* (2nd Ed.). Butterworth Heinemann, Oxford, 415p.

CAE [Centre for American Entrepreneurship]. 2020. CAE home page [on line].Available: https://startupsusa.org › what-is-entrepreneurship. [07 May 2021]

Calantone, R., Cavusgil, S., and Zhao, Y. 2002. Learning orientation, form innovation capability, and firm performance. *Int. Mark.Manag*.31: 515-524.

Cantillon, R. 1730. Essai Sur la Nature Commerce En General (Originally published in French language in 1730), Quoted from Mishra, P. N., development banks and the new entrepreneurship in India, New Delhi, National Publishing House, 88 p.

CDB [Coconut Development Board]. 2010. *Study conducted by Technology Mission on Coconut for coconut development in India*. [on line]. Available: https://www.coconutboard.gov.in/TechnologyMission.aspx.[07 March 2020]

Chan, F. T. and Chan, H. K. 2010. An AHP model for selection of suppliers in the fast changing fashion market. *Int. J. Adv. Manufacturing Technol*. 51(12): 1195-1207.

Chandargi, A. M. 1994. An experimental study on the impact of training on knowledge and adoption behaviour of farm women in Dharwad, Belgaum and Karwar districts of Karnataka state. M.Sc. (Ag) thesis, University of Agricultural Sciences, Bangalore, 180p.

Chowdhury, S. R. 2014. Skill mismatches in Indian labour market: policy priorities and challenges ahead. *Indian J. Ind. Relations*, 49(3): 422-438.

Comyn, P. 2014. *Integrating core work skills into TVET systems: six country case studies*. International Labour Organization, Geneva, 99p. Available: https://www.ilo.org/wcmsp5/groups/public/---ed_emp/ifp_skills/documents/publication/wcms_470726. pdf [27 December 2018].

Covin, J. G. and Wales, W. J. 2012. The measurement of entrepreneurial orientation. *Entrep. Theory Practice*, 36(4): 677-702.

Covin, J. G. and Slevin, D. P. 1989. Strategic management of small firms in hostile and benign environments. *Strategic Manag. J.* 10(1): 75-87.

Deepthi, V. 2016. A critical study on entrepreneurial behaviour of agripreneurs in Andhra Pradesh. M.Sc. (Ag) thesis, Acharya N.G Ranga Agricultural University, Guntur, 166p.

Drucker, P. F. 1985. *Innovation and entrepreneurship*. Harper Business, New York, 288p.

Ekerete, B. I. and Ekanem, I. T. 2015. Assessment of information and communication technology utilization by agro-processors in Ikono local government area of akwaibom state. *Asian J. Agric. Ext.* 5(1): 22-28.

Engelbrecht, M., Kruger, M., and Saayman, L. 2011. The role of culture with festival entrepreneurs. *Acta commercii*. 11(1): 247-268.

Figueiredo, P. N. 2002. Learning processes features and technological capability accumulation: explaining inter firm differences. *Technovation.* 22(11): 685-698.

Fudjaja, L., Tenriawaru, A. N., Mukarrama, H. K., Salman, D., and Bakri, R. 2020. Competitiveness of Mandar coconut oil industry. *Earth Environ. Sci.* 575(1): 1-11.

Gabaly, M. E., Moustafa, E. l., and Majidi, M. 2003. ICT penetration and skills gap analysis USAID Report, U.S. Agency for International Development,Washigton, D.C, 222p.

Gabriela, R. K. 2016. Chosen methods and tools for measuring managerial competencies. *J. Hum. Res. Manag.* 19(2): 56-62.

Gade, Y. R. 2011. A study of adoption of milk production practices by dairy entrepreneurs. M.Sc. (Ag) thesis, Anand Agricultural University, Anand, 122p.

Gayathri, B. R. 2020. Analysis of entrepreneurship development training of Krishi Vigyan Kendras (KVKs). M.Sc (Ag) thesis, Kerala Agricultural University, Thrissur, 131p.

GEM [Global Entrepreneurship Monitor]. 2007. *Global Entrepreurship Monitor Executive Report 2007*. London Business School and Global Entrepreneurship research consortium, London, 155p.

George, J. 2014. A blue print for neera supply chain. *Indian Coconut J*. 58(7): 13-15.

Grimm, M., Paffhusen., and Luisa, A. 2013. Do interventions targeted at micro enterprises and small and medium sized fims create jobs? A systematic review of the evidence for low and middile income countries. *IZA Discussion paper series No.8193*. Institute of Study of Labour, Bonn, 37p.

Guan, J. and Ma, N. 2003. Innovative capability and export performance of chinese companies. *Technovation.* 23(9): 737-747.

Halos, S. C. 1999. *Agriculture technology acquisition, development and dissemination in the private sector.* Philippine Institute for Development Studies Series No.99, Philippine Institute for Development Studies, Makati, 34p.

Hermans, F., Sartas, M., van Schagen, B., van Asten P., and Schut, M. 2017. Social network analysis of multi-stakeholder platforms in agricultural research for development: opportunities and constraints for innovation and scaling. *PLoS ONE* .[e-journel] 12(2). Available: https://doi.org/10.1371/journal.pone.0169634.ISSN 1932-6203 [March 2020].

Hidalgo, C. A., Klinger, B., Barabasi, A. L., and Hausmann, R. 2007. The Product space conditions the development of nations. *Sci*. 317(5837): 482-487.

Hisrich, R. D., Peters, M. P., and Shepherd, D. A. 2010. *Entrepreneurship* (8th Ed.). McGraw-Hill Education, United States of America, 603p.

Hsieh, M. H. and Tsai, K. H. 2007. Technological capability, social capital and the launch strategy for innovative products. *Ind. Mark. Manag.* 36(4): 493-502.

Hyman, E. L. and Patterson, G. W. 1991. New approaches for developing small and medium scale coconut processing enterprises: experience in the Philippines and the south pacific [abstract]. In: *Abstracts, COCOTECH Meeting/Conference*; 22-26 July, 1991, Suva, Asian and Pacific Coconut Community, Fiji, p.3

ILO [International Labour Organisation]. 2008. *Skills for Improved Productivity, Employment Growth and Development Report*. International Labour Organisation, Genava, 160p.

ILC [International Labour Commission]. 2008. *World of Work Report 2008*. International Labour Commission, Geneva, 181p.

Isohella, L., Oikarinen, E. L., Saarela, M., Muhos, M., and Nikunen, T. 2017. Perceptions of digital marketing tools in new microenterprises [abstract]. In: *Abstracts, Management Challenges in a Network Economy Make Learn and TIIM International Conference*; 17–19, May, 2017, Lublin. International School for Social and Business Studies, Slovenia, p.85.

Jaaffar, A. H., Ibrahim, H. I., Rajadurai, J., and Sohail, M. S. 2019. Psychological impact of work-integrated learning programmes in Malaysia: the moderating role of self-esteem on relation between self-efficacy and self-confidence. *Int. J. Educ. Psychol.* 8(2): 188-213.

Jayanth, R. R. and Beegum, M. 2015. Hyderabad-a potential market for value added coconut products. *Indian Coconut J.* 58 (2): 26-27.

Jayarani, L., Singh, M. K., Chaudhary, K. P., and Ram, D. 2013. Entrepreneurial behaviour of women entrepreneurs in Imphal of Manipur. *Indian Res. J. Ext. Edu*. 13(2): 213-216.

