TECHNOLOGY AND MARKETING ISSUES IN CINNAMON INDUSTRY IN SRI LANKA

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Degree of Master of Business Administration

Department of Management of Technology

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Dissertation submitted in partial fulfillment of the requirements for the degree

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Declaration

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Technology and Marketing Issues in Cinnamon Industry in Sri Lanka

Abstract

The main purpose of this study is to identify the technological and marketing issues prevail in the Cinnamon Industry in Sri Lanka and propose policies and the recommendations to gain the competitive edge. It is suggested to implement appropriate technological and marketing strategies concerning the entire value chain activities. Situational analysis was carried out for the entire industry through focused group discussions (FGD), semi structured and an in-depth questionnaire surveys. The in-depth questionnaire survey was carried-out to gather data from different value chain players while semi structured questionnaire focused more high level information from stakeholders with broad knowledge and practical experience. Cinnamon is exported without any product diversification and its product portfolio is limited to very few numbers. But the majority of Cinnamon raw materials (Oil and Quills) exported is used for variety of purposes. Cinnamon is used for variety of purposes and more purposes are still being explored. This vital crop inherits the potential to drive the economy towards great heights. Competitive edge is considered to be a function of technology and marketing. The Galle district was focused on collecting the necessary information. The inaccessibility to data regarding the exporters limited the study to a greater extent. Policies and Recommendations are made in attaining the industry edge. Technology and marketing solutions are suggested concerning the total value chain activities. A considerable number of people are involved in the Cinnamon industry. Most of the existing cultivators fall under the small holders' category and the processors earn high salaries. Upon suggested improvements these sectors will receive a better living with the improvement of the economy of the country. This study identified the issues and the overcoming strategies for the development of the Cinnamon industry in Sri Lanka. Since this crop is native to Sri Lankan soil it will provide many value additions to the economy.

Key words: Cinnamon industry, Technology, Marketing, Value addition, Sri Lanka.

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LIST OF ABBREVIATIONS

EACs	-	Export Agriculture Crops
NAA	-	Naphthalene acetic acid
BAP	-	Benzyl Amino Purina
SWOT	-	Strength, Weakness, Opportunity and Threats
PEST	-	Political, Economical, Social & Technological
GDP	-	Gross Domestic Product
GNP	-	Gross National Product
SL Rs	-	Sri Lankan Rupees
US $	-	Unites States Dollars
Tech	-	Technology
Mkt	-	Marketing
Val	-	Value
Vol	-	Volume
Eff	-	Efficiency
R&D	-	Research and Development
LDL	-	Low Density Lipoprotein
ha	-	hectares
cm	-	centimeter
m	-	meter
g	-	grams
mt	-	metric ton
mln	-	million
EDB	-	Export Development Board
IDB	-	Industrial Development Board

C	-	Celsius
UoR	-	University of Ruhuna
Hon.	-	Honourable
ppm	-	parts per million
DEET	-	*N*,*N*-Diethyl-*meta*-toluamide
LC_{50}	-	Lethal Dose, 50%
INGOs	-	International Non Government Organizations
GTZ	-	German Technical Cooperation
JAICA	-	Japan International Cooperation Agency
GMP	-	Good Manufacturing Practices
HACCP	-	Hazard Analysis & Critical Control Point

CHAPTER 1: INTRODUCTION

Global economic environment shows very dynamic behaviour under critical financial conditions facing recessions and other issues. Great uncertainties on the financial stability show hardships even for the financial giants and cause the international competitiveness to be raised to their maximum heights. Countries are thriving to strategically gain the advantages through the technology development in every sector they are operating in. Technological advancement has become a key factor deciding country's relative position in the global environment.

It is very important to analyze and solve the issues pertaining to the technology if we wish to target a competitive edge for any industry and providing a comprehensive total solution. Sri Lanka is popular as an agricultural country from the past and secured a reliable competitive position. *'Peradiga Dhanyägäraya'* is the renowned name given in Sinhala language to imply the meaning '*global eastern grains' store'*. This study focuses on one of the spices – '*Cinnamon'*, which is providing a greater contribution to the Sri Lankan economy since many centuries back. Since there is no considerable development in the industry it is a timely important factor to analyze the existing situation focusing the technology and marketing issues and then come up with the improvements needed to develop the industry for the future progress. On the other hand identifying and suggesting the probable improvements is purely not enough. It should be coupled with a genuine intention and related strategies to upgrade the industry.

Finding the most appropriate practical solutions is the most important factor and subsequently it becomes a challenge when it comes to the implementation stage in the real term. That will definitely help the industry to overcome the present operating level and contribute to Sri Lankan Gross Domestic Product (GDP) in a substantial manner. It is also necessary to emphasis on marketing aspects and to develop a long term sustainable strategy to maintain the market shares within the global competition in a consistent manner.

1.1 Background of the Study

Sri Lanka the Spice Island is renowned for the spices export from time immemorial. Cinnamon, Pepper, Cardamom, Clove and Nutmeg are the major spices which has the export significance. Cinnamon (Cinnamomum verum syn. Cynnamomum Zeylanicum) is one of the oldest and the most significant spice grown and it was a popular spice in ancient Arab world. Firstly the Arabs and then the Europeans became the traders for Cinnamon and this brought Sri Lanka in contact with other parts of the world. It became a crucial turning point for the future aspects of the country. Cinnamon played a major role in the world's history, by motivating the Christopher Columbus to discover the new world and Vasco de Gama to South India and Sri Lanka (Knox, Ihaystack). Traditionally known Cinnamon is the peeled Cinnamon bark rolled in to the quill form.

Except '*True Cinnamon'*, almost all the other Export Agriculture Crops (EACs) are cultivated in many other countries in large bulk forms. Therefore Sri Lanka has maintained the comparative advantage over the Cinnamon industry at global level. For other spices comparative advantage lies in niche markets where intrinsic quality has become the main concern (Herath and Weerasinghe 2004, 12).

A spice is ***'any dried plant product used primarily for seasoning purposes'*** (American Spice Association c. 2010). Spices include tropical aromatics, leafy herbs, spice seeds and dehydrated vegetables which may be used to add aroma or flavour to food stuffs, beverages, pharmaceuticals, cosmetics and households and personal care items. They are occasionally used as the functional agents like air fresheners.

Cinnamon is available in the following forms and respective grades in the current Cinnamon market;

- *Cinnamon Quills*: Quills available in Continental (C), Mexican (M) and Hamburg (H) quality standards. It could take bale form and could be cut into any custom size. Following table shows the respective grading under each standard.

Table 1.1 : Cinnamon Standards and respective Grades

Standard	Respective Grades
Continental grades	Alba, C_4, C_5, C_5 SP
Mexican grades	M_4, M_5
Hamburg	H_1, H_2, H_3

- *Cinnamon Quillings*
- *Cinnamon Featherings*
- *Cinnamon Chips*
- *Cinnamon Powder*
- *Cinnamon Leaf Oil*
- *Cinnamon Bark Oil*

Cinnamon at present is the fourth most important exporting agricultural crop and the predominant export spice in terms of foreign exchange earnings in Sri Lanka. It was estimated to 25,294 ha of Cinnamon lands distributed in the entire country. About 93,767 families with around 150,000 labour units are actively involved in Cinnamon cultivation (Bawappa et al. 2005, 7). Additionally Cinnamon leaf oil and Cinnamon bark oil industries also generate a notable income.

Sri Lankan government emphasis in developing the Cinnamon industry by providing many supports such as provision of cash grants, extension and research inputs and assistance for Cinnamon based value added products. But there is no evidence of studies carried out to determine the total production to assess the Sri Lanka's Total Cinnamon production. Anyway the economic research unit of Department of Export Agriculture (DEA) estimated this figure incorporating indirect methods.

There is a notable growth in the volume of Cinnamon exports during the last two decades, but not adequate enough when compared with the growth of export volume of Cassia (Figure 1.1), which is the competitor for Cinnamon market at global level.

Figure 1.1 : Sample of Cassia

By considering these different perspectives it has become indeed a requirement to strengthen the Cinnamon industry not only to support the economy but also to target the sustainable development in the long run.

1.2 Research Problem

Being an indigenous crop to Sri Lanka with diversified product ranges the Cinnamon industry doesn't show a significant development. Cinnamon exporting was carried out for the wealth creation of the country from the past. Various countries incorporate Cinnamon products as a raw material for manufacturing other diversified products while the others use in the same raw form for final consumption. Being an inherited crop that is not possible to grow successfully in any foreign country, the comparative advantage it could provide to Sri Lanka is very high. From the Sri Lanka's perspective the industry is operating at the same traditional level and it seems that the value of the entire industry has not been properly understood by most of the stakeholders even in a knowledge intensive era.

At the same time the authorities paying higher attention to improve similar exports and it has become an indirect reason for the failure of the industry too. It is not purely due to the open economic policies in the country but have many other reasons. Lack of concentration, poor returns due to the lack of quality, lack of new technological applications and variations in the international market conditions are some of the main reasons. It is also noticeable that Cinnamon plantation sector is not properly maintained, unproductive and the stakeholders are not motivated to involve in this industry considering the long term sustainability.

The processing and manufacturing sector too faces many issues with regard to the industry and it incorporates the same old traditional methods. The peelers used to sit on the floor for hours and carrying out their jobs without considering quality standards & health conditions. This is the step where the Cinnamon bark gets mixed up with foreign materials from the environment and it causes directly to decrease the quality. Since this process is highly skilled and time consuming it has become the bottle neck for the entire industry performance (Figure 1.2).

Figure 1.2 : Cinnamon Peeler at Work

This process has evolved for a considerable period and it is socially and culturally accepted by many industry players. This has unfortunately become a hindrance for implementing the newly developed methods. High cost of new applications, lack of knowledge & poor confidence on return for investment, impracticability of the solutions are some of the problems foreseen on the other hand. However it is highly felt that the industry needs novel methods and new technology applications to improve the processing division.

Marketing and sales promotions plays a vital role for the success of any industry. The level of return is the most crucial factor and it needs to be given an improved attention. Inability to provide value added Cinnamon products in meeting global market conditions is the main disadvantage in penetrating to international market. Lack of strategies to prioritize and explore new market segments for Cinnamon has become the main challenge. It is evident that no proper actions were implemented for the Cinnamon promotion at national and/or international level up-to-date.

The endeavours to build up an excellent brand image in providing uniqueness is also lacking in the global environment. The presentation of Cinnamon products incorporating new technological applications such as attractive packing, use of novel methods for distribution systems…etc. need to be inbuilt with in the marketing process. Evidently the importers are making higher margins through the same raw products imported without any value addition. Sometimes the only value addition incorporated is the addition of an attractive packing apparently.

Obviously without the new technological applications and proper interlink among the value chain activities the industry performance couldn't be upgraded. Therefore in reaching better solutions, it is vital to identify prevailing technological issues in the Cinnamon industry as a first move.

If technological applications become obsolete as a result of unconformity to the situation, it will be ineffective resulting waste of money and time eventually. Hence identifying the best technological applications is a must to take the industry to a better place in the global market. It will not only become profitable but also saves some consistent activities in the long run. In implementing the most suitable technology solutions to the industry it is vital to identify the current state of the art technological availability. This will result in the identification of the gap between Sri Lankan and global technological levels if it is targeted in suggesting international technology transfer as an appropriate mechanism.

In summarizing most of the problems faced in the industry and incorporating the right type of technological applications means improving the productivity in a market oriented manner. Therefore finding overall issues through giving special emphasis to the technological and marketing aspects and then crafting exact application to satisfy the issues at global level are the vital needs in the current context. This entire concept should focus to carry out the entire Cinnamon industry to a better place with continuous growth in the future.

1.3 Research Objectives

By considering the contents of the research problem it is encouraged to form the following research objectives depending on the logical order of their attainment:

Therefore the objectives of this research study are:

Objective 1 **:** To identify the current situation of the Cinnamon industry in Sri Lanka by incorporating SWOT and PEST analysis

Objective 2 **:** To identify the technological issues faced by the value chain players along with the marketing issues in the Sri Lankan Cinnamon Industry

Objective 3 **:** To recommend policies and strategies to overcome technology and marketing problems prevail in Sri Lankan Cinnamon Industry

Primary objective helps to identify the current situation of the industry through very popularly used two different analysis methods to have a better understanding of the entire industry. It denotes the finding out of the solution for '*Where are we? (performing as an Industry)'* at the initial stage for helping the strategizing process. After finding out the present situation the special concern is given to the next step.

Secondary objective of the study is to identify the Technological issues associated with the value chain players along with the marketing problems in the industry. It has become a prime concern for the purpose of improving the productivity in all three main processes identified in the Value Chain (i.e.: Planting & Maintaining, Harvesting & Processing and Marketing & Sales) to get the competitive edge. It will provide a new form to the industry to take the direction in a more optimistic manner.

Finally it will be explored with the right recommendations and policy strategies not only to drive industry to a profitable venture but also to open the eyes in the relevant way for the purpose of awakening this entire industry for the stakeholders. It will help to carry the Sri Lankan economy towards great heights through supporting to denote the solution for '*Where we want to be? (as an entire Industry)'*.

1.4 Research Questions

Depending on the above research objectives it could be directly formulate the following research questions to easily carry out the research.