Jayasree, A. 2013. Farmer organisations: collective bargaining for prosperity. *Indian Coconut J.* 56 (4): 12-16.

Jonker, M., Romijn, H., and Szirmaib, A. 2006. Technology effort, technology capacities and economic performance of the paper manufacturing sector in West. *Technovation.* 26 (1): 121–134.

Joseph, J. V. 2008. Coconut oil milling industry in Kerala: choice of technology and linkages. Ph. D thesis, Mahatma Gandhi University, Kottyam, 123p.

Kamaraddi, P. 2011. Entrepreneurial behaviour of pomegranate growers in koppal district of Karnataka. M.Sc. (Ag) thesis. Acharya N. G. Ranga Agricultural University, Andhra Pradesh, 135p.

Kapoor, S. 2019. Education and vocational training for women. *Soc. Welf*. 44(12): 2-4.

Katz, J. M. 1987. *Domestic Technology Generation in LDCs: A Review of Research Findings*, Macmillan Publishers, London,46p.

Kerlinger, F. N. (1986). *Foundations of Behavioral Research* (3rd Ed.). Henry Holt and Company, New York, 1025p.

Kerlinger, F. N. 1964. *Foundations of Behavioural Research*. S. Chand Company Ltd, New Delhi, 1008p.

Kiyabo, K. and Isaga, N. 2020. Entrepreneurial orientation, competitive advantage, and SMEs' performance: application of firm growth and personal wealth measures. *J. Innovation Entrep*. 9(1): 1-15.

Koster, S. and Andersson, M. 2018. When is your experience valuable? Occupation-industry transitions and self-employment success. *J. Evolutionary Econ*. 28(2): 265-286.

Kothari, C. R. 2017. *Research Methodology: Methods and Techniques*. New Age International Publishers, New Delhi, 196p.

KPMG [Klynveld Peat Marwick Goerdeler]. 2014. A look back at the progress, challenges and the way forward [on-line]. Available: https://www.kpmg.com/IN/en/IssuesAndInsights/ArticlesPublications/Documents/FICCI-KPMG-Global-Skills-Report-low.pdf [03 June 2020].

KSPB [Kerala State Planning Board]. 2019. Status Paper on Coconut Production in Kerala, *Proceedings of the international conference and exposition on coconut development.* 2-3 November 2019, Kozhikode, Kerala State Planning Board, Thiruvananthapuram, pp.19.

Krishnan, G. 2017. Role of Krishi Vigyan Kendra in promoting entrepreneurship amongst rural women in Nalgonda district- experiences of KVK Kampasagar. *Agric.Update.* 12(6): 1625-1628.

Kumar, B. 2017. Activities of Krishi Vigyan Kendra in Samastipur district of Bihar: an evaluative study. M.Sc.(Ag) thesis, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, 131p.

Kumar, R. 2008. Entrepreneurial behaviour of dairy farmers of Tamil Nadu. Ph. D. thesis, Acharya N. G. Ranga Agricultural University, Hyderabad, 169p.

Kumar, S. and Mahapatra, S. S. 2009. A fuzzy multi-criteria decision making approach for supplier selection in supply chain management. *Afr. J. Bus. Manag*. 3(4): 168-177.

Kumar, V., Kumar, U., and Persaud, A. 1999. Building technological capability through importing technology: the case of Indonesian manufacturing industry. *J. Technol. Transfer*. 24(1): 81-96.

Kumari, U. and Singh, I. 2004. Rural development and women empowerment. Kurukshetra. 55(5): 3-8.

Kyndt, E. and Baert, H. 2015. Entrepreneurial competencies: assessment and predictive value for entrepreneurship. *J. Vocational Behav*. 90(12): 13-25.

Lall, S. 1992. Technological capabilities and industrialization. *World Dev.* 20(2): 165-186.

Le, N. T., Le, H. L., and Tran, T. V. T. 2021. Determinants of technical efficiency of microenterprises in Vietnam: a case study of coconut handicraft industry. *J. Asian Finance Econ. Bus.* 8(6): 829-838.

Lee, H. D., Kelley, J., and Lee, S. 2018. SME Survival: The Impact of internationalization, technology resources, and alliances. *J. Small Bus. Manag.* 50(13): 1-19.

Libet, J. M. and Lewinsohn, P. M. 1973. Concept of social skill with special reference to the behavior of depressed persons. *J. Consulting Clinical Psychol.* 40(2): 304-306.

Lin, C. 1997. The Impact of technology absorptive capacity on technology transfer performance. *Int. J. Technol. Transfer Commercialisation*. 3(4): 384–409.

Lin, F. J. and Lai, C. 2020. Key factors affecting technological capabilities in small and medium-sized Enterprises in Taiwan. *Int. Entrep. Manag. J.* 17(1): 131-143.

Lu, I.Y., Chen, C., and Wang, C. 2007. Fuzzy multivariate analysis for evaluating firm technology innovation capability. *Int. J. Technol. Manag*. 40(3): 114-130.

Malikadas, H. 2013. Women entrepreneurs from India: problems, motivations and success factors. *J Small Bus. Entrep*. 7 (3): 67-79.

Mamata, B. and Renuka, T. 2012. Role of RUDSETI in empowering women through entrepreneurship – a study of Bijapur district. *Int. J. Eng. Built Environ*. 1(2): 208-222.

Markman, G. D. and Baron, R. A. 2003. Person–entrepreneurship fit: why some people are more successful as entrepreneurs than others. *Hum. Resour. Manag. Rev*. 13(2): 281-301.

Mannekote, J. and Kailas, S. 2013. Value added products from coconut oil. *Indian Coconut J*. 56 (12): 38-40.

Manjunath, S., Shravan, M. B., and Dechakka, B. B. 2019. A study on assessment of skill gap to enhance workforce performance. *Int. J. Manag. Technol. Eng*. 9(4). 3561-3576.

Meena, L. L. 2015. Impact of KVK training towards socio-economic upliftment of farmers in Jagatsinghpur district Odisha. M.Sc. (Ag) thesis, Orissa University of Agriculture and Technology, Bhubaneswar, 126p.

Mehrotra, S., Gandhi, A., and Sahoo, B. K. 2013. The international market for public policies on skills development: the special case of India [abstract]. *In: Abstracts, NORRAG Conference*; 25 – 26 June, 2013, Geneva. Graduate Institute of International and Development Studies, Geneva, p.110

Mendis, M. N. M. B. 2010. Technology issues in Sri Lankan coconut industry with special emphasis on marketing and sales promotion aspects. MBA Dissertation, University of Moratuwa, 156p.

Michael, G. and Paffhausen, A. L. 2013. Interventions for employment creation in micro and medium size enterprises in low and middle income countries – a systematic review [abstract]. In: *Abstracts, IZA World Bank Conference on Employment and Development*; 22-23, August, 2013, Bonn. World Bank, Bonn, p.23.

Mohammad, A. 2006. Study of perceived training needs of the dairy entrepreneurs of Murshidabad district West Bengal. M.Sc. (Ag) thesis, National Dairy Research Institute, Karnal, 102p.

Mori, D. C., Batalha, O. M., and Alfranca, O. 2016. A model for measuring technology capability in the agri food industry companies. *Br. Food. J.* 118(6): 1423-1461.

MMSME [Ministry of Micro Small and Medium Enterprises]. 2015. *MSMEs'-role in propelling economic development of India and a discussion on current HR issues in MSMEs' in India*. Ministry of Micro Small and Medium Enterprises, Government of India. New Delhi, 40p.

MSME [Micro Small and Medium Enterprises]. 2018. *Annual Report 2017-2018.* Ministry of Micro Small and Medium Enterprises, Government of India, New Deihi, 107p.

MSME [Micro Small and Medium Enterprises]. 2020. MMSME home page [on line]. Available:https://msme.gov.in/sites/default/files/MSME_at_a_GLANCE_EN_0.pdf. [07 May 2021].

Mukherjee, S. 2018. Challenges to Indian micro small scale and medium enterprises in the era of globalization. *J. Glob. Entrep. Res.* 8(1): 1-19.

Muralidharan, K. and Jayashree, A. 2012. Article on value addition. *Indian Coconut J.* 57 (3): 26-27.

Murgesan, S. B. 2008. A study of cost and returns of vanilla cultivation in India. Ph.D thesis, Madurai Kamaraj University, Madurai, 123p.

Nagalakshmi, T. and Sudhakar, M. 2013. Agripreneurs: a case study of Dharmapuri farmers. *Int. J. Sci. Res*. 12 (8): 208-214.

Narayan, T. G. 2005. An analysis of poultry entrepreneurs' knowledge about poultry management practices. M.Sc. (Ag) thesis, Anand Agricultural University, Gujarat 156p.

Neumann, T. 2020. The impact of entrepreneurship on economic, social and environmental welfare and its determinants: a systematic review. *Manag. Rev.* 71(3): 553-584.

Neves, M. C. 2000. *Capacities and technological demands of the food industries of the Baixada Cuiabana and the potential of interaction with Mato Grosso Universities*, Federal University of Rio Grande do Sul, Porto, Alegre, 211p

Noorulhaq. A., Kannan, G., and Govindan, K. 2006.Fuzzy analytical hierarchy process for evaluating and selecting a vendor in a supply chain model. *Int. J. Adv. Manufacturing Technol*. 29(1): 826-835.

NSDC [National Skill Development Corporation]. 2012. *Skill gap report*. National Skill Development Agency, Government of India, New Delhi, 17p.

Ogutu, V. and Kihonge, E. 2016. Impact of business incubators on economic growth and entrepreneurship development. *Int. J. Sci. Res*. 5(5): 231- 241.

Onuoha, G. 2007. Entrepreneurship. *AIST Int. J.* 10: 20-32.

Padhi, P. K. 2015. *Induistial Relations and Labour Legislation,* Prentice Hall of India, New Delhi, 56p.

Panda, H. and Ramanathan, K. 1996. Technological capability assessment of a firm in the electricity sector. *Technovation,* 16(10): 561-588.

Pandey, S., Kumar, P. R., Srivastava, P., Singh, R., and Kumar, B. A. 2017. KVK's trainings: effective tool for empowering rural women. *Int. J. Agric. Sci.* 10(9): 5990-599.

Pang, B. 2007. Multi-criteria supplier evaluation using fuzzy AHP. *Afr. J. Bus. Manag*. 42(14): 12-15.

Paramasivam, V., Senthil, V., and Ramasamy, N. R. 2010. Decision making in equipment selection: an integrated approach with digraph and matrix approach, AHP and ANP. *Int. J. Adv. Manufacturing Technol.* 54(12): 1233-1244.

Paridar, M. 2013. *MBA notes – market competiveness* [on line]. MBA lectures, Enostemba e-note services, Available: https://www.enotesmba.com/2013/03/mba-notes-marketing-competitiveness.pdf. [20 May 2021].

Pavitt, K. 1998. Technologies, products and organization in the innovating firm: what Adam Smith tells us and Joseph Schumpeter doesn't. *Ind. Corporate Change*. 7(3): 433-452.

Phillip, J. P. 2002. Management in agriculture. *Planters Chronicle*. 89(6): 239-241.

Poudel, K. P., Carter, R., and Lonial, S. 2018. The impact of entrepreneurial orientation, technological capability, and consumer attitude on firm performance: a multi-theory perspective. *J. Small Bus. Manag*. 0(0): 1-28. https://doi.org/10.1111/jsbm.12471

Poduval, S. 2011. Relevance of quality standards in global marketing of coconut products. *Indian Coconut J*. 54 (9): 23-27.

Qureshi, M. N. 2009. Selection of 3PL Service Providers; a combined approach of AHP and graph theory. *Int. J. Service Technol. Manag*. 12: 35-60.

Raghunath, A. K. 2014. Entrepreneurial behavior of nursery growers. M.Sc (Ag) thesis, Mahatma Phule Krishi Vidhyapeeth, Rahuri, 156p.

Rajini, N. and Sarada, D. 2008. Women entrepreneurship and support systems. . *Kurukshetra*. 57 (3): 3-8.

Raju, P. N. 2017. Socio economic factors affecting entrepreneurial behaviour of agripreneurs of KAU technology. *Agric.Update*. 13(4): 384-389.

Rammohan, K. T. 1999. *Technological change in Kerala industry: lessons from coir yarn spinning*. Kerala Research Programme on Local Level Development, Centre for Development Studies. Thriruvananthapuram, 44p.

Rani, S. T. 2007. A study of the problems and prospects in the production and marketing of various products of coconut in Kanyakumari district. Ph.D thesis, Bharathi Dasan University, Tiruchirapalli, 196p.

Rao, P. 2008. Environmental initiatives taken by entrepreneurs in the Philippines. *J. Entrep.* 17(1): 73-81.

Reichert, M. F. and Zawislak, P. N. 2014. Technological capability and firm performance. .*J. Technol. Manag. Innovation*. 9(4): 1-13.

Rehman, E. and Elahi, Y. A. 2012. Entrepreneurship education in India-scope, challenges and role of Bschools in promoting entrepreneurship education. *Int. J. Eng. Manag. Res.* 2(5): 5-14.

Renko, M., Carsrud, A., and Brännback, M. 2009. The effect of a market orientation, entrepreneurial orientation, and technological capability on innovativeness: a study of young biotechnology ventures in the United States and in Scandinavia. *J. Small Bus. Manag.* 47(3): 331-369.

Sairam, C. V., Jaya, S., and Sekhar, S. 2018. *World coconut economy: sectoral issues market and trade*. The Coconut Palm (Cocos nucifera L.) - Research and Development Perspectives .Springer, Singapore. pp. 801-812.

Saaty, T. L. 1991. Some mathematical concepts of the analytic hierarchy process. *Behaviormetrika*. 18(29): 1-9.

Saaty, T. L. 2008. Decision making with the analytic hierarchy process. *Int. J. Serv. Sci.* 1(1): 83-98.

Sahu, R. P. 2014. Barriers in functioning of dairy enterprise managed by rural women. *Indian J. Ext. Educ.* 50(3): 110-112.

Sanghi, M. S. and Sensarma, M. K. 2014. *Skill Challenges of Informal Sector in India*. CII Publication, Gurugram, 36p.

Sanghi, S. and Srija, A. 2015. *Skill Development and Productivity of the Workforce*. CII Publication, Gurugram, 51p.

Sanjay, K., Luthra, S., and Haleem, A. 2000. Benchmarking supply chains by analyzing technology transfer critical barriers using AHP approach. *Benchmarking: An Int. J*. 44(4)*:* 538-558.

Santhanam, R. 2003. Issues in linking information technology capability to firm performance. *MIS Quart.* 27(1): 125-153.