Question 1 : In which stage the Cinnamon industry is currently remaining in Sri Lanka?

Question 2 : What are the technology issues faced by the value chain players along with the current marketing problems of Sri Lankan Cinnamon industry?

Question 3 : What policies and strategies will help to better perform the Cinnamon industry in meeting the industry edge in Sri Lanka?

1.5 Scope of the Study

The primary focus of this study is to identify the real causes, effects, issues and impacts associated with technological applications along with the marketing problems in the Sri Lankan Cinnamon industry. Since the entire industry is focused under this study, it becomes comprehensive aspect to focus all the value chain players in the industry where the processes may change even at local level. The value chain players includes Cinnamon cultivators, Peelers, oil producers both leaf oil and bark oil, Cinnamon fruit oil producers, Cinnamon flower processors, diversified value added product manufacturers and intermediates at various levels.

For the convenience of studying the entire industry it was grouped in to 3 main processes according to the Michael Porter's Value Chain Model highlighted in Figure 1.3 (Hindle 2008). Then the technological applications within each group will be thoroughly analyzed to have a better understanding of the issues and related impacts.

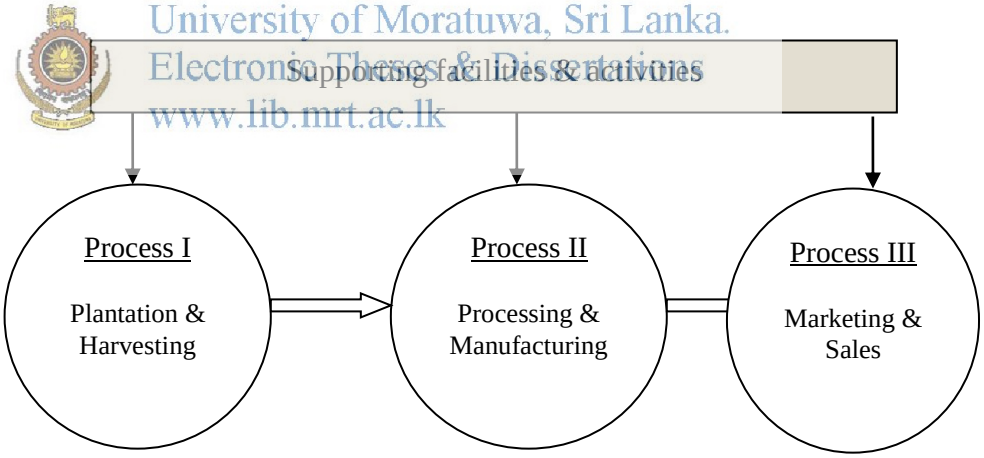


Figure 1.3: Cinnamon Industry Processes : Adopted from Michael Porter's Value Chain Model

The entire industry is depicted as one interconnected chain with separate sections or phases of different areas. This will assist to identify most relevant issues in a more logical manner due to its completeness and it further facilitates to focus more within each sub section.

Prior to suggest any improvement it is essential to identify the quality levels demanded by the customers. Sri Lanka is the only country exporting True Cinnamon for the entire world but there are no significant value added Cinnamon products manufactured at local level. The popular export product is in the form of quills and its quality is mainly decided by the importers to match their own quality standard. This process is taken place from many years back and nobody knows for what exact purpose they are being incorporated. That is the tragedy Sri Lanka is facing because it can't be evaluated the final real economic value of this raw material under exports (Weerasinghe, Liyanage and De Silva 2006, 21-30). Therefore special attempt is taken in analyzing the diversified Cinnamon products manufactured by foreign countries and identifying similar possible value added product manufacturing.

Therefore once the above requirements are fulfilled (i.e.: Data gathering and analyzing is completed) it helps to get a detailed idea about the entire industry and relevant technological issues along with the marketing aspects. Then it will become a great tool to design the most appropriate recommendations and necessary solutions for the industry's sustainability.

1.6 Significance of the Study

It is evident in the history of Sri Lanka that the Cinnamon tree was considered similar to gold. There were rules imposed to execute the people who break even a branch of a Cinnamon tree. Also in the 16th century the first international agreement on agriculture trade was signed providing the base for the Cinnamon plantation. Accordingly the king of '*Kotte kingdom*' had to supply 250,000 lbs for the Portuguese and in return the Portuguese governor had to protect the kingdom from the attacks by external parties. Eventually the Portuguese were enabled to build the Cinnamon supplying monopoly at international level by defeating the Arabs. In 1636 this monopoly was owned by the Dutch and similarly from 1796 to 1833 it was under the English. But up to date Sri Lanka was enabled to secure the monopoly of supplying the world's best Cinnamon (Bawappa et al. 2005, 1). Therefore it is easily understood the very close relationship prevailed in between the Cinnamon tree and

the Sri Lankan history and also how much it contributed to the entire economic path of the country.

When considering the significance of this study it could be discussed through two different perspectives as follows:

Empirical significance:

Nowadays Sri Lankan government is focusing on a rapid development of the country since it completed the long lasted civil war prevailed for about 30 years period and headed the country to a distressed situation. Due to this reason it became a very difficult task to deal with the global economical trends. Because any country is now dependent on the exports and imports and their market area has broadened up to the international level. Therefore as a strategic movement it is focused to develop the entire Sri Lanka incorporating the theme *"The Wonder of Asia"* through analyzing every possible sector and paying higher weight to the agricultural sector. It incorporates a sub theme *"Lets Grow and Build the Country"* in this regards and fortunately this industry is in line with one of the government's major concerning areas.

Since Sri Lanka is positioned in a location where it is very conducive for agricultural sector, it has majorly driven towards the agriculture based economy. It has also become the reason for the comparative advantage of the country. Therefore this industry has a great potential for the development. But when considering the performance of this sector, it is not at the preferred level compared with the early stages.

Cinnamon exporting has become a major component of the entire economy. It has secured the fourth most significant crop in foreign exchange from entire agricultural sector and the No. 1 among the spices exports as discussed above. Most of the Cinnamon cultivated lands are owned by small holder plantations. There are about 250,000 Cinnamon cultivators and 400,000 Cinnamon sector employees in Sri Lanka

and 60,000 family units dependent directly on the Cinnamon industry being the main source of income (Rupasinghe 2011, 4-5). But the only product known to be exported is the Cinnamon quills with a length of 106.7 cm and weight of 45 kg. Although this product is able to secure a 90% market share in the global market this fact is not known by many locals as well.

Apart from 2-3 products exported as Cinnamon value added products there is no considerable range of Cinnamon products although it has multi usages. Therefore it is clear that the Cinnamon is not promoted and no proper marketing strategies were undertaken to promote this industry at local & global levels. Cinnamon exporting is in the hands of very few entrepreneurs and they mostly achieve their export quantities through collecting the harvest from the small and medium holders (Ranasinghe 2011).

There is no significant growth in the industry in technology applications at the most required time. Therefore it is very vital to conduct a technology audit and find out the most suitable technological applications at primary level. Implementation of these solutions will results in improving the productivity of the industry, employment generation, GDP of the country and the life style of people who are involved in the industry. On the other hand it allows the technological impotents of the plantation sector to take the necessary strategies in overcoming them.

Through proper application of the technology it is expected to increase the productivity while reducing costs associated within the industry. This aspect is considered for the value chain phases separately and it will become an eye opener for Cinnamon value chain players to realize the significance of the new technology applications.

The soil and the other climatic conditions being ideal for the Cinnamon plantation it is generally possible to obtain 470 kg/ ha of Cinnamon. But the Cinnamon Research Centre at Palolpitiya, Matara came up with two improved varieties with great results

providing more productivity for the industry. Therefore it is evident that there is a high potential for further improvement in the industry.

Also the cultivation carried out in other parts of the country shows excellent results especially in Ratnapura and Negombo areas and as a result the sustainability could be guaranteed in continuous-increasing pattern with proper exploitation. The Cinnamon variety called “Pieris Kurudu” cultivated in Ratnapura area shows further developed characteristics. All these improved varieties could be introduced island wide for better results (Paligasnghe 2011).

Some unexplored facts with respect to the manufacturing of Coca Cola soft drink which incorporates Cinnamon as the base chemical ingredient prevails and believed by many scholars. If it is found out, the potential of this industry to change the entire prevailing conditions in the country is unimaginable.

Theoretical Significance:

The importance of the theoretical significance is seeking the possibility of introducing a conceptual model. It could be used in the industry for the future purpose or in the case of analyzing the benchmarking possibilities with other or same industry related activities to improve the productivity in a more methodical manner. This would provide greater advantage to the industry to use it as a strategic tool to achieve required objectives and to gain the competitive edge at the time of practical implementations.

These types of models also play an important role in an academic point of view not only to make use of it in future references to identify industrial behaviour but also to provide greater assistance to carry out future research studies in a more successful manner.

1.7 Organization of the Study

In presenting the findings of this research study it is outlined in to eight chapters in a logical order to facilitate the better understanding.
Chapter wise it provides the following descriptive details:

- Chapter 1 provides a basic introduction of the research study and the back ground. It lays the foundation for the study with the necessary areas to be focused.

- Chapter 2 considers the Literature Review. It is for the purpose of reviewing the existing literature and any other related facts on exploring and findings of the research area.

- Chapter 3 presents the Methodology adopted in the research study. It is focused in identifying the gap between the literature reviewed in Chapter 2 and the objectives which were drawn. Accordingly the relevant objectives, sampling techniques & sampling frame selection, methods of data collection & data analysis were determined.

- Chapter 4 is the Situation analysis of the Cinnamon industry in Sri Lanka. It was discussed under three categories according to the Cinnamon value chain analysis steps as follows:
  1. Plantation & maintaining
  2. Harvesting and processing and
  3. Marketing & sales.

  This chapter discusses the findings from the semi structured questionnaires as a discussion guide. Situation analysis is carried out through the primary and secondary data gathered.

- Chapter 5 explains Data analysis and Interpretation. It includes two different analysis methods based on objectives of the study. Prime objective is satisfied through a partial inductive method and tried to identify technological issues or variables of the issues. Secondary objective is expected to be done through quantitative data analysis techniques.

- Chapter 6 emphasizes Conclusions, Findings, Policy Recommendations & Future Research Directions. Conclusions are arrived through previous findings and the analysis, which was done through both inductive & deductive methods. Those conclusions will provide the outcome of the study and also provide the current situation of the industry.

  Recommendations are given as policies and strategies to the industry and to the relevant authorities as appropriate guide lines or decision making criteria to overcome technology problems. Here the researcher is not expecting to test any Hypothesis but wish to build the Hypothesis or proposition (tentative relation statement) from the study.

  Future Research Direction explores any future research opportunities found out while carrying out this research study. The direction is shown in two paths to carry out future findings under empirical and theoretical directions. These types of research become more important in the current competitive environment in providing substantial impact to the Sri Lankan economy.

1.8 Limitations of the Study

Due to the limitation of the resources such as time, money and skilled man power…etc., any researcher will come across certain limitations in conducting a research. This study also has such limitations of its own as discussed below:

The sample population was selected to be within the Galle and Ratnapura district limits mainly due to the time constraints and ease of traveling. Of course this is

directly linked with the cost aspects too. But Cinnamon value chain players are from almost all the parts of Sri Lanka and the crop is successfully grown in the coastal belt starting from Kalutara district up to the Hambantota district. Therefore it was assumed that there is no considerable change in the processes incorporated and the technologies adopted for the same value chain group within the industry.

Following hindrances were also faced during the study:

Cinnamon bark oil production incorporates a unique process and it significantly needs a technology improvement with respect to the traditional mechanism. It was observed that some individual stills have developed their own methods and technologies but are unwilling to share them. In such situations it was not possible for the data collectors and the researcher to collect required information.

When collecting information regards to the total export of Cinnamon products by the existing suppliers in Sri Lanka it became unreachable task since the Export Development Board (EDB) and other authorized bodies are bound by the laws and the policies not to provide such information to any third party personnel. If those information gathered it would have been easily decided the competition level among the competitors. Therefore more valuable information with respect to the marketing aspects could be finalized for decision making process as well.

It is not possible to carry out an economic or any other analysis of the Cinnamon being used by the various importers from foreign countries. Since there is no such an idea on how, when and in what quantities Cinnamon is exactly being used the study limits the value chain players at local level only. But this is indeed very essential to find out in strategic manner for future decision making. It is high time it should have a more organized and strategic mechanisms to develop more exports and assess the customer perceptions and their actual needs through proper market research at global level. This is also became a limitation for this research study.

CHAPTER 2: LITERATURE REVIEW

The emphasis of this chapter is given to literature found on similar researches carried out in the world. It comprises of initiating with the industrial back ground and the importance. The industry was divided in to three main sectors (Figure 1.3) and all the relevant issues will be discussed in detail. For the purpose of justifying the literature in a constructive manner, statistical figures and tables were incorporated where ever possible. It was also emphasize the current Sri Lankan Cinnamon industry position in the global market.

It will be further reviewed the impact of the technological applications. Although it is not directly based on the study it will become one of the most influential factors to upgrade the industry. The final part of the chapter will provide significance of the product positioning strategy in the global market with the support from past literature findings. These aspects were given the special emphasis in search for a vital tool to gain the competitive edge from the international market.