Sartas, M., Schut, M., Proietti, C., Thiele, G., and Leeuwis, C. 2020. Scaling readiness: science and practice of an approach to enhance impact of research for development. *Agric. Sys* .183(32): 102874-102878.

Sartas, M., Schut, M., Schagen, V. B., Velasco, C., Thiele, G., Proietti, C., and Leeuwis, C. 2020. Scaling readiness: concepts, practices, and implementation [online]. Available: http//www.scalingreadiness.org/cigar/218.pdf [15 January 2020].

Schoenecker, T. and Swanson, L. 2002. Indicators of firm technological capability: validity and performance implications. *IEEE Trans. Eng. Manag.* 49(1): 36-44.

Schut, M., Leeuwis, C., and Thiele, G. 2020. Science of Scaling: understanding and guiding the scaling of innovation for societal outcomes. *Agric. Systems*.184: 102908-102913.

Shahjar, F., Khadi, S. A., Bafanda, R. A., Bhushan, B., and Khateeb, A. M. 2018. Study of the relationship between socio-economic profile and perceived training needs of dairy farmers in the Jammu district of Jammu and Kashmir, India. *The Pharma Innovation J.* 7(11): 71-76.

Shamsuddin, A., Wahab, E., Abdullah, N. H., and Kamaruddin, N. K. 2012. Technological capability assessment process: a perspective. In: *International Conference of Technology Management, Business and Entrepreneurship*, 18-19 December 2012,Malaysia[Online].Available:http://eprintsuthm.edu.my/id/eprint/3449/1/TGM100.pdf [07 Mar.2020].

Sharma, N. K. 2013. A Study on attitude of rural women towards agro based enterprise under District Poverty Initiatives Project (DPIP) in Rewa block of Rewa district (M.P.). M.Sc. (Ag) thesis, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, 143p.

Shehrawat, P. S. 1998. Training needs of entrepreneurs for modernization of small scale agro-processing industries in Haryana. Ph.D. (Ag) thesis, Haryana Agricultural University, Haryana, 180p.

Singh, P. 2001. A Study on production and marketing of mushroom in Haryana. Ph.D. (Ag) thesis, College of Agriculture Chaudhary Charan Singh Haryana Agricultural University, Hisar, 279p.

Singh, R ., Singh, S. P., and Singh , P. K. 2012. Reading behavior of livestock farmers and factors affecting their behavior in Haryana. *Indian Res. J .Ext. Educ.* 14(2): 50-53.

Sinha, B. K. 2016. Assessment of capacity building programmes of RUDSETI for self-employment among rural youth. Ph. D. thesis, Indian Agricultural Research Institute, New Delhi, 132p.

Sirmon, D. G., Hitt, M. A., and Ireland, R. D. 2007. Managing firm resources in dynamic environments to create value: looking inside the black box. *Acad. Manag. Rev.* 32(1): 273-292.

Sobanke, V., Adegbite, S., Iiori, M., and Egbetokun, A., 2014. Determinants of technological capability of firms in a developing country. *Procedia Eng*. 69(2014): 991-1000.

Statists. 2019. *Global coconut production 2000-2019* [on-line]. Available: https://www.statista.com/statistics/577497/world-coconut-production/[02 May 2020]

Stephan, U., Martin, L., Dominika, D., and Richter, P. G. 2012. Attitudes towards and perceptions of entrepreneurs in central eastern Europe (Poland, Czech Republic, and East Germany). *Int. Small Bus. J*. 27(3): 57-60.

Stevenson, H. H. and Jarillo, J. C. 1990. A paradigm of entrepreneurship: entrepreneurial management. *Stud. Home Comm. Sci*. 2(2): 107-112.

Su, Z., Peng, J., Shen, H., and Xiao, T. 2015. Technological capability, marketing capability, and firm performance in turbulent conditions. *Manag. Org. Rev*. 9(1):115-138.

Sulaja, B. 2013. Impact of training on entrepreneurial traits. *J. Ext. Educ*. 25(4): 143-149.

Sulistiyowati, W. and Jakaria, R. B. 2018. Assessment of technology content level with integrated technometrics and Analytical Hierarchy Process (AHP) methods in small and medium enterprises. *Mater. Sci. Eng*. 434(1) :12246-12248.

Sundaran, R. S. 2016. Performance analysis of self help groups on farm entrepreneurship in Thiruvananthapuram district of Kerala. M.Sc (Ag) thesis, Kerala Agricultural University, Thrissur,136p.

Suresh, J. 2004. Entrepreneurship: concept and development. *Third Concept.* 17(203): 39-42.

Suseno, B. D. and Yusuf, F. A. 2020. Significance of resources sharing innovation in industrial human competitiveness: empirical study at the manufacturing industries. *PalArch's J. Archaeology Egypt/Egyptology*. 17(7): 6550-6561.

Sweezy, P. M. 1943. Professor Schumpeter's theory of innovation. *The Rev. Econ. Statist*. 25(1): 93-96.

Tahriri, F., Osman, M., Ali, A., and Yusuff, R. 2008. A review of supplier selection methods in manufacturing industries, Suranaree. *J. Sci. Technol*. 15(3): 201-208.

Tan, N. L. E., Long, H. L. E., and Tran, T. V. T. 2021. Determinants of technical efficiency of microenterprises in Vietnam: a case study of coconut handcraft industry. *J. Asian Finance Econ. Bus.* 8(6): 829-838.

Thamban, C., Jayasekhar, S., Chandran, K. P., and Muralidharan, K. 2016. Evolving tender coconut sector in Kerala-need for up gradation in the value chain. *Indian Coconut J*. 56 (9):16- 21.

Thasnimol, F. and Prema, A. 2017. Performance and competitiveness of coconut trade in India. *Trends Biosci*. 10(22): 4495-4499.

Tremblay, P. J. 1998. Technology capability and productivity growth: an industrialized industrializing country comparison. *Sci*. 9(2): 98-107.

Triantaphyllou, E., and Mann, S. H. 1995. Using the analytic hierarchy process for decision making in engineering applications: some challenges. *Int. J. Ind. Eng.* 2(1): 35-44.

Tsai, K. 2004. The impact of technological capability on firm performance in Taiwan's electronics industry. *J. High Technol. Manag. Res.*15:183-195.

Ullah, H., Shah, B., Hassan, S. U., and Zaman, T. 2011. The impact of owner psychological factors on entrepreneurial orientation: Evidence from Khyber Pakhtunkhwa-Pakistan. *Int. J. Educ. Soc. Sci*. 1(1): 1-16.

UN [United Nations]. 2021. *Technology and Innovation Report*. United Nations Organizations, United Nations Publications, New York, 170p.

UNDP [United Nations Devekopment Programme]. 2012. *Skills Gap Analysis for Graduates of Youth Polytechnics, Vocational Training Centres and Out of School Youth, Youth Employment Regional Programme.* United Nations Development Programme. United Nations Publications, New York.94p.

Upadhyay, S. 2010. A study on participation of dairy entrepreneurs in animal husbandry occupation. M.Sc. (Ag) thesis, Anand Agricultural University, Anand, 189p.

Wang, C. L. 2008. Entrepreneurial orientation, learning orientation, and firm performance. *Entrep. Theory Pr*. 32(4): 635-657.

Wang, Y. 2009. An application of the AHP in supplier selection of maintenance and repair parts. *Sci. Eng*. 63(9): 4176-4179.