2.1 Importance of the Industry

Cinnamon tree could be grown successfully within the ideal conditions prevail in Sri Lankan soil. Those areas spread mostly on the southern coastal belt and Ratnapura district (Appendix 5). Subsequently it has been converted to an industry which is mostly important for the international market and enabled to secure a considerable market share.

But there are proof to justify that the Cinnamon was grown initially in the central province areas. Because some places with in Kandy, Matale, Belihuloya, Haputale areas and in Sinharaja forest it is found very ancient Cinnamon cultivations even today (Rupasinghe 2011, 3).

Therefore it is evident that the climatic conditions prevailing in inlands are also helpful for the successful cultivation (Figure 2.1 (a)).

a. In Entire Sri Lanka;

b. In Galle District;

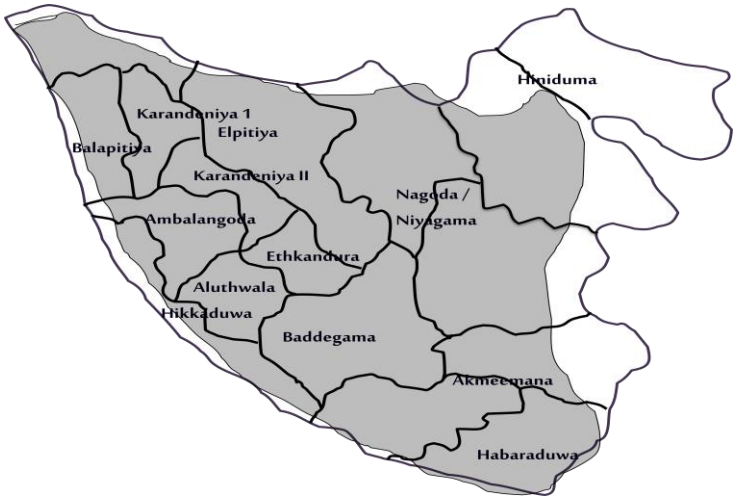


Figure 2.1: Cinnamon Cultivated Areas

Figure 2.1 (b) indicates the areas where the Cinnamon cultivated land-density is relatively high within the Galle district and it is shown by the grey area.

Unlike the other plantations the Cinnamon is mainly dependent on how much sunshine it receives throughout the year. Therefore it is not possible to couple with other categories as an inter-crop except for coconut. But in these situations the crop spacing needs to be maintained in such a manner to receive the direct sunlight for each plant (Dias and Sumanasena 2000).

As shown above the southern coastal belt is the suitable area for Cinnamon cultivation. It has been identified major and minor areas of Cinnamon cultivated lands among the region where the minor areas mostly consist of the newly cultivated lands (Figure 2.1 & Appendix 5).

Cinnamon provides direct impact to the economy while extending indirect impacts to the social, political and technological environments. The importance of the industry has significantly increased after it directly connected with the social life of the community. Different parts of the tree have different usages and surprisingly it includes totally different essential chemicals differing in a large scale from one to the other. Due to the special heat trapping capacity of the Cinnamon leaves it is also incorporated as the base material for horse-barns in relatively cold climatic countries. And the Cinnamon sticks left behind after the peeling process are used for making ornamental products and also as an effective fire wood material especially for boilers (Appendix 6). Flowers are used as a medicine for the 'Ayurwedic' medicinal purposes. These are some of the additional purposes of the Cinnamon.

When the commercial viability of the various products extends up to the global market level the importance increases and starts generating significant incomes. It leads to improve the production processes and marketing activities in various forms to meet global customer requirements. But there is no any single product manufactured out of Cinnamon supplied to the export market. But it is evident that Cinnamon is used as a raw material for many product ranges at international level. Therefore the objectives should be to produce such diversified products and obtain the competitive edge affecting the entire range of parameters relating to the country's development.

Increasing figures of volumes and the values of the major export Cinnamon products from the year 2002 to 2008 (Appendix 7) show how important this crop to Sri Lankan economy. It has an ability to improve the GDP with the minimal effort. The importance is not only driven from the export market but also assisted by the consumable Cinnamon products at domestic market. The consumption of spices in local tourist hotels has increased as a result of the boom in the tourism sector. Since this product is very essential for certain Sri Lankan & Indian type curries and also used in many forms to enhance the taste and quality of the meals the consumption has naturally increased.

It is also encouraging to note that the "International Association for Perfumery Industry (IAPI)" has standardized to include 1% of the Cinnamon oil in any perfume manufactured internationally (Rupasinghe 2011, 14).

2.2 Decline of the Industry

Even though the industry performs with a slight positive growth in the export market, the Cinnamon cultivated land extent had declined over the past decades. Most of the large and medium scale Cinnamon cultivators are disappointed with the current situation of the industry. Nowadays it is mostly seen as small scale cultivation units within the industry as a result (Rupasinghe 2011, 14).

Cinnamon total production and the average yield have been decreased without a considerable change in the extent of cultivation during the last two decades. Although Cinnamon has secured a considerable share in the export market, there is a stagnant market in terms of export quantity and values, particularly for its value added products. Eventually, the average retail prices of Cinnamon products have also become stagnant despite of short term fluctuations. The grower's involvement in producing quality Cinnamon products has drastically diminished.

During the recent decades the motivation and the consideration towards the industry among the cultivators has also has diminished. There are no proper benefits and supports extended for the Cinnamon value chain players in the industry and day by

day the cost of supplies has also increased. This has lead to increase the cost of production. But there seems no proper strategy to cover this additional cost from the buyers due to the existing system and their high bargaining power. That directly affects to lose the interest of these Cinnamon value chain players day by day (Paligasnghe 2011).

Although the Cinnamon auctions become a better solution in above situations few major traders are somehow capable enough to demolish such events providing bad experiences. Unavailability of authorized body to protect against this monopoly seems a big problem (Ranasinghe 2011).

2.3 Industry Issues in the Plantation & Maintaining Sector

Plantation and Harvesting is considered as a one unit and the all the issues falling under these two separate sections will be combined together. Since it has already been discussed the history and the importance of this invaluable crop, it is better to concern other characteristics too.

2.3.1 Botanical characteristics:

The botanical classification of the *Cinnamomum zeylanicum* is as follows:

Domain:

Eukarya - Eukarya is one of the three domains of life that includes Eukaryotes, organisms that contain a "true nucleus". Organisms also have membrane bound organelles like mitochondria. Eukarya includes all of the plants, animals, and fungi.

Kingdom:

Plantae - Organisms are capable of performing photosynthesis to acquire nutrients.

Phylum:

Magnoliophyta - Organisms with flowering structures (flowers).

Class:

Magnoliopsida - Organisms are dicotyledons and have two seed leaves or cotyledons in the embryo contained in the seed.

Order:

Laurales - Organisms are members of the basal group of dicots. (arise from the base of a stem.)

Family:

Lauraceae - Organisms are aromatic evergreen trees or shrubs.

Genus:

Cinnamomum – Organisms have aromatic oils in their leaves and bark.

Species:

Cinnamomum zeylanicum - *"True Cinnamon"* is different from other species that belong to the same genus Cinnamomum.

Cinnamon is a natural producer in its environment and provides not only just sugar but is constantly omitting oxygen out into the environment. Cinnamon forms flowers and reproduces sexually by seeds enclosed in an ovary. Its flowers house the female reproductive structures, the carpel, including the ovary, style, and pollen tube and the male reproductive structures, the stamen, including the anther and filament. Pollen grains are called microspores and are required to fertilize the megaspore, the female egg. Pollen is carried to the carpel by means of wind, insects, or other pollinators (Pittman, Ethno-Siu).

C. zeylanicum cross-fertilizes, meaning the pollen and egg are typically from separate organisms. During fertilization the pollen lands on the sticky stigma of the style and travels down the pollen tube where it reaches the ovule and fertilizes the egg. The seed develops in the ovule and are protected by the pericarp or ovary wall. This is the fruit of the plant (Figure 2.2) and houses the seeds. Cinnamon seeds are dicots, meaning they have two cotyledons (Anon 1973, 13-20).

Figure 2.2 : Cinnamon Fruits

2.3.2 Climate and the soil

For a Cinnamon seed to germinate it requires an average temperature of 20° - 30° C, rainfall of 1250 - 2500mm and elevation of 300 - 350m from sea level. The countries where these ideal conditions prevail at global level are shown in figure 2.3. It also prefers deep, well-drained moist soil that is either loam or sandy and has no root disturbances. Loam soil is a mix of sand, silt or clay and organic matter. The typical life span of a Cinnamon tree in nature is forty to fifty years. However it is different for Cinnamon trees that are harvested for product (Bawappa et al. 2005, 3-4).

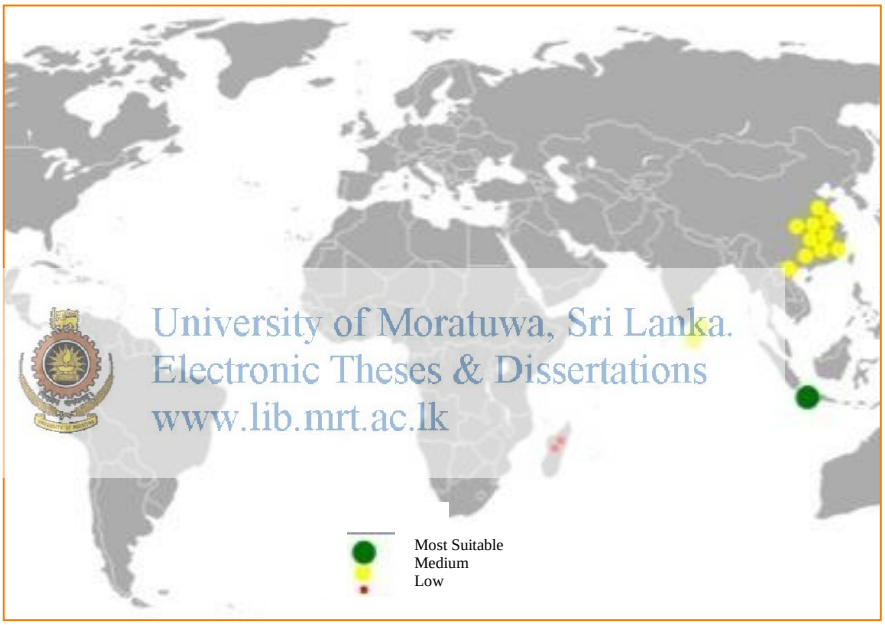


Figure 2.3 : Global Regions suitable for Cinnamon Cultivation

The quality of the bark is greatly influenced by the soil and ecological factors. The best quality bark is obtained from plants cultivated on sandy soils mixed with humus. Although a higher bark yield could be obtained through planting on other types of soils unfortunately the Cinnamon quality will become inferior (i.e.: the bark becomes coarser).

2.3.3 Varieties and potential crop improvement strategies

There are several species of Cinnamon found in South-East Asia. In addition to the cultivated Cinnamon types (*Cinnamon zeylanicum* or *C. verum*) there exist four other species (Table 2.1) of Cinnamon which are endemic to Sri Lanka (Wijesekera, Ponnuchamy and Jayewardene 1975, 47-69). With the use of these genetic resources Cinnamon plants with elite characteristics can be developed.

Potential technologies available for propagation are identified as 'Tissue culture technique' and 'the selection of vegetative propagated plants'. The second technique is widely practiced in the current scenario. Additionally "Controlled cross pollination technique" is also incorporated in crop improvement.

Table 2.1 : Cinnamon Species found in Sri Lanka

Botanical Name	Common Name	Description
Cinnamomum multiforum (Wight)	Wal Kurundu or Mal Kurundu	A small tree commonly found in forests
Cinnamomum ovalifolium (Wight)	Wal Kurundu	A small tree rather common in forests
Cinnamom litseifolium Thw.	Kudu Kurundu	A large trees rare in the mountain zone
Cinnamom citriodorum	Pangiri Kurundu	Very rarely found

Source : Navaratne and Punchihewa, Faculty of Agriculture

Seven different types (Cultivars) of Cinnamon (*Cinnamomum zeylanicum*) with commercial value are available in Sri Lanka based on pungency of bark and petiole, texture of bark and the structure of leaves. However no botanical descriptions of such varieties are available. Details of them are as follows (Table 2.2):

Table 2.2 : Different Cultivars of Cinnamomum zeylanicum in Sri Lanka

Botanical Name	Local / Sinhalese Name
Cinnamomum Type 1	Pani Kurundu, Pat Kurundu or Mapat Kurundu
Cinnamomum Type 2	Naga Kurundu
Cinnamomum Type 3	Pani Miris Kurundu
Cinnamomum Type 4	Weli Kurundu
Cinnamomum Type 5	Sewala Kurundu
Cinnamomum Type 6	Kahata Kurundu
Cinnamomum Type 7	Pieris Kurundu

Source : Navaratne and Punchihewa, Faculty of Agriculture

Two more types of Cinnamon were developed by Cinnamon Research Station at Palolpitiya very recently. They are considered superior over the other types and they were named after two of the most invaluable kings 'King Dutugemunu' and 'King Wijayabahu', who ruled Sri Lanka. To praise and tribute for their great commitment for the country the two species were named as "Sri Gemunu" and "Sri Wijaya" and their basic improved characteristics are shown in Table 2.3.