Wigboldus, S., Klerkx, L., Leeuwis, C., Schut, M., Muilerman, S., and Jochemsen, H. 2016. Systemic perspectives on scaling agricultural innovations. *Agron. Sustain. Dev*. 36(3):1-20.

Wind, Y. and Saaty, T. L. 1980. Marketing applications of the analytic hierarchy process. *Manag. Sci.* 26(7): 641-658.

Xu, C. and Li, Y. 2007. Multiphase supplier selection model based on supplier development orientation. *J. Technol. Manag. Innovation*. 56(12): 826-831.

Yee, R. W., Yeung, A. C., Cheng, T. E., and Lee, P. K. 2013. Market competitiveness and quality performance in high-contact service industries. *Ind. Manag. Data Syst*. *43*(12): 1536-1539.

Yi, H. T., Amenuvor, F. E., and Boateng, H. 2018. The impact of entrepreneurial orientation on new product creativity, competitive advantage and new product performance in SMEs: the moderating role of corporate life cycle. *Sustain.* 13(6): 3586-3589.

Yu, B., Hao, S., Ahlstrom, D., Si, S., and Liang, D. 2013. Entrepreneurial firms' network competence, technological capability, and new product development performance. *Asia Pac. J. Manag.* 31(3): 687-704.

Yu, H, S., and Yan, K. W. 2020. The application of a managerial competency model in employee promotion—combination of AHP and VIKOR methodology. *Int. J. Bus. Manag*. 15(7):123-126.

Zarefard, M. and Cho, S. E. 2018. Entrepreneurs' managerial competencies and innovative start-up intentions in university students: focus on mediating factors. *Int. J. Entrep*. 22(2): 1-22.

Zawislak, P., Alves, A., Tello, G. J., Barbieux, D., and Reichert, F. 2012. Innovation capability: from technology development to transaction capability. *J. Technol. Manag. Innovation*. 7(2):14-27.

Zhenhua, G. 2009. The application of DEA/AHP method to supplier selection IEEE Computer society. *Int. J Supply Chain. Manag.* 45(3): 449-451.

Zwan, P., Thurik, R., Verheul, I., and Hessels, J. 2016. Factors influencing the entrepreneurial engagement of opportunity and necessity entrepreneurs. *Eurasian Bus. Rev.* 6(3): 273-295.

Zea, H., Liu, X., and Ghauri, P. 2010. Technology capability and the internationalization strategies of new ventures. *Organ. Mark. Emerging Econ.* 1(1): 1625-1628.

Appendices

APPENDIX I

KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF AGRICULTURE
Department of Agricultural Extension
Technology capability analysis of coconut based enterprises

A. Interview schedule Enterprises/entrepreneurs

Name of the unit: …… Address: ……
Contact: …….

1. Details of the enterprise

1. Year of establishment: ……
2. Type of ownership: Sole Proprietorship ☐ Partnership ☐ Joint Family ☐

   Co-operative ☐ Private Ltd. ☐ Public Ltd ☐

3. Registration details:
   A. Registered as? :- Small Scale ☐ Medium Scale ☐ Large Scale ☐
   B. Agency of registration?:-
   …….....
4. Number of employee :

Employee category	No. of Male	No. of Female
Regular		
Contract		
Hired		
Seasonal		
Technical		
Managerial		
Labor		

5. Have your enterprise received any financial assistance from any organizations? If Yes, Please specify the details.

Type of	Organization providing the	Amount received
Subsidy		
Grant		
Loans		
Seed capital		
Any others		

2. Product and services from the enterprise

6. No. of products in market?
7. List the products in market?

1.	7.
2.	8.
3.	9.
4.	10.
5.	11.
6.	12.

8.Details of products manufactured :

Main product	
By products	

9.Brand name under which products are marketed? .....

10.A. Type of product manufactured in the enterprise?

a. Husk based
b. Shell based
c. Kernel based
d. Water based
e. Inflorescence based
f. Any other?. Please mention……

10.B. Quality standards followed in the marketing of the product?

Sl. No	Quality standards followed	Please mention in the columns below
1.	Minimum standard for the marketing of the produce	
2.	National level higher standards	
3.	Quality standards for exporting	

11. Details on production cost and price?

Sl. No	Name of the product	Production cost	Quantity (liters/Kg)	Price (Rs)
1.				
2.				
3.				
4.				
5.				

12. Details on marketing cost

Sl. No	Name of the product	Advertising cost	Branding cost	Cost for quality certification
1.				
2.				

13. Market channels for the products

1. Important supply channels and margin of each intermediate (%)
   a)……
   b)……
   c)……
2. Important value channels and margin of each intermediate (%)

   a)……

   b)……

   c)……

14. On what basis you fix the price of the product?

    a. Demand and supply
    b. Price of other competitive products in the market
    c. Industrial rates
    d. Based on production cost
    e. Other reasons

15. Strategies used to ensure market visibility of products?
    a. Advertisements
    b. Improving product quality
    c. Improving the package
    d. Others

16. Sale of product

Product	**Price per unit of the product**	**Avg. Sales per month**

Average total sales of a month**: ……**

17. Details on demand and supply of the product. (of past three years)

Sl.No	**Name of the product**	**Demand for product in the market**	**Supply of the product in the market**

3. Details on technology use

18. Which type of technology is used by the unit during the different stages of processing? (Put tick mark on the appropriate columns):

	Manual	Semi mechanized	Mechanized
Processing			
Grading			
Packing			

19. Total investment in raw material

a. Owned …….
b. Borrowed ……

20A. Year of installation and operation of technologies in the enterprise

Sl.No.	Products	Technology used	Year of installation	Year of operation	Technology provider

20.B. Technoology facilitation support

Sl. No	Technology facilitation support sources	Mention the agency providing technological support
1	Private agencies	
2	Institutions like CDBs, CPCRI, KAU ABIs etc	
3.	Agencies institutions related to local government	
4.	National institutions associated with MSMEs	

21A. Infrastructure use

Product	**Type of techno-logy**	**Product-ion capacity**	**Number of working days in a month**	**Cost involved**		
				Procurement	Maintenance	operational

21.B. Infrastructure facilities

Sl. No	**Infrastructure facilities**	**Yes/No**
1.	Introduction of new technology/innovation in last three year	
2.	Power back up facility	
3..	Distribution amenities	
4.	Networking	
a.	Only land line	
b.	Troll free Number	
c.	Email	
d.	Website	
e.	Social media	

22. Annual turnover and investment (Put tick mark on the appropriate columns)

Sl. No	Investment	Turnover
1.	Less than Rs.1 Crore	Less than Rs.5 Crore
2.	Less than Rs.10 Crore	Less than Rs.50 Crore
3.	Less than Rs.20 Crore	Less than Rs.100 Crore

23. Asset ownership status

Sl. No	Asset ownership status	Put tick mark on the appropriate columns
I	**Ownership**	
1.	Leased or rent	
2.	Conversion with owned household	
3.	Separately owned	
II	**Number of buildings owned**	
1.	Only one	
2.	Two to three buildings	
3.	More than three buildings	

24. Credit availability

i. In your opinion the credit availability to your enterprise is ?.

Sl. No	Credit support	Please mention in the columns below
1.	Not available	
2.	Partially available	
3.	Sufficiently available	

4. Technological capability of enterprises

A. Resources:

A1. Investment

1.) Percentage share in innovative activities

i. 0.5 % ii. 5-10% iii. >10%

2.) Percentage share for training per year

i. 0.5 % ii. 5-10% iii. >10%

A2. Human resource

1.) Technical qualification of workers

i. Yes ii. No

2.) Years of experience in technology use ?.

i. > 5 yrs ii. 5- 15 yrs iii. > 25 yrs

A3. Infrastructure

1.) Introduction of new technology /innovation in last years ?

i. Yes ii. No

ii. Un interrupted power facility?

i. Yes ii. No

ii. Distribution amenities ?

i. Yes ii. No

B. Level of technology

B1. Preprocessing

1.)Quality check in preprocessing stage ?

i.Yes ii. No

2.) Type of preprocessing activities ?

i. Manual ii. Semi mechanized iii.Mechanized

B2. Processing

1.) No .of processed products ?

i. >5 ii. 5-15 iii. >15

2.)Types of processing (of major product)

i.Manual ii. Semi mechanized iii.Mechanized

3.)Use of green technology in processing activities ?

i. Yes ii. No

4.) Waste management system?

i. Sewage treatment plant ii. Waste product processing

iii. No waste product processing system

C. Market competency

C1. Branding

1.) Branding status of products ?

i. Yes ii. No

2.) Trademark for products ?

i. Yes ii. No

C2. Packaging

1.) Types of packaging?

i. Glass bottles ii. Cans iii. Plastic bottles /pouches

2) Use of eco friendly packaging material?

i. Yes ii. No

3.) Method packaging ?

i.Manual ii. Semi mechanized iii.Mechanized

C3. Certification

1.) Compilation of registration standards for the products

i. FSSAI, Agmark and relatd standards

ii. Organic certification ?

iii. International market standards

2.) Coordination and accessibility

D1. Facilitating services availed by your enterprise

1.) Contract with R&D agencies

i. Yes ii. No

2.) Contract with other training agencies

i. Yes ii. No

3.) Recipient of grants/subsides

i. Yes ii. No

D2. Technology information access in the enterprises

1.) Contract with suppliers

i. Yes ii. No

2.) Visit to similar industries

i. Yes ii. No

3.) Participation in seminars , conferences etc.

i. Yes ii. No

D3. Skill upgradation in enterprises

1.)In house skill upgradation facilities ?

i. Yes ii. No

2.) No. of training attended / organized in an year?

i. <2 ii. 2-5 iii. >5

D4. Method of promotion of the product ?

1) Digital marketing

i. Yes ii. No

2) Use of social media platforms

i. Yes ii. No

3) Advertisements

i. Yes ii. No

D5. Risk orientation

1) Policy coverage for equipments, building and employees ?

i. Yes ii. No

2) Safety amenities

i. Yes ii. No

3) Fire extinguisher

i. Yes ii. No

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B. Interview schedule for entrepreneurs/skill workers

1. General information

1. Name of the respondent:
2. Address:
3. Name of the enterprise:
4. District:

2. Socio economic profile of the entrepreneur /skill worker

1. Age

i. >35 years ii. 35-50 years iii. > 50 years

2. **Gender** i. Male ii. Female

3. Education

i. Illiterate ii. Primary school iii. Middle school

iv. High school v. College/JOC

4. Occupational status

c. Agriculture (farming)
d. Farming + Business
e. Farming +Service
f. No-farming only business
g. Any other (specify)

5. Extension contact

Please indicate your response in appropriate alternatives by putting a tick (W-Weekly, FN-Fortnightly, M-Monthly, HY-Half yearly, Y- Yearly)

Sl. No.	**Extension personnel/ agency**	**W 5**	**FN 4**	**M 3**	**HY 2**	**Y 1**
1.	District MSME office					
2.	DICs					
3.	Industrial Extension officers					
4.	Coconut Development Board					
5.	Centre for Plantation Crops and Research Institute					
6.	Agricultural scientists in University/ Research stations					
7.	Agri Business Incubators					

6. Mass media exposure:

Please indicate your response in appropriate alternatives by putting a tick

Sl. No.	Mass media sources	Regularly	Occasionally	Never
1.	Newspaper, magazines, leaflets, bulletins			
2.	Radio			
3.	Television			
4.	Exhibitions			
5.	Seminars			
6.	Social media			

7. Social participation

a. Are you a member of any social organization ? Yes/No

b. If Yes, how frequent you visit the organization or attend the meeting of organization?

i. Regular ii. Partial iii. Do not visit organization

8. **Anuual income** (Rs.) ……..

9. Managerial competency

State your degree of agreement or disagreement with the following statements

Strongly agree (SA)(5), agree (A)(4), Neutral (N),(3) disagree (D)(2) and strongly disagree (SD)(1)

Sl. No	Statement	5	4	3	2	1
1.	I communicate in a supportive way when people in my enterprise share their problems with me.					
2.	I encourage others in my enterprise to generate new ideas and methods.					
3.	I motivate and energize others to do a better job.					

4.	I keep close track of how my enterprise is performing.					
5.	I regularly coach subordinates to improve their management skills so they can achieve higher levels of performance.					
6.	I insist on intense hard work and high productivity from my subordinates.					
7.	I give my subordinates regular feedback about how I think they're doing.					
8.	I assure that regular reports and assessments occur in my enterprise					
9.	I interpret and simplify complex information so that it makes sense to others and can be shared throughout the organization.					
10	I facilitate effective information sharing and problem solving in mygroup.					

11. Entrepreenurial orientation

State your degree of agreement or disagreement with the following statements

Strongly agree (SA)(7), agree (A)(6), Partially agree (PA)(5), Neutral (N)(4), disagree (D)(3), Partially disagree (PD) (2)and strongly disagree (SD)(1)

Sl. No	Statement	1	2	3	4	5	6	7
	Innovativeness items							
1.	Marketing of tried-and-true products or services							
2.	R&D, technological leadership, and innovations							
3.	No new lines of products or services							
4.	Very many new lines of products or services							
5.	Changes in product or service are minor in nature							
6.	Changes in product or service are usually been quite dramatic							
	Proactiveness items							
7.	Responds to actions which competitors initiate							

8.	Initiates actions to which competitors then respond							
9.	Seldom become the first to introduce new products/services.							
10.	Often the first to introduce new products/services.							
11.	Avoid competitive clashes							
12.	Adopts a very competitive posture							
	Risk-taking items							
13.	Strong proclivity for low-risk projects							
14.	Strong proclivity for high-risk projects							
15.	Cautious and incremental behavior according to the nature of the environment							
16.	Bold, wide-ranging acts to achieve the firm's objectives							
17.	Adopts a cautious posture to minimize the probability of making costly decisions							
18.	Adopts a bold, aggressive posture to explore potential opportunities							

12. Perceived Skill gap analysis of the work force

State your degree of agreement or disagreement with the following statements ,
Strongly agree (SA)(5), agree (A)(4), Neutral (N),(3) disagree (D)(2) and strongly disagree (SD)(1)

Sl. No.	**STATEMENTS**	**5**	**4**	**3**	**2**	**1**
A.	**Communication**					
1	I am able to express the ideas with clarity and present them before people					
2	I am able to communicate with people from different cultural background					
B.	**Technical**					
3.	I am aware of technology trends in coconut processing enterprises					
4.	I need more knowledge on technical aspect which is essential for my job					
5.	I am well versed with the operation of machines					
6.	I am aware of different tools used in the enterprise					

7.	I am providing training and advices to the subordinate workers /operators for their various job and machine operations					
C.	**Decision making**					
8.	I am aware of the workplace happenings and responds in a suitable manner to situations.					
9.	I am aware about the importance of quality of the product in production process					
10.	I am able manage both preprocessing and processing activities					
11	I can manage change in my job very well whenever the situation demands(job rotation)					
D	**Problem solving**					
12.	I can be a better negotiator at times					
13.	I am aware about the proper schedule for cleaning and maintenance of various machines					
14.	I am able to identify and repair the complaints of machines					
E.	**Interpersonal**					
15	I accept corrections and advises from the superiors and experts.					
16.	I can manage conflicts that could damage my relationship with others					
17.	I am able to work systematically by taking my peers and team together					

13. Scaling readiness

1. What are the core innovations in your enterprise? (Core innovations : They are typically techniques and technologies at the core of the intervention. Example, the drier used in the processing of copra , a phone application providing you consumer preferences etc **)**

……..