Table 2.3 : Characteristics of Cinnamon types Sri Gemunu and Sri Wijaya

Description	Sri Gemunu	Sri Wijaya
Bark Harvest	1100kg	1300kg
Bark oil quality	3.2%	1.4%
Leaf oil quality	3.4%	2.9%
Cinamaldihyde content – in Bark	74.7%	48.4%
Euginol content – in Leaf	88.5%	90.5%

Source : Rupasinghe 2011, 20.

Spacing of Cinnamon plants is a critical factor in obtaining the optimum yield. It is also dependent on the number of plants per planting point, harvesting frequency and plant nutrition. Higher yields with superior quality of Cinnamon quills were obtained from closer spacing of 1.2m x 0.6 m when compared to wider spacing (1.2m x 1.2m

or 1.2m x 0.9m). Closer spacing leads to tall, straight stems with restricted development of lateral branches. Therefore it is advocated to cultivate in the closer spacing although it leads to difficulties in harvesting and control of pest and diseases on the other hand.

Cinnamon can be established by planting seeds at stake or planting Cinnamon balls. But much better results are obtained by planting seedlings raised in polythene bags under nursery conditions. The latter system permits better selection of planting materials since established selections or vegetative propagated plant materials are not available. In order to improve the efficiency of vegetative production, plant training coupled with harvesting at 6 cm above the collar region at an angle of 45° inward cut is recommended. The highest percentages of bark and leaf oil are obtained when the Cinnamon sticks were harvested after 18 months period (Abeykoon 2000).

Cinnamon is a potential spice crop for inter cropping with coconut in low country intermediate zone of Sri Lanka. An experiment was commenced in 1995 at Narammala to find out the suitability and appropriate plant density of Cinnamon for intercropping with coconut in semi wet, inter mediate law country region. Higher growth and yield were obtained in 120 cm x 60 cm with 3 rows and the lowest were in 120 cm x 90 cm with 2 rows and the difference was significant (p=0.005). Cinnamon leaf water potential at 120 cm x 60 cm, 3 rows was -13 bars and the critical value may be bellow -18 bars. This indicates the potential for further expansion of Cinnamon into relatively drier areas. Growth, leaf water status and yield trends indicate that120 cm x 60 cm spacing with 3 rows of Cinnamon between two rows of Cinnamon appeared to be a suitable planting system for intermediate zone for intercropping with coconut (Dias and Sumanasena 2000).

2.3.4 Propagation

Two major methods of Cinnamon propagation are ‘Seed propagation’ and ‘Vegetative propagation’, and the selection of the best mother plant is vital aspect in both the situations.

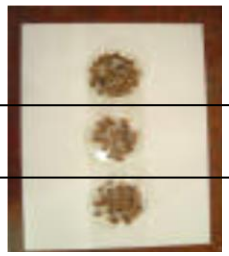
The selection criteria depend on the following characteristics (Wijesekera, Jayewardene and Rajapakse 1974, 1211-20).

- Erect stems with smooth bark
- Vigorous growth
- Easiness of peeling the stem bark
- Free from pest and diseases
- Good quality characteristics (sweetness, pungency, flavour…etc.)
- Dry bark yield (Current average yield in Sri Lanka 470/ha/yr)
- Oil yield - Leaf & Bark (current average oil yield - 0.9% for both leaf and bark oil where it could reach 3% in selected varieties)
- Oil Quality (Percentage of Euginol in leaf oil and Cinnamaldihyde in bark oil)

Seed propagation

This is a very simple method and the collected fleshy fruits are left in heaps for about 2-4 days in shade in order to soften and rot. Then the pulp is removed and allowed to air dry. Over fermentation the partially filled seeds and the damaged seeds should be excluded by hand sorting. Only the large and medium sized seeds are selected for further process (Table 2.4).

Table 2.4 : Cinnamon Seeds Classification

	Category	Length (mm)	Width(mm)
	Large	>12.5	>9.9
	Medium	8.5 - 12.5	6.1 - 9.9
	Small	<8.5	<6.1

Source : Navaratne and Punchihewa, Faculty of Agriculture

The seed viability could fall drastically if kept stored for a long time. Therefore seeding should be done without much delay. At around seven weeks of storage

germination percentage falls almost to zero. So prepared seeds can be kept for around 6 months period by mixing with sand and storing in air tight poly bags under dark conditions without any problem.

Then it should follow the 'Raising seedlings in poly bags method', which is the recommended method. Polythene bags of 12.5 cm x 20 cm size and thickness of 250 gauges with a potting mixture composed of equal parts of top soil and well decomposed cow dung is used to raise seedlings. At least 8 seeds per bag is sown and thinning out is necessary to keep 5 to 10 seedlings per bag. Field planting is carried out after 3 months period and these potting bags can be kept for a maximum of 8 months, if correct potting mixture is used (Bawappa et al. 2005, 5-7).

Potting mixture comprised of the following contents in volume basis.

Top soil (1) : Sand (1) : Cow dung (1) : Coir dust (1)

Vegetative propagation

This propagation method comprised of three different types. They are discussed in detail as follows.

a. Propagation by stem cuttings

Cinnamon can also be propagated by cuttings of young one-leaved shoots or by layering. Partially matured shoots (Semi hard wood) with a node are removed from selected mother plants with desired characteristics. Single node shoots are prepared by making sloping cut just above the node (length of cutting 1"). Cuttings should be put into water immediately and maintained in water until planted in polythene bags. Polythene bags 12.5 cm wide and 20 cm long should be pressed to be firm. The filled polythene bags should be put together, within frames made of bamboo or suitable supports to give beds not more than 1 m wide. The soil under the pots should have been forked over to ensure good drainage. 2-3 cuttings should be placed in each bag. The bed of polythene bags and cutting must be kept moist. In order to prevent water

losses through evapo-transpiration, the bags must be covered with polythene and this type of an arrangement is known as 'simple propagator'. It is important to protect from direct sunlight. After 2 months, the shade has to be removed gradually for hardening of plantlets. The rooted plantlets are ready for planting in 6-8 months (Figure 2.4).

Figure 2.4 : Propagator under a Shade house

b. Propagation in Vitro

In this type of propagation technique there is a potential for rapid multiplication of selected plant species with desired characteristics. The possibility of using Plant Tissue Culture techniques for the rapid multiplication of *Cinnamomum zeylanicum* has been established. Ravishankar Rai and Chandra (1987, 81-88) induced multiple shoots from hypocotyls segments of seedlings on Murashige and Skoog's basal medium supplemented with each Naphthalene acetic acid (NAA) and 6-Benzyl Amino Purina (BAP) at 0.5 mg/L. However there is no information about the adoption of Tissue Culture technology for commercial micro-propagation of Cinnamon so far.

c. Air Layering

The possibility of propagation of *Cinnamomum aromaticum* Nees (Cassia) through Air Layering has been recorded. According to Krishnamoorthy and Rema (1994, 48-49), propagation of Cassia has been achieved through air layering with 50% to 87.5% success depending on the time of the year.

2.3.5 Field planting

On flat lands Cinnamon can be planted in straight lines and on sloping lands planting on the contour lines is recommended. Spacing can be adjusted according to land type (Appendix 8).

Planting hole having the dimensions 0.3 m x 0.3 m x 0.3 m can be filled with top soil. Preliminary research has shown that addition of 25 g of Rock Phosphate seems to have a positive effect on root development and the researches are still being carried out. At 1.2 m x 0.9 m spacing one acre occupies 3,600 planting points. Planting must be done at the onset of rains at a rate of 5 plants per hole. Planting holes could also be sown direct with prepared seeds during the rainy season.

Vacancy filling should be done in timely manner, if not the yield is reduced and weed will grow resulting in pest attacks. Transferring of nursery plants in to larger poly bags with the same mixture and allowing them to grow up to 1 1/2 years can be used in vacancy filling (Bawappa et al. 2005, 8).

2.3.6 Maintenance

This is also a very crucial aspect when considering the productivity of the Cinnamon cultivation. Because there are few valuable aspects to be concerned in the Cinnamon plantation for the effectiveness and it will directly affect the productivity and the long run sustainability within the plantation. They are discussed in detail as follows:

a. Soil management

When the land is sloppy the adaptation of soil conservation measures are very important. Following steps should be followed in better soil management system:

- Digging of contour drains at suitable distance depending on the slope and the rainfall. The drains should be deep enough to allow for settlement of eroded soil.

- Mulching with pruned branches and weeds
- Follow recommended spacing

Burying of weeds and pruned leaves around the root stocks is beneficial. Gathering earth up to the root stock without mounting should be done as Cinnamon is a surface feeder. The root stock should be exposed to sunlight to allow new shoots to develop and to prevent termites attacking the root stock (Bawappa et al. 2005, 8).

b. Fertilizer application

This is an important aspect for commercial cultivation of Cinnamon to improve the productivity, as the crop is normally grown as a long-term monoculture crop. In the absence of fertilizers, the supply of nutrients available in the soil will become exhausted leading to mineral deficiencies and drop of yield. Further it will cause to reduce the content of the bark and leaves. Therefore the optimum application will vary from one region, plantation or field to another in accordance with local conditions. The DEA of Sri Lanka recommends the best fertilizer mixture and the quantities for Cinnamon cultivation in Sri Lanka (Appendix 8).

The quantity of Fertilizer required will also vary according to the age of the plantation. The recommended rates of fertilizer for young plantations on annual basis are shown in Appendix 8.

The above quantities of fertilizer have to be applied as two splits at six months intervals. The soil should be under moist conditions and therefore it is recommended to apply fertilizers at the commencement of the rains for the best results. Fertilizer needs to be applied at 50 cm radius around the plant or between rows. After applying the fertilizer it is important to fork it into soil.

It has found in the case of symptoms of magnesium deficiency, the application of Dolomite at the rate of 500 kg/ha, 2-3 months prior to the application of the

recommended fertilizer mixture will be advantageous. Maintaining the soil pH value around 4.5-5.5 facilitates better absorption capacities of nutrients by Cinnamon roots.

On the other hand for mature plants it should be considered a different method. After 3 years period Cinnamon plantation is considered as mature. The dose of fertilizer should be doubled for every successive application thereafter. However the fertilizer requirement may be determined according to the yield potential as well (Bawappa et al. 2005, 10-11).

c. Training the plant and pruning

Training of the plant is done to make sure a strong base which is capable of producing a greater number of healthy stems. When the seedlings attain the age of about 2 years and the diameter of the base of the stem is about 4-6 cm the main stem is coppiced or cut back to a height of about 4-6 cm from the ground level. The cutting is done with a sharp Keththa at an angle of 30° in such a way that the cut faces the inside of the clump. This will promote the tillers from the base and only three strong and straight tillers are left for better results. All the other shoots should be removed to promote the growth of these shoots as main stems.

After 1-2 years the main stems are harvested (pruned) alternately. It is necessary to allow each base of the pruned stem to initiate 3 healthy new stems. This would generate 5-8 stems for harvesting after 8-10 years from a single bush per year. It is also important to remove side branches of main stem to promote strong growth of stem which will make it easy to peel the bark. In addition pruning of side branches will expose the base of the plant to sunlight to initiate more tillers from the base (Bawappa et al. 2005, 10).

d. Replanting

When Cinnamon plantations are around 40-50 years old, the ability of regenerating new stems is minimal and this will results in decreased yield. Therefore the

replacement of old or low yielding plantations becomes necessary. If large scale plantation is being contemplated it becomes worthwhile to consider the possibility of distilling the root bark to produce the *Camphor-rich root bark oil* used in pharmaceutical preparations (Bawappa et al. 2005, 12).

2.3.7 Pests and diseases

There are no major pests affecting the production of Cinnamon. However in certain areas of Sri Lanka the leaves are found to be attacked by minute arthropods causing gall-formation which results in decrease in leaf oil yield by about 20%. The gall forming mites could be brought under control by spraying a systemic insecticide. According to the Bawappa et al. (2005, 13) there are two types of galls formed in Sri Lankan conditions:

a. Gall forming mites - *Erioplytes boisi* Gerber

Galls can be found on the lower surface of the leaves. Galls are pinkish in colour at the beginning and then turned to green over maturity. Mites lay eggs in the leaf tissue and gall formation starts immediately.

Figure 2.5 : Galls at Maturity on lower surface

b. Jumping Plant louse- *Trioza cinnamini* boelli

Galls can be found on the upper surface of leaves. The eggs are laid on the leaf surface and the gall formation appears to be due to the feeding effects of emerging nymphs.

Figure 2.6 : Galls at Maturity on upper surface

Cinnamon Wood Borer (Clear wing moth) is the moth damaging the base of the bush by making holes for laying eggs. In about 4-5 years period whole bush may collapse. The other pest known as Shoot Borer feeds on the tender shoots which results in dying off the upper part of the shoot. Meanwhile Sing et al. (1978, 24-27) reported that there are several major pests, including Cinnamon Butterfly (Chilasa clytie), Shoot and Leaf Webber (Sorolopha archimedias), Leaf Miner (Acrocercops sp.) and Chafer Beetle (Popillia) which distributed in all the Cinnamon growing tracts of India and Sri Lanka.