2. What are the complementary innovations in your enterprise? (Complementary innovation: they support the scaling of core innovation. Example. any technologies or techniques attached with core innovation . it can be social ,economic or institutional

……..

A. Innovation use

Level of innovation use	Level number	Level description	Indicate the level innovation use of core innovation in your enterprise	Indicate the level of innovation use complimentary innovation in your enterprise
Livelihood system (Common)	**9**	The innovation is commonly used by intended end-users who had nothing to do with the innovation development or the intervention project		
Livelihood system (Rare)	**8**	The innovation is used by some intended end-users who had nothing to do with the innovation development or the intervention		
Innovation system (Common)	**7**	The innovation is commonly used by organizations or individuals who work on the innovation in similar geographies or sectors but are not directly connected to the intervention partners		
Innovation system (Rare	**6**	The innovation is used by some organizations or individuals who work on the innovation in similar geographies or sectors but are not directly connected to the intervention partners		
Innovation network (Common)	**5**	The innovation is commonly used by organizations or individuals who are not formally involved in the project but are connected to intervention partners		
Innovation network	**4**	The innovation is used by some organizations or		

(Rare)		individuals who are not formally involved in the intervention but are connected to intervention partners		
Project partners	**3**	The innovation is used by the intervention or project teams and the direct partners that were involved in the development of the project and receive funding from the intervention project		
Project team	**2**	The innovation is used only by the intervention or project team		
Project leaders	**1**	The innovation is not yet used by the intervention or project team but is embraced by project leaders		

B. Innovation readiness

Level of readiness	Level number	Level description	Indicate the level innovation readiness of core innovation in your enterprise	Indicate the level of innovation readiness complimentary innovation in your enterprise
Ready	9	The innovation have validated capacity to meet specific objectives in an uncontrolled environment without support from an intervention		
Incubation	8	The innovation have tested capacity to meet specific objectives in an uncontrolled environment with support from an intervention		
Proof of Application	7	The innovation have tested capacity to meet specific objectives in an uncontrolled environment with support from an intervention		
Working Application	6	The innovation have tested capacity to meet specific objectives in a controlled environment		
Working Model	5	The innovation have validated capacity to meet specific objectives using applied science evidence		
Formulating Working Model	4	The innovation have researched capacity innovation to meet specific objectives using applied science evidence		
Basic model	3	The innovation have validated principles that the innovation can meet specific objectives using basic science evidence		

Basic research	2	The innovation have validated hypothesis that the innovation can meet specific objectives using basic science evidence		
Idea/Hypothesis	1	Formulated idea or hypothesis for an innovation to meet a specific objective for intended users		

APPENDIX II

Indicators under each mesoindexes for measuring Technology Capability Index (TCI) and scores

A. Investment (I)

Indicators	Measurement	Score
1. Percentage share in innovative activities	0- 5%	1
	5-10%	2
	>10%	3
2. Percentage spent for training per year	0- 5%	1
	5-10%	2
	>10%	3

B. Human resource (HR)

Indicators	Measurement	Score
1. Technically qualification of workers	Yes	1
	No	0
2. Years of experience in technology use	>5 years	1
	5-15 years	2
	15-25 years	3
	>25	4

C. Infrastructure (IS)

Indicators	Measurement	Score
1. Introduction of new technology/innovation in last three year	Yes	1
	No	0
2. Power facility	Yes	1
	No	0

3. Distribution amenities	Yes	1
	No	0
4. Networking	Only land line	1
	Troll free Number	2
	Email	3
	Website	4
	Social media	5

D. Asset position (AP)

Indicators	Measurement	Score
1. Ownership	Leased or rent	**1**
	Conversion within own household	**2**
	Separately owned	**3**
2. No. of buildings	Only one	**1**
	Two or three buildings	**2**

E. Preprocessing (PP)

Indicators	Measurement	Score
1. Quality check in preprocessing stage	Yes	**1**
	No	**0**
2. Type of preprocessing technology used	Manual	**1**
	Semi mechanized	**2**
	Mechanized	**3**

F. Processing (P)

Indicators	Measurement	Score
1. Number of processed products	>5	**1**
	5-15	**2**
	>15	**3**
2. Type of processing technology used	Manual	1
	Semi mechanized	2
	Mechanized	3
3. Use of green technology	Yes	1
	No	0
4. Waste management system	Sewage treatment plant	2
	Waste product processing	1
	No waste management system	0

G. Packaging Technology (PT)

Indicators	Measurement	Score
1. Type of packaging technology used	Manual	**1**
	Semi mechanized	**2**
	Mechanized	**3**

H. Distribution (D)

Indicators	Measurement	Score
1. Availability of vehicles	Own vehicles	2
	Rented vehicles	1

2. Channels for distribution	Own shops	1
	Other local shops	2
	Shopping malls	3

I. Branding (B)

Indicators	Measurement	Score
1. Branding status of products	Yes	**1**
	No	**0**
2. Trade mark	Yes	**1**
	No	**0**

J. Packaging (Pkg)

Indicators	Measurement	Score
1. Type of packaging material used	Glass bottles	3
	Cans	2
	Plastic bottles /pouches	1
2. Use of eco friendly packaging material	Yes	1
	No	0

K. Certification (C)

Indicators	Measurement	Score
1. Compilation of registration standards	FSSAI, Agmark and related standards	**1**

	Organic certification	**2**
	International market standards	**3**

L. Promotion of the product (PM)

Indicators	Measurement	Score
1. Method of promotion		
a. Digital marketing	Yes	1
	No	0
b. Use of social media	Yes	1
	No	0
c. Advertisements	Yes	1
	No	0
2. Market position	Local	1
	National	**2**
	International	**3**

M. Technology Information access (TI)

Indicators	Measurement	Score
1. Contact with R&D agencies	Yes	**1**
	No	**0**
2. Contact with training centres	Yes	**1**
	No	**0**
3. Recipient of grants/subsidies	Yes	**1**
	No	**0**

N. Facilitating Services (FS)

Indicators	Measurement	Score
1. Contract with suppliers	Yes	**1**
	No	**0**
2. Visit to similar industries	Yes	**1**
	No	**0**
3. Participation in seminar, conferences etc.	Yes	**1**
	No	**0**

O. Skill Upgradation (SU)

Indicators	Measurement	Score
1. In house skill upgradation facilities	Yes	**1**
	No	**0**
2. No. of training programmes attended	<2	**1**
	2-5	**2**
	>5	**3**
3. Incentives for skill upgradation	Yes	**1**
	No	**0**

P. Risk and safety amenities

Indicators	Measurement	Score
1. Insurance coverage		
a. Equipments	Yes	1

	No	0
b. Employees	Yes	1
	No	0
c. Buildings and other resources	Yes	1
	No	0
2. Safety amenities		
a. Fire extinguisher	Yes	1
	No	0
b. First aid box	Yes	1
	No	0

APPENDIX II1

Weightages of macro and meso indexes estimated using AHP for measuring TCI

1. Meso indexes

A. Resources

Sl.No.	Mesoindexes	Priority	Rank
1.	Investment	**43.8%**	**1**
2.	Human resources	**37.5%**	**2**
3.	Infrastructure	**12.1%**	**3**
4.	Asset position	**6.6%**	**4**

Consistency ratio (CR)= 0.6%
Principal eigen value = 4.105

B. Level of technology use

Sl.No.	Mesoindexes	Priority	Rank
1.	Preprocessing	**30.9%**	**2**
2.	Processing	**43.2%**	**1**
3.	Packaging technology	**12.3%**	**4**
4.	Distribution	**13.7%**	**3**

Consistency ratio (CR)= 2.9%
Principal eigen value = 4.080

C. Market competency

Sl.No.	Mesoindexes	Priority	Rank
1.	Branding	**44.2%**	**1**
2.	Packaging	**35.5%**	**2**
3.	Certification	**13.0%**	**3**
4.	Product promotion	**7.2%**	**4**

Consistency ratio (CR)= 5.3%
Principal eigen value = 4.143

D. Coordination and accessibility

Sl.No.	Meso indexes	Priority	Rank
1.	Facilitating services	**50.8%**	**1**
2.	Technology information access	**24.5%**	**2**
3.	Skill upgradation	**15.4%**	**3**
4.	Risk and safety amminities	**9.3%**	**4**

Consistency ratio (CR)= 3.2%
Principal eigen value = 4.088

2. Macro indexes

Sl.No.	Macro indexes	Priority	Rank
1.	Resources	**38.3%**	**1**
2.	Level of technology use	**34.8%**	**2**
3.	Market competency	**14.2%**	**3**
4.	Coordination and accessibility	**12.8%**	**4**

Consistency ratio (CR) = 0.8%
Principal eigen value = 4.021

TECHNOLOGICAL CAPABILITY ANALYSIS OF COCONUT BASED ENTERPRISES

By

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Abstract of the thesis

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ABSTRACT

Coconut based enterprises holds great significance in the state as coconut is the prime homestead crop of Kerala. These enterprises are proven to generate higher economic returns for the coconut sector. Technological capability (TC) plays key role in the performance of the hundreds of enterprises involved in manufacturing and marketing of various coconut products. Technological capability (TC) encompasses all activities, physical systems, skills and knowledge bases, managerial systems, and entrepreneurial values that generate unique benefit for an enterprise. Thus, it formed a determining factor in the efficiency and effectiveness of enterprises. Therefore, an understanding of TC of coconut-based enterprises holds great importance for state'seconomy in terms of entrepreneurship development.

It was in this rationale, the present study was undertaken to document and characterize coconut enterprises based on the major products and services, to map the technology use pattern of these enterprises, to evaluate the technological capabilities of the selected enterprises and to evolve a conceptual model for sustainable entrepreneurship development. The results of the studycan be used to decode the critical factors that form the basis the technological capability of coconut enterprises that can effectively redefine the coconut-based entrepreneurship in the state.

The three districts from the state of Kerala viz. Thrissur, Kozhikode and Ernakulam which had the largest number of registered coconut processing enterprises were selected as the study area. The details of Micro Small Medium Enterprises (MSMEs) collected from the respective District Industries Centres (DICs) were used for the purposive selection of these districts. The enterprises under farmer collectives using the technological support from Coconut Development Board (CDB)functioning in these districts were also included under the study. The total sample size ofenterprises was fixed as 45 following the ratio of 20:10:15 in proportion to the number of registered coconut enterprises in the selected districts of Thrissur, Ernakulam and Kozhikode respectively. An additional eight social enterprises run by farmer collectives in these

selected districts were also selected. A total of 100 skilled workers involved in technology use in these enterprises were also selected as respondents in the study. Thus, the total sample size of the study was 153 comprising of the 45 MSME coconut entrepreneurs, 08 FPO CEOs and 100 skilled workers.

The results delineated three major products from coconut enterprises based on productionproportion viz. coconut oil (81.14%), virgin coconut oil (VCO) (9.43%) and coconut paste (9.43%). Coconut oil was identified to have a production proportion of 80 per cent in micro enterprises while in small enterprises and in medium and social enterprises it recorded 90 and 76.93 per cent respectively.

The technology use pattern of coconut enterprises was mapped based on the skill sets of the workforce related to communication skills, technical skills, problem solving skills, interpersonal skills and decision-making skills. The correspondence analysis result showed that problem solving skills was associated with both micro and small enterprises while decision making skills and technical skills were associated with small enterprises. The skill which assumedimportance in medium and social enterprises was interpersonal skill. The analysis of perceived skill competence of workforce across the enterprises revealed that, in micro enterprises workers expressed highest competence in problem solving while in small enterprises it was for technical skills while in the case of medium and social enterprises the workers perceived their expertise in decision making. The perceived skill gap analysis revealed that in micro enterprises the highest gap (with a score of 34.17) was in decision making and in small, medium and social enterprises were lacking more in problem solving skills with scores 30.96 and 24.22 respectively. Kruskal-Wallis test was performed to compare the perceived skill competence of workforce in different category of enterprises and it showed that there was a significant difference in the perceived skill competence of work force among the different categories of coconut enterprises.

The technological capability of enterprises was estimated using technology capability index (TCI) with resources, level of technology use, market competency and coordination and accessibility as four macro indexes. The weightage for each macro

index was calculated from the Analytical Hierarchy Process (AHP). The average TCI score for the entire coconut-based enterprises were found to be 0.34 and the enterprise categories were giving importance for level of technology use (with a score of 0.66) in developing their technological capability followed by resources (0.5). There was a significant positive correlation between technological capability and educational status, skill competence of workforce at 5 per cent level of significance and a significant positive correlation between the level of extension contact, mass media contact, social participation, managerial competency, level of technology use, and production capacity at 10 per cent level of significance. Scaling readiness of technologies were measured as the product of innovation use and innovation readiness in the levels of management, technology use and marketing. The micro enterprises got highest score of scaling readiness which in turn indicates more interventions can be made with less investment in the existing technological ecosystem of these enterprises.

The study suggested a frame work combining selected dimensions to elucidate sustainable entrepreneurship development in coconut enterprises**.** Sustainable entrepreneurship development in coconut enterprises has been defined as the function of technological capability of enterprises, skill competence of workforce, scale readiness of innovations and forward and backward linkages of the enterprise. The technology capability dimensions identified were resources, level of technology use, market competency and coordination and accessibility. The skill competence determined the technology use pattern in coconut enterprises from the significant relation with TC. Innovation was another important attribute of technology capability which was analyzed in termsof its scaling readiness. Scaling readiness defined the status of an enterprise to upgrade with technological innovations at different levels. The forward and backward linkages in enterprise such as value and supply chain channels were also having paramount importance in the determining the sustainable enterprise performance.