Apart from these pests, several diseases of Cinnamon have also been reported.

a. Rough bark

This is a fungal disease and it will reduce the quality of bark by reducing peeling ability and oil quality. It could be controlled by using Bordeaux mixture, Champion or Folicar.

b. White root

This is also a Fungal disease and commonly taken place when rubber plantations are replaced by Cinnamon. This disease affected plants cannot be recovered but further spreading can be prevented by applying sulfur dust.

c. Leaf spot taken or leaf blight (Colletotrichum gloeosporides)

Symptoms of this disease are seen as brownish leaf spots and they may enlarge to make large lesion. Spraying 1% Bordeaux mixture or any other copper fungicide may be necessary to control the disease.

d. Black sooty mould (Stenella sp)

The blackish growth on the leaf surface is the characteristic symptom of this disease. The fungal growth is confined only to the surface and no penetration into

leaf tissues. Since this disease is not severely affecting on the yield, application of fungicides is not necessary.

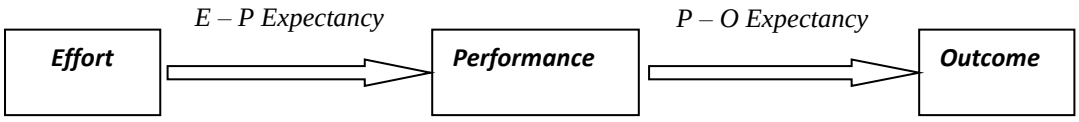
2.3.8 Future trends

Germplasm enhancement or genetic improvement of the crop has not been attempted until recently to meet the requirements of the industry. In the late seventies, the DEA has started a program of collection, conservation and evaluation of the Germplasm of Cinnamon crop.

At the first stage of screening program 100 accessions were selected on the basis of morphological and yield data. In order to strengthen the Cinnamon industry, Germplasm collection, breeding and genetic research are vital aspects. Establishment of two isolated seed gardens using these Germplasm in wet and intermediate zones has been proposed to provide planting material for the new and replanting programs in the major Cinnamon growing areas. Identification of genetic markers for quality and yield characters through molecular techniques and initiation of a program for production of pure lines and analysis of their combining ability has been suggested (Wijesinghe and Pathirana, 2000).

The open-cross pollination habit of the plant has lead to highly heterogeneous plantation in growth, morphology and quality characters. Even though some superior land races have been identified, homogenous plantations could not be established due to lack of sound vegetative propagation techniques. Cinnamon is hard to root & woody species thus cannot be cloned through traditional vegetative propagation techniques, which are generally applicable to other tree species. Vigorously growing plantlets could be produced within a period of 6-8 months and are ready for field planting. Field performance of vegetative-propagated plants is remarkable under good management practices. Successful root initiation could not be obtained in micro shoots so far (Dayatilake, 2000).

Value chain players of the industry always look for commercial benefits on individual basis but not to develop the whole industry as a one unit. That concern might show good results in short run. It is clear that people's motivation rises along with the expectations that will support to fulfill their aspirations (Figure 2.7). The issue is that the some stakeholders may also look at it in the same point of view and provide negative outcomes to the industry on a large scale since it doesn't confirm to their objectives (i.e.- Most of the NGOs are not directly supporting for this industry since it couldn't be substantially increase the GDP according to their expectations).



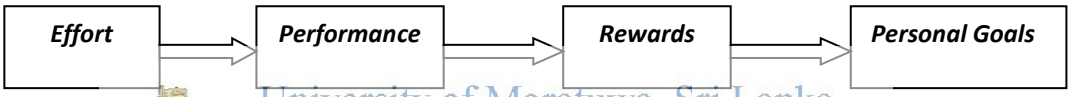


Figure 2.7 : Expectancy Theory represented Graphically

2.4 Industry Issues in the Harvesting & Processing Sector

Cinnamon is ready for harvesting after 2-3 years after initial planting, when the plant reaches a height of 1.5-2 m with three to four shoots and the bark turns to brown colour. The main shoot is coppiced or cut back to a height of about 6 cm from the ground level. Two to three crops are taken annually depending upon the rainfall. Harvesting is carried out from May to August -*'Mahamosama'*. During this period bark peels off easily.

2.4.1 Harvesting of Cinnamon

It is in details discussed the important factors relating to the harvesting process and the steps performed in each process activities with the necessary equipment incorporated in the field as follows:

<u>Step 1</u> – Cut suitable trees

Skilled peeler can visually identify maturity level and keeps several immature shoots for the next harvest. The peeler makes a cut and lifts the bark to test bark level of detachment. If there is any difficulty in peeling, the peeler rejects the shoots.

Making a test cut Harvesting Transporting

Figure 2.8 : Cinnamon Tree cutting and Transporting

After harvesting and removing leaves the sticks are collected, tied and carried to the open area for further cleaning. Peeling ability of bark is low during fruits borne and late flushing periods.

In General Cinnamon can be harvested throughout the year except during the above mentioned periods which in average is about two months. Peeling is quite difficult during the dry periods when soil moister depletes. Adoption of mulching practices with Cinnamon leaves is a good practice to conserve soil moisture.

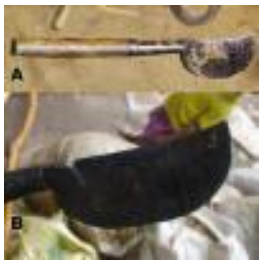
All the harvesting operations are done by a simple tool called the Ketta, which has a very sharpen blade and long handle. The blade is made of quality steel and local blacksmith usually fabricate it from a disposed leaf spring.

Step 2 - Removing knots

Peeler holds the stick in one hand and works with the other hand with Ketta along the stick and removes all the knots. Usually men are engaged in this job at standing or sitting position. After removing knots, scratch should be in a button shape.

Removing knots

View after removing knot



Ketta

Figure 2.9 : Removing Knots

Step 3 - Scraping

Scraping is the cleaning or removing the outer cocky tissue layer from the sticks. It is not laborious but time consuming. Traditional hand tool Koketta is used for this purpose. There are two types of tools, one with curved sharpen blade and other with a blade and small handle. That is called 'Sawthtuwa'. Curvature of the blade is selected to match the diameter of the stick.

Sometimes two or three scraping tools with different curvature are used for efficient scraping. Understanding the physical quality of the sticks (roughness, maturity) is very important for proper scraping. Therefore mechanization of this step is complicated.

Stillness and physical properties of the sticks (stick diameter, number of knots, straightness...etc.) are the affecting factors for the scraping time.

Peeler performs scraping

Scraped bark

Traditional Koketta & Modified Koketta

Figure 2.10 : Scraping Process

<u>Step 4</u> - Rubbing

Historically bark was detached without the rubbing process. Subsequently a piece of wooden rod (Keppitiya kotu) was used for rubbing process. Then a copper rod was used and then it was further replaced by the brass rod. Average diameter, length and weight of the brass rod are 15mm, 20.3 cm, 110g respectively.

Rubbing is the most laborious step in Cinnamon processing which helps to detach the bark from the stick very easily. Time taken for rubbing vary with the diameter of the stick, crookedness and other abnormalities, number of knots, season, cultivars…etc. During the off season extra effort has to be applied for rubbing. After 4-6 hrs of rubbing, performance of the peeler falls down resulting bark damages and producing poor quality quills.

Peelers usually change their posture to prevent muscle pain. About 40-60 strokes have to be applied around selected length of the sticks for proper rubbing and 9-30 N of vertical force have to be applied during rubbing. During the rubbing process bark sap oozes, this indicates that the proper rubbing is carried out. On the other hand extreme rubbing too damages the bark.

Rubbing process

Result of Rubbing process

Brass Rod

Figure 2.11 : Rubbing Process

<u>Step 5</u> - Peeling

This is the most skilled and time consuming step in the Cinnamon processing. Just after rubbing stick is examined to decide the maximum length of the bark portion that can be peeled off to make outer cover of the quill. Then make two cuts around the sticks with maximum length of intervals using a small pointed knife. A longitudinal slit is drawn from end to end and the knife is worked carefully between the bark and hard wood to raise the bark. Finally the other longitudinal slit is drawn opposite to the first slit. Bark can be detached in two equal halves with the little knife. When the diameter of the stick is higher bark can be divided into three or four strips as necessary. The rest of the bark left on the bended sticks and close to the knots or other bark abnormalities can't be detached as complete peels to make outer cover of the quill and therefore detached as small strips to fill the quills.

Peeling process with Small knife

Un detachable bark

Easily detachable bark

Figure 2.12 : Peeling Process

<u>Step 6</u> - Shade drying before quill making

After peeling the bark, long pieces are used to make the outer cover of the quills and are kept for 2-3 hours for shade drying. During this period bark curls inversely. In rainy season this period is extended up to 5-8 hours. At present rope racks or steel racks are used to shorten the drying period.

2.

Figure 2.13 : Shade Drying

<u>Step 7</u> - Quills making

Cinnamon quills are prepared by experienced peelers to maintain uniform thickness throughout the stick. Bark halves are packed one inside the other until cigar like quills are formed. When it reaches the required length the end is trimmed with scissors and it is gently lifted and kept on the mat for drying. The hollow inside of the quills is then packed with pieces of thin bark, which are unsuitable to use for the

outer cover of the quill. A pair of scissors and a measuring stick of 106.7 cm long attached with a wooden lifter called Pethi Kotuwa are used for Quills making.

Figure 2.14 : The Art of Quills Making

Standard length of a quill is 106.7 cm but trimmed with a pair of scissors when it is necessary. Quills are air dried and pressed by hand to stack properly. Quills will be covered by Gunny bags to prevent from direct sunlight. The processed quills will be bundled in to 45 kg each for the marketing purposes.

According to the interviews and discussions with these value chain players a skilled labour can produce 4 to 5 kg of dried processed Cinnamon per day. To achieve this target it is required to peel about 50 sticks per day, consuming 10 to 15 hrs. Shortcomings of these existing techniques are low efficiency in the entire process and incorporating high labour cost which is generally about 50 % of the income.

2.4.2 Major Cinnamon products, production processes and characteristics

Cinnamon has a variety of uses and it's every part has unique distinctive purpose. Its bark, leaves, roots, fruits & flowers and the stem consist of different chemical substances which are varying in a wide scale. They are commercially very vital and therefore incorporated in various manufacturing industries as a raw material for different applications.

A. Cinnamon bark products

As highlighted in above discussions Cinnamon quills represent the most valuable product originated from the Cinnamon bush according to the existing knowledge.

Depending on the characteristics of the Cinnamon bark they are graded according to the International Standard (Appendix 9 : *ISO 6535:1997*). The physical comparison of the above grades could be easily carried out by the naked eye very closely.

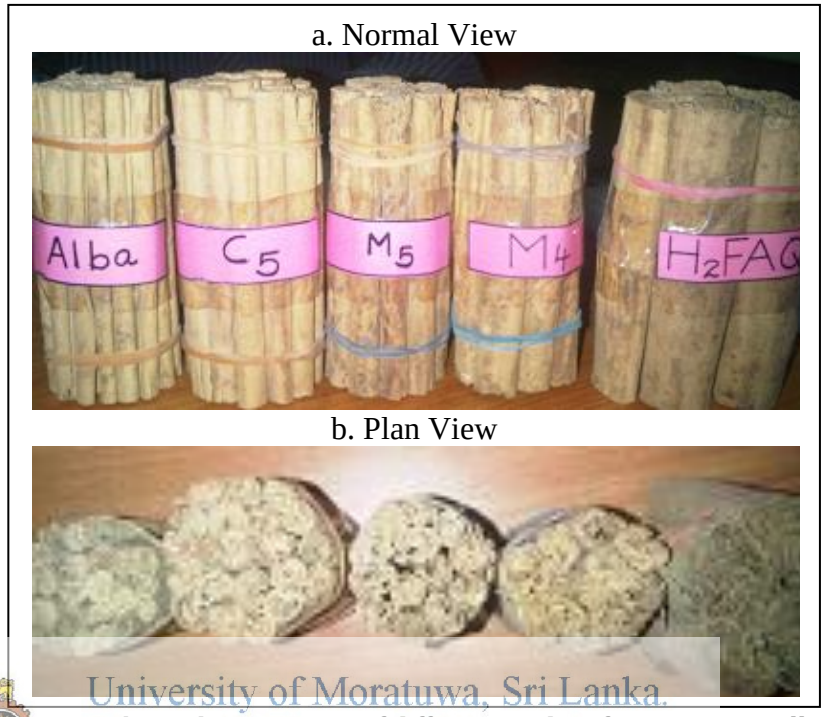


Figure 2.15 - Physical Appearance of different grades of Cinnamon Quills

However there are several by products generated during the processing of quills. They are classified into 3 major commercial groups namely Quillings, Featherings and Chips as identified in the market.

a. Quillings

Broken pieces and splits of all grades of Cinnamon quills are named as Quillings. The main characteristics of quillings are their shapes and the sizes. The aroma and taste of quillings are the same as the quills, even though they are marketed as medium quality Cinnamon. It contains featherings and chips but their quantities should not exceed 3% by mass. If proper precautions are not taken during the processing, extraneous matter including pieces of wood, stem or twigs may get

mixed with the quillings. Quillings are separated from the quills in the preparation of quills and they are separately dried in shade followed by sun drying.

b. Featherings

They are feather like pieces of inner bark consisting of shavings and small pieces of bark left over in the process of making quills. Scraping of the bark or small twigs and stalks of Cinnamon shoots including a minimum quantity of chips are also considered as featherings. The product is marketed as medium quality Cinnamon.

c. Chips

Chips are not peeled out from the stem. Instead they are scraped off greenish brown mature thick handpicked, pieces of bark, which are inferior in quality. Outer bark which has been obtained by beating or scraping the shoots also includes in chips. Chips are graded into 2 categories:

- *Grade 1* - Those containing small featherings obtained by scraping very small twigs. They contain a small amount of other bark material too.
- *Grade 2* - Those containing inner and outer bark and pieces of wood.

Depending on the extent of being free from extraneous matter such as refuse and dust the chips are further divided into 4 categories. They are named as type 1, 3, 0 & 00. Hygienic conditions, free from dust, mould and other pathogenic organisms are important common aspects of the production of Cinnamon quills, quillings, featherings or chips.

Consumers directly use them in most of the food formulations. It has been reported that compounds such as Cinnamic Aldehyde & Eugenol found in them both are growth retardants of microorganism (Senanayake, Wills and Lee 1977, 2032-33).

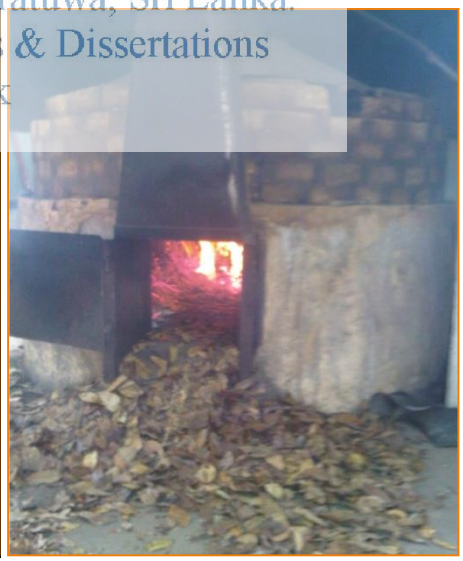
B. Cinnamon Leaf oil production

According to the available statistics steam distillation is the preferred method adopted in leaf and bark oil distillation. There are about 200 stills in operation. Most of these distillation units are spread in Batapola, Meetiyagoda, Galle and Matara areas. Among the distillers very few were processing bark oil (Paligasinghe, 2011).

a.) Feeding Cinnamon Leaves (after undergoing distillation) as fire material

b.) Collecting Cinnamon leaf oil

c.) Cinnamon leaves loaded still



d.) Furnace - Cinnamon Leaves under fire to vaporize water

Figure 2.16 : Traditional Leaf oil Distillation unit at operation

Steam Stills have 5 main components namely Furnace, Boiler, Condenser, Oil collector and Smoke Tower (Figure 2.17). Most of the stills are found to be

'Meetiyagoda type stills', made of stainless steel and sold at Rs 300,000/-. A modified still is introduced by ITI, which costs around Rs.3.7 mln. The ITI made stills have very limited use due to high price.

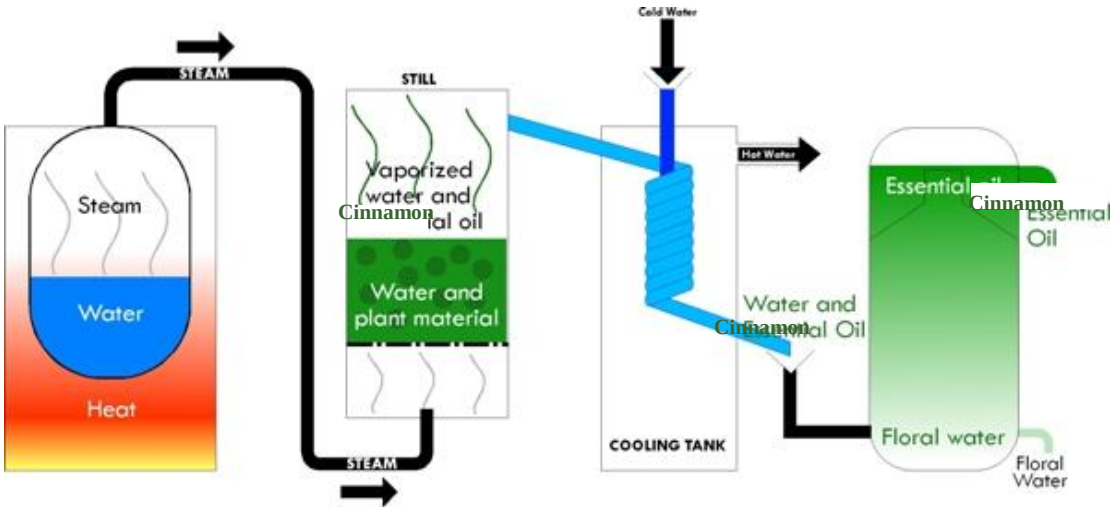


Figure 2.17 : Main Components of Team Distillation Process

Major importers of Cinnamon Leaf Oil from Sri Lanka (Table 2.5) are worth noting with distinct specialization of the EEC and US market.

Table 2.5 : Market Share of the Leaf Oil Market

Importer	Market share (%)
US	57.00
UK	14.40
Germany	6.07
France	4.40
Spain	4.83
Italy	3.30
India	4.12

Source : EDB statistics, 2010

174 leaf bundles could be collected on average from one hectare field. A bundle is about 40 kg in weight and about 7 bundles are manually compacted in the still, which is capable of producing about 3-4 bottles of leaf oil. Collectors are paid about Rs 1,000/- for the collection of 7 bundles by the distiller and from which Rs. 35-45/- per each bundle goes to the owner (Ranasinghe, 2011).

C. **Cinnamon Bark Oil Production**

Bark oil distillation is mainly done with *'Katta'* (i.e.: Rough barks) which provides the lowest quality bark oil (i.e.: *'Katta Thel'*). In super quality bark oil production quills, quillings and featherings are incorporated. Most of the super bark oil producers use their own bark in the form of quills for distillation. Purchasing of quality bark material from regular suppliers will definitely help to keep the confidence line high in super bark oil trade (Jayawardene 1978, 25).

Very few Cinnamon processors engage with bark oil distillation technology. Most of the processors carry out the bark oil distillation incorporating the same facilities available for leaf oil distillation. Once again the Steam distillation is the mostly adopted technology in the process and the single ownership or family ownership is dominant within the industry.

Fractionation of bark oil is rarely done in Sri Lanka. Only very few companies including *EOAS organic Pvt. Ltd*, are involved in this process. Anyway the demand lies on normal Cinnamon bark oil, but not on fractionated oil (Encyclopedia of Spices, s.v. "Cinnamon Bark Oil").

2.4.3 New approaches for Cinnamon processing and way forward

It is evident that the Department of Agriculture Engineering - University of Ruhuna (UOR) is playing a major role in developing the Cinnamon industry. It had commenced a research program in the year 1997 to study the whole processing steps and attitudes & habits of the peeling groups to design and test appropriate devices for overall Cinnamon processing (Navaratne and Punchihewa, Faculty of Agriculture).

It was focused to enhance the following areas:

- Replace the laborious steps by new strategies for production
- Shorten the time consuming steps

- Keeping peelers health and comfort
- Modernize the process to attract new generations
- Promote phyto - hygienic production to meet higher demand of export market
- Product diversification

Considering the above facts the following equipment and devices are already developed under this program to match with each step of the existing production process.

For Cinnamon Quills Production:

a. Scraper

A simple improvement to 'Ko Ketta' is made by doubling the scraping surface with a provision to manual adjustment of the scraping surface using a spring mechanism. Scraping surface of the device can be changed to suit the diameter of the Cinnamon stick.

Figure 2.18 : Scraper

Preliminary results of the applicability of the device revealed that time consumption for scraping is reduced by 30% when the suggested mechanism is used.

b. Cinnamon rubbing machine

'RUWEEKA_CG' is the name given for the rubbing device which was introduced by the UOR after a series of experiments. This device replaces the heavy labour involvement by increasing the efficiency up to 59.7%. This device consists of brass ended spindles, springs, nuts and casein. Spindles are mounted on spring in a circular arrangement in three planes on the casing. Springs provide optimum force evenly on

entire surface of the sticks for rubbing. That reduces the heavy labour involvement and operation could be done by a single person easily. People can engage with rubbing process in better working posture preventing muscle pain and fatigue.

Operation could be done by inserting the scraped sticks through the spring loaded spindles and moving several strokes. In this way entire sticks could be rubbed in 25 seconds.

Figure 2.19 : Cinnamon Rubbing Device - RUWEEKA_CG

RUWEEKA-PG is patented by Weerasinghe and Pushpitha (2004) as an improved design of RUWEEKA-CG by scaling and incorporating the suitable mechanisms to insert the stick. The efficiency improvement is also significant with compared to the existing manual system (Table 2.6).

Table 2.6 : Efficiency of Rubbing process with RUWEEKA Machine

Method of Rubbing	Time requirement for the stick (mean value)
Manual	72 seconds
RUWEEKA-CG	25 seconds

Source : Pushpitha, 2006

The following device is also working in the same principle but shows some improvements and sticks up to 5.6 cm diameter can be processed with it. A simple mechanism is incorporated to the device which helps for inserting sticks to the rubbing device without any difficulty. Pressing or pulling the handle of the mechanism spring-loaded spindles can expand at once to insert the stick and then shrink it. Machine mounted in a stand could be rotated around its horizontal axis. This helps to change the rubbing ends of the sticks easily (Figure 2.20).

Figure 2.20 : RUWEEA-PG Machine

c. Cinnamon processing bench

This device helps to improve and modernize the Cinnamon processing by enhancing the quality and quantity of the production, adhering to peelers comfort and health.

Figure 2.21 : Cinnamon Processing Bench

Cinnamon processing is very tedious and slow job at the moment. People used to work wearing dirty clothes in un-hygienic state, sitting on the floor as a group with poor working posture. It causes health hazards, postural stress, fatigue and pain. During this process impurities are mixed with products. This newly designed Processing Bench consists of basically rotating comfortable chair with half rounded table which could be adjusted to suit with personal body dimensions.

These equipments are now adopted in the estate sector, who takes the lead to change the technology of peeling by adding new production lines.

For Cinnamon Leaf Oil Production:

The ultimate quality level of the distilled Cinnamon leaf oil is dependent on the selection of the high quality raw material at the initial stage. According to the research carried out at Research Station at Thihagoda and the Agriculture Faculty Mapalana, it was assessed the best resting period for Cinnamon leaves prior to distillation to maximize the leaf oil output and its quality. Cinnamon leaves with twigs and without twigs were experimented with three replicates. Samples were subjected to distillation, in daily intervals for 5 days, to detect the optimum resting time; quantity and quality of the leaf oil.

Average oil yield resulted by distilling leaves with twigs was 1.8%, but when leaves alone was subjected to distillation, oil yield was 2.32% which was significantly high by 28%. The maximum oil yield was observed after a resting period of 5 days in both treatments. The average oil yield of leaves resulted after 5 days was 2.63% and that of leaves with twigs was 2.32%. At this stage, the moisture content of leaves and leaves with twigs were 18% and 28% respectively. The Eugenol content observed in leaves alone was 10.8% higher than that of leaves with twigs. Cinnamaldehyde content of leaves were lower by 160% than that of leaves with twigs.

In the field evaluation test, the oil yield observed by distilling pure leaves was 1.28, which was significantly higher than that of leaves with twigs 0.87. It was observed that 60% of the total oil yield was obtained in first hour of distillation of the pure leaves. In the case of leaves and twigs, the oil content within the first hour was 30%. Moisture content of about 18% is observed as the optimum moisture content to get high quality and maximum yield within short period of pure leave distillation.

It was revealed that the average oil yield of 2.32% could be achieved when pure leaves were used for distillation which is 28% increment compared with 1.8% of oil which could be obtained when leaves with twigs were subjected to distillation (Kodikara, 2002).

For Cinnamon Bark Oils:

A study was conducted on comparative assessment of quality and quantity parameters of the Cinnamon bark oil based on the method of processing and resting period. A laboratory experiment was conducted at the Cinnamon Research Station, Thihagoda and the field evaluation was conducted at the research farm at UoR.

Cost-Benefit analysis was conducted to assess the best method for Cinnamon bark oil distillation and it was assessed the economical aspects of quills production compared to bark oil distillation. It was observed that optimum moisture content of the peeled bark for the oil distillation is about 18%- 20%. Under the machine operation, maximum oil obtained from the scraped and non-scraped bark was observed in 5 days after the peeling. However for the manual operation was observed in 7 days after the peeling. It was revealed that peeling by the prototype machine for Cinnamon bark oil distillation is economical and time saving.

Machine peeling of Cinnamon sticks with or without scraping of the outer bark didn't have any significant difference on Cinnamon bark oil yield and the quality. From the cost-benefit analysis, it was revealed that best method for bark oil production is non scraped bark prepared by machine and the bark oil production seemed to be more profitable than the quill preparation. The oil yield gained in the laboratory unit was 1.07%, which is much higher compared to the yield gained in industrial unit of the faculty which constituted only 0.47% **(**Kumara, 2003).

Cinnamon bark contains commercially important volatile oils. These oils can be separated by steam or hydro distillation. The yield of oil could be 0.7% to 1.5%. The chemical composition of volatile oil is analyzed by 'Gas Liquid Chromatographic method'. Cinnamic Aldehyde is the most important chemical and oil is graded according to its percentage. Overall organo-leptic properties of oil depend on the large number of chemicals present at correct proportions (Senanayake, 2000; Angmor, Dicks and Evans 1979, 342-347).

2.5 Industry Issues in the Marketing & Sales Sector

Marketing becomes the crucial determining factor for any industry's success. It is the step enabling to gain return for the investment while competing with the existing competitors in winning the game. When it compared the purpose of the Cinnamon products against the total Cinnamon production it can be summarized as follows (Table 2.7).

Table 2.7 : Use of Cinnamon bark products Vs Total Cinnamon Production (in mt.)

Type of use	1993	1998	2001	2005	2009	Average (%)
Exports	8,755	9,401	11,074	12,356	14,576	77%
Household Consumption	500	500	900	1,170	2,140	7%
For Oil extraction	1,293	935	1,485	1,623	1,857	10%
For medicinal industry	500	500	500	500	600	3%
Other uses	250	250	250	250	250	2%
Unreported exports	500	500	500	500	500	1%
Total Production	11,798	12,088	13,494	15,898	19,923	100%

Note:
House hold consumption – obtained from the Consumer surveys of Census and Statistics Department
Volume of Oil extraction – derived from the oil exports figure and converting that into bark products by using the standard formula
Unreported exports – limited statistics from the Customs Department

Source: Present Situation and Future Trends of Cinnamon Industry in SL, 2006

It is evident that there is a very huge demand for the Cinnamon from the export markets even at current situation where there is neither considerable value addition nor a range of diversified products. Therefore the main concern regards to the Cinnamon industry should be focused on the international market without any second thought.

Further the main reasons for increase in the demand in the above values on annual basis are as follows:

- Expansion of newly cultivated lands especially in non-traditional areas
- Subsidy schemes of the DEA
- Activation of the advices provided by the DEA
- Increased fertilizer application

97% of the cultivators are operating the parcels less than 1 ha of Cinnamon, which cover about 72% of the total acreage. In around 28% of the total area, Cinnamon is being cultivated as a pure crop and in the rest of the area Cinnamon is mixed with other tree species.

There should be a steady supply throughout the year to become a dominant market player in the international market. Therefore local Cinnamon lands should be given the priority to promote Cinnamon cultivation among the small holders. In order to achieve this DEA is administering an extension approach inclusive of a package deal. Execution of new planting and replanting subsidy schemes for the extension and promotion of Cinnamon is the strategy of the present extension approach. As a short term strategy it is proposed to execute a different assistance package based on the past experience along with the present development program to cater to the needs of the average farmer. This package may include financial assistance as an incentive to adopt recommended cultural practices to cater to the needs of the different farming systems (Rupasinghe, 2000).

Cinnamon can have a variety of product ranges in a more diversified manner. It is not an easy task to focus a niche market and directly target it. Therefore according to Angmor et al. (1972, 416-20), the prime concern is to continue research & development activities to begin with a broader picture and then gradually focus into means to narrow down to specific niche markets (Figure 2.22). That will be a very effective strategy with the logical framework facilitating the decision making process aligned with the long term objectives.

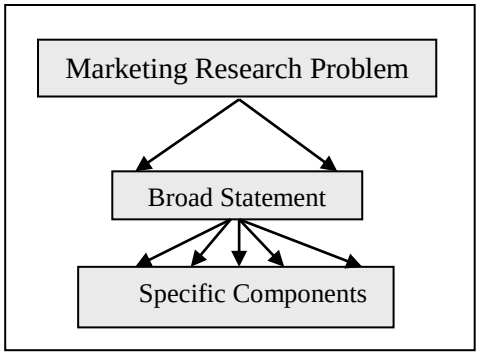


Figure 2.22: Specific Area focus through the Market Research

Since there are wide spread of applications as a natural product in culinary, food and beverages, liquor, medicine and perfumery industries the viable new product range will also be broaden. Mexico and Latin American countries act as the world's largest market place for Cinnamon products, from where the distribution is done to other countries. Mean while USA, Europe and India has become the major buyers from them.

Enormous avenues will be opened for investors and researchers to engage with technology improvement, product diversification and introduce the processing and packaging beauty to diversified products through the proper exploitation (Figure 2.23).

Figure 2.23 : Some of the Cinnamon diversified products

The probable solutions for this state could be further analyzed by using the '*Ansoff's Market Alternatives'* as shown in Figure 2.24. It suggests 4 different marketing alternatives with many potential applications under each probable condition. It helps to focus specific applications with great uniqueness.

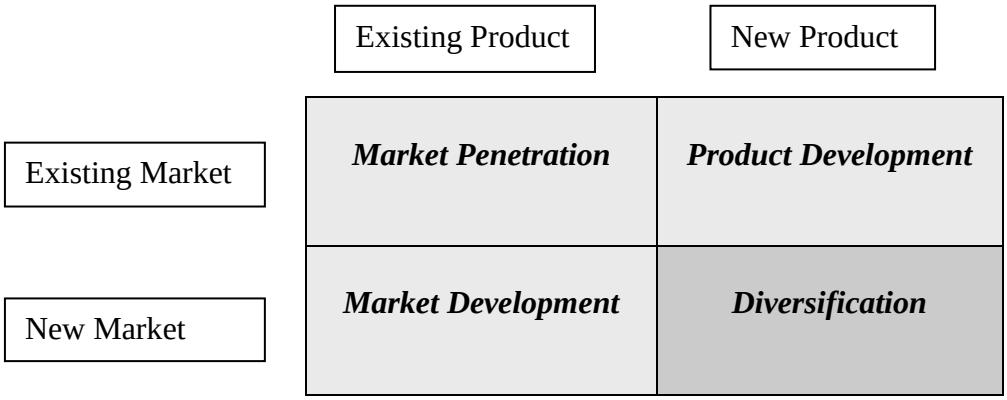


Figure 2.24 : Ansoff's Market Alternatives

Source : QuickMBA, 2010

Market Penetration :

The option under market penetration refers to the supplying of the same existing products of Cinnamon (which are supplied by the Cinnamon manufacturers and the sellers) for the same existing markets. Therefore in order to build the industry it is necessary to focus the market promotional aspects primarily and there is a better chance to focus the 4Ps and 7Ps as required.

Market Development :

Under market development strategy it is focused on supplying the same existing products but for the new markets. Therefore it is necessary to grab more buyer countries to buy the existing products. There is a huge competition with the Cassia which is the only substitute available for Cinnamon. Cassia is very low in quality and not suitable due to cancer causing substances. Therefore those countries buying Cassia should be targeted on supplying True Cinnamon through proper marketing channels and proper marketing promotional activities.

Product Development :

This is the option which is very essential and needs to consider with high weight. Because there is a huge vacuum existing for new products of Cinnamon generally associated with the R&D activities. It is evident there are many uses for which Cinnamon could be used. Entire Cinnamon tree has separate usages and therefore there is an unexplored huge area where the importers from the other countries could make use of.

Market Diversification:

This alternative almost similarly associated with the above discussed strategy - Product Development. The only difference being the targeting of these discussed new products for new market segments. Therefore once the above discussed strategies under the product development alternative are implemented this will become a much easier aspect through the Cinnamon industries perspective. But this will lead innovations to appear more regularly in the market. Therefore it also could be given a high weight and importance.

The remaining issue is that there are no adequate resources and supports from the government to carry out these types of research activities, especially connected to the marketing aspects. There will be a tremendous impact in the export market through proper marketing promotions. Identification of the niche markets and positioning with the right product are the essentials. Highlighting the market focus emphasis is similarly important to position your product in the right market place. Market positioning implies how the customer perceives the product and its characteristics such as features, benefits, comparative advantages…etc. according to their perceptions.

To create an effective brand image it is very important to identify the customer behaviour, their changes and applying the necessary strategies to meet exact or above customer needs requirement and surprise them positively. Since most of these products are very competitive and there is a high price elasticity of demand, issues could be set off from the value addition activity for marketing aspects. But there

exists a possibility to add value directly to the product or to the supply chain (Figure 2.25).

Improvements of the value chain activities provide greater satisfaction to the international customer through purchasing their products in more convenient manner. It is one of the current issues which need a better solution but in an immediate fashion (Hindle 2008).

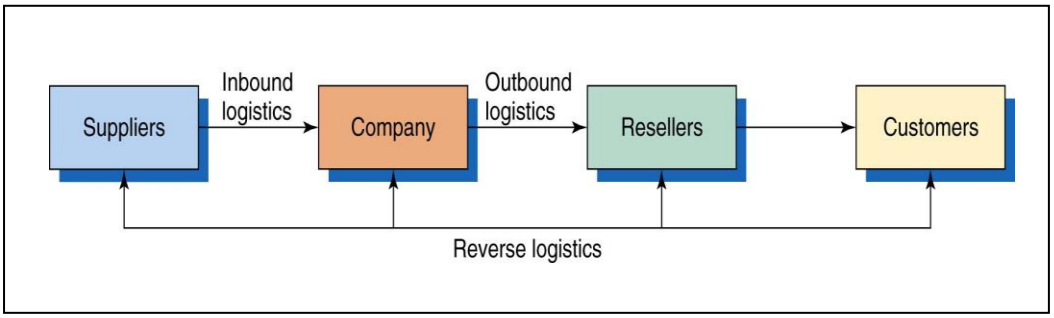


Figure 2.25 : Supply Chain Indication

With respect to marketing aspects, many experts in the industry have examined & proved that not only the product and supply chain providing impact to the industry but also the price becomes a very sensitive factor. Surveys indicate that the price is also playing a major role in the export market. Therefore it is recommended that it is the high time to implement a value based pricing mechanism (Figure 2.26) to cater to top end markets with reasonable profit margin in the industry (Hindle 2008).

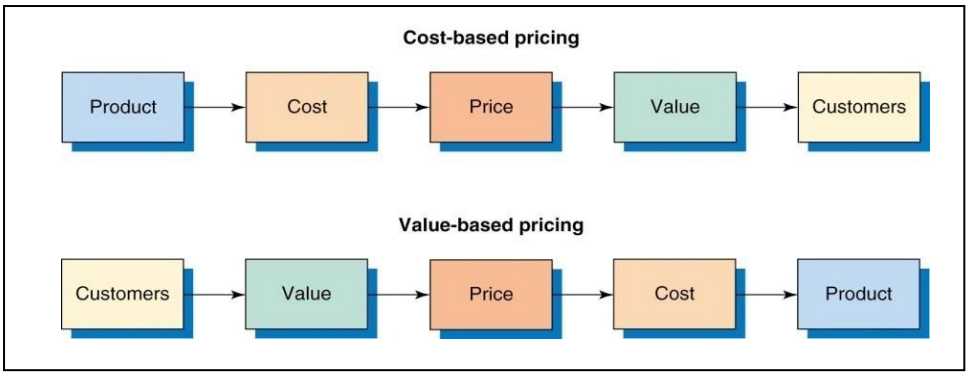


Figure 2.26 : Cost based Vs Value based Pricing

Another key issue in marketing sector is the inability to create a brand image for the Cinnamon industry in Sri Lanka. From the past it was popular as the True Cinnamon, but no special concern is given to promote it internationally (i.e.: Although the True Cinnamon is also popular at international level, no proper strategies were under taken to promote and gain competitive edge). Therefore it is a timely important factor to promote the brand image to get a good mark up, since we have the ability to provide the best quality products. This will also restrict other secondary level competitors promoting their low level products and getting high revenues for their inferior quality products.

It is a necessity to create awareness and promote True Cinnamon through effective marketing communication channels. Organizing attractive advertising campaigns to cover large target audiences, sales promotion activities in the short term to cater for international customer bases, participating in international trade exhibitions…etc. are some of the important and much needed marketing strategies. Promotional campaigns are especially necessary at the time of expanding the global market. These strategies should be implemented in a consistent manner to maintain the market share in a steady growth. Because Sri Lanka's current engagement on above aspects is at the minimal level.

2.6 Impact of Technological Applications

There is a significant impact from technology to the plantation sector and especially for a multi beneficial industry like Cinnamon. Technology can assist not only plantation and manufacturing but also the sales and marketing sector to improve the industry in a consistent manner. It is a must for the Sri Lankan Cinnamon industry to produce Cinnamon diversified products in a range with possible forms. Subsequently it contributes to consider further improvements in product and process developments aligned with the productivity improvement (Figure 2.27).

Hemakumara (2006, 23) states that Cinnamon is also one of the important plantation that could be converted to sub products by efficiently improving the process

technology. The right technology and innovation will upgrade the process giving substantial impact to the competitive edge at the time of marketing.

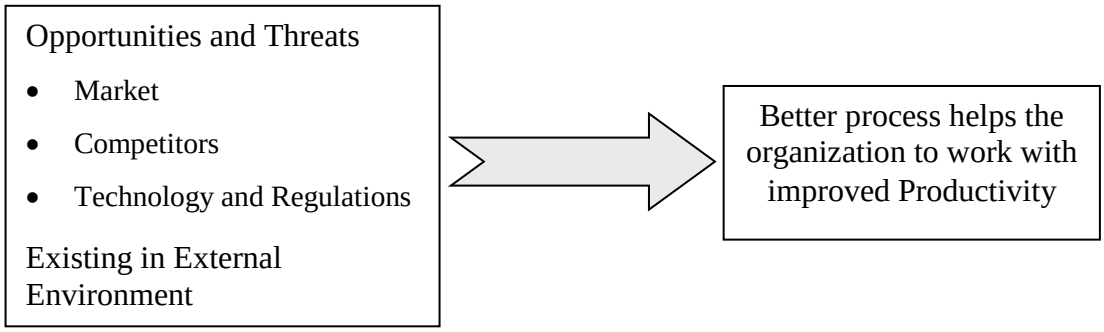


Figure 2.27 : Process Innovation

Process development in the industry should primarily focus the Cinnamon plantation sector. After identifying the environmental signals relating to associated costs, market potential, customer needs and perception, competitors…etc. it is needed to design a right strategy matching the plantation sector. Identification of the suitable technological application for an activity will definitely reduce the cost of production. This key aspect is followed by the search, selection and need to find out a suitable sustainable solution/ alternative. The final step is to engage with correct implementation & learning through monitoring and evaluation of the performance. Some professionals practice the above process concept in a correct manner which leads their findings to reduce the cost of production especially in the plantation sector in practice (Sheffield 2007).

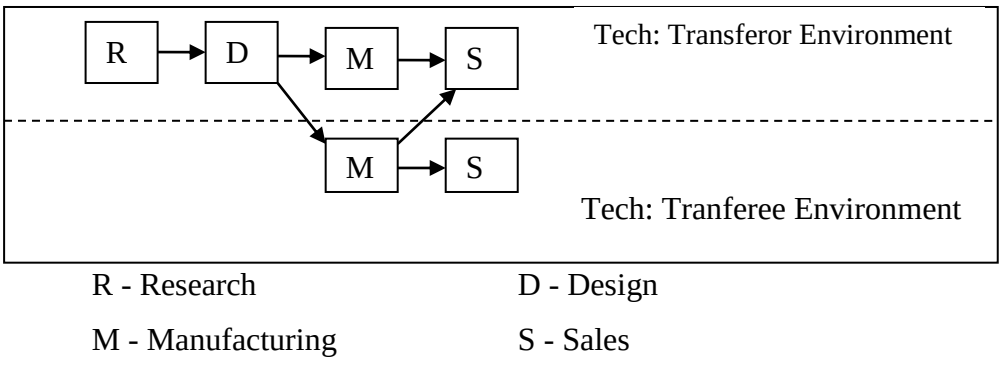


Figure 2.28 : Technology Transfer Model (Manufacturing intensive)

Manufacturing intensive technology transfer model (Figure 2.28) should be carefully analyzed and probably the application has to be modified accordingly. Because there are no direct technology transferors for this sector who are experienced in applying the technology for this type of plantation sector. On the other hand Sri Lankan conditions are the best suited for True Cinnamon plantation and therefore the applications should focus the local conditions very much. Therefore special concern is needed in selecting the transferor and the process should be so strategic to protect the competitive edge. In this context the parties involved should have a thorough understanding of the entire sector aligned with the objectives and efficient incorporation of technology application mechanisms.

2.7 Industry Position in the Global Market

True Cinnamon is native to Sri Lanka and there is a huge demand from the international market from the history. Therefore it has derived the comparative highest position by this wonderful tree.

Few other countries are involved in the plantation of Cinnamon and they are trying to give a considerable competition to the Sri Lankan True Cinnamon industry in the future. On the other hand there are many stakeholders in this industry including government, non-government, private and other foreign countries. Some of them are directly linked with the value chain activities and therefore industry wide strategy is very essential focusing everyone to face these potential competitors with confidence.

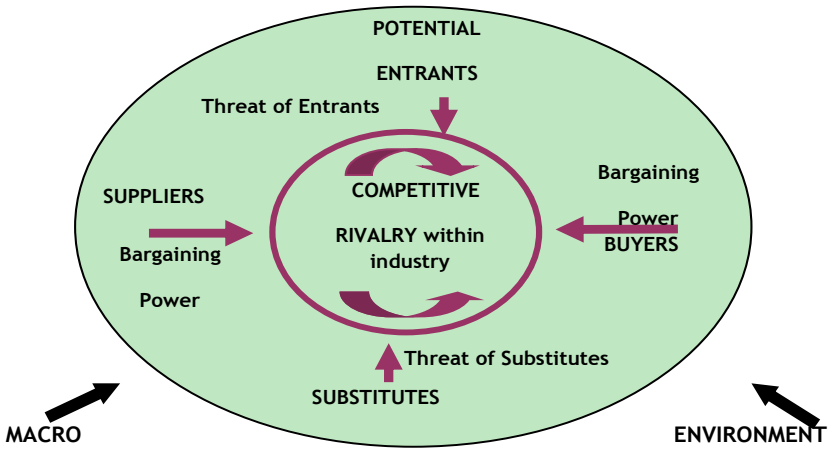


Figure 2.29 : Porter's Five Forces Model

Above model will help to analyze the potential areas by which the competitive forces are initiated and the characteristics of them. The Porter's five forces model (Figure 2.29) illustrates that the threat is not only come from within the industry, but it arises in many other forms. Substitute products, new entrants to the market and bargaining power from both the suppliers and the buyers are the constituents of it. Therefore to meet this stiff competition the industry has to upgrade their quality standard in a continuous manner through improving the processing and operational aspects with the help of new technology. In order to achieve this vital aspect it is required a special concern on applying strategic direction (QuickMBA, 2010).

According to the international marketing concept most of the industries turns around from product pushing situation to pulling position (Figure: 2.30).

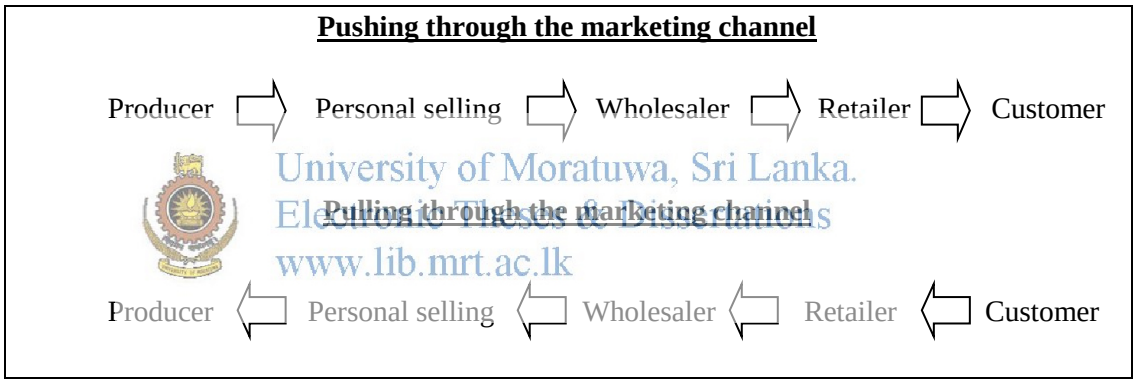


Figure 2.30 : Market Push & Pull Strategies

This concept has resulted due to the continuous supply of novel value added products improved through consistent R&D activities. This will help to gain the competitive edge through increasing the price and improving the volumes by catering to new global markets. Within the international market conditions the Cinnamon marketing should focus operating within a Cinnamon monopolistic situation through maintaining that conditions for future sustainability. Policies should always provide market driven solutions and they should not be in temporary form but in permanent strategic form to fulfill industry requirements. These solutions will lead to achieve long term economic objectives providing the industry edge as expected.

2.8 Technology Competency

It is evident that there are many research findings in all three sectors considered above in the Cinnamon industry. But majority of the research has been conducted for the plantation sector while very few for the marketing sector. Therefore there is a significant gap in the industry marketing aspects and needs to be fulfilled through proper R&D activities. Main research objective should focus to gain the competitive edge through proper value addition and related activities. Accordingly the main concerns of the conceptual model are Technology Competency & the Market Orientation.

Technology Competency is the technological knowledge which enables to implement any solution in a more practical manner in achieving business objectives with full confidence. This is the core competency influencing to improve the productivity and efficiency. Therefore both the qualitative and quantitative factors should be focused in gaining the competitive edge.

When it considers the Technology competency as the main construct/ contributor it is found that there are many dimensions/ variables which lead to demonstrate it. Goedde (2006) explains knowledge as one of the crucial factors giving substantial impact to the technology competency. Knowledge will help to carry out the technical operations successfully & apply the knowledge in a more meaningful manner to add value in improving the efficiency of the process.

Experience will successfully assist to handle any issue pertaining to technology & finding a suitable solution. However research findings indicate that both the knowledge & experience provide comprehensive competency to improve operational effectiveness & cost efficiency. Further it develops & trains the relevant staff to fulfill long-term industrial sustainability.

Experts in the industry also reveal the importance of technology, especially as the main contributor to gain the competitive advantage in the process sector in manufacturing value added products. They explore technological innovativeness &

creativity is playing a significant role in technological competency of any industry. In particular innovation should enable not only to implement new findings and improve process efficiency but also to meet marketing & business objectives. The internal & external exposures of an organization also provide an impact to the technology competency (Sheffield 2007). Technological strategies aligned with organizational vision & objectives and the internal management support need to collectively focus the technology competency of the organization.

Attitudes & perception are the important variables leading to build technology competency in a constructive manner in any organization. Primarily there should be a positive thinking towards technology and then it is needed to follow up with overall management perception. When it is believed the technology to solve problems it is immaterial to consider the probable outcomes such as risks and other negative factors. However other external factors like amount of technology literacy, complexity of technology & understandability of proposing techniques also affecting the attitude or likeness. Ultimately it provides a positive or negative impact to the technology competency.

2.9 Market Orientation

One of the most important construct leading towards competitive edge is the Market Orientation. Literature reveals that even though the industry has a good harvesting or manufacturing process it couldn't sustain unless it receive a competitive edge from the target market.

According to the research conducted by Narver & Slates (1990), Lado & Olives Rivero (1996) and Sargent & Mohammed (1999) it was revealed there are three main dimensions which affect market orientation. They are Customer orientation, Competitor orientation and Inter functional orientation. The first two factors are external factors while the third being internal.

Most important variable is the customer orientation among the 3 dimensions stated above. Findings emphasis serving customer needs & strategizing to reach them in a consistent manner plays a major role to align with the company strategies. Under competitive environment provision of more value added products comparative with the competitors' products makes it a distinct competitive advantage. The strategies implemented during the pre & prior sales stages should focus on surprising the customers. Therefore it is important to monitor and evaluate all these activities in a pre planned manner to meet the long term objectives.

Right pricing & the selection of the correct distribution channels are also equally important indicators in evaluating the customer orientation. In global competitive environment marketing communication strategies such as attractive advertising campaigns, suitable sales promotion & sponsorships…etc. also have a similar importance. These collective aspects have a high impact to market expansion and diversification.

Competitor orientation is similarly important to a greater extent under market orientation. It is more vital when the products are in the competitive stage. Diversified products always have high price elasticity against the demand & the supply. According to Porter's five forces the competitiveness comes from five directions as we have discussed above. It is the industry capability to act against all these competitive forces and survive as necessary. With respect to relative position in the industry it is necessary to gather competitive market information & identify unique strengths & weaknesses of the competitors. That information should be the foundation for the implementation of necessary strategies in reaching the marketing objectives.

In evaluating competitor orientation, it is necessary to provide products and services beyond customer expectations and surprise them. This leads to increase the perceived value of the product & make more profits. There is the possibility to apply this aspect throughout the supply chain to gain a competitive edge in the international market.

Coordination is one important internal criterion in meeting overall business objectives. At this juncture, the whole organization's responsibility is to look in to marketing perspectives & then streamline their creativeness in meeting the customer expectations. These marketing activities should not be linked within the process but should be aligned with other processes in satisfying the needs.

All the processes must communicate & exchange information within & outside the organization. This helps to understand the expectations & build core-competencies by make use of individual strengths and exchanging resources if required. When the customer value is created in this manner it will assist to enhance the volumes as well as the profits in a sustainable manner. This is the necessity to gain the competitive edge in the industry.

2.10 Summary of Literature Review

Literature review explores the researches carried out relative to the Cinnamon industry on various aspects to improve this vital indigenous crop for Sri Lanka. The True Cinnamon brand name has to be promoted at global level and subsequently it is important to conduct R&D activities and diversify the market as required.

Being a main export of the country it has secured a substantial market share and naturally Cinnamon has become a great contributor to Sri Lankan economy. But the stakeholders especially the relevant authorities had not concerned on promoting this vital industry. It is significant the gaps related to Marketing & Sales Promotion activities at international level. These gaps need to be fulfilled not only to protect as an industry in the long-term but to gain the competitive edge and secure the monopolistic situation at global level.

This research carries out in finding out the technical implications in the industry through extending the emphasis on marketing aspects to develop the whole sector. Therefore it is considered the performance development of the entire value chain players to keep the monopolistic condition among the Cinnamon exporters.

CHAPTER 3: METHODOLOGY

3.1 Introduction

Constructing the conceptual framework is the main concern and it will be incorporated as the main guide for the entire study. It is given a special attention to the research design and the data collection process while deciding the methodology adopted.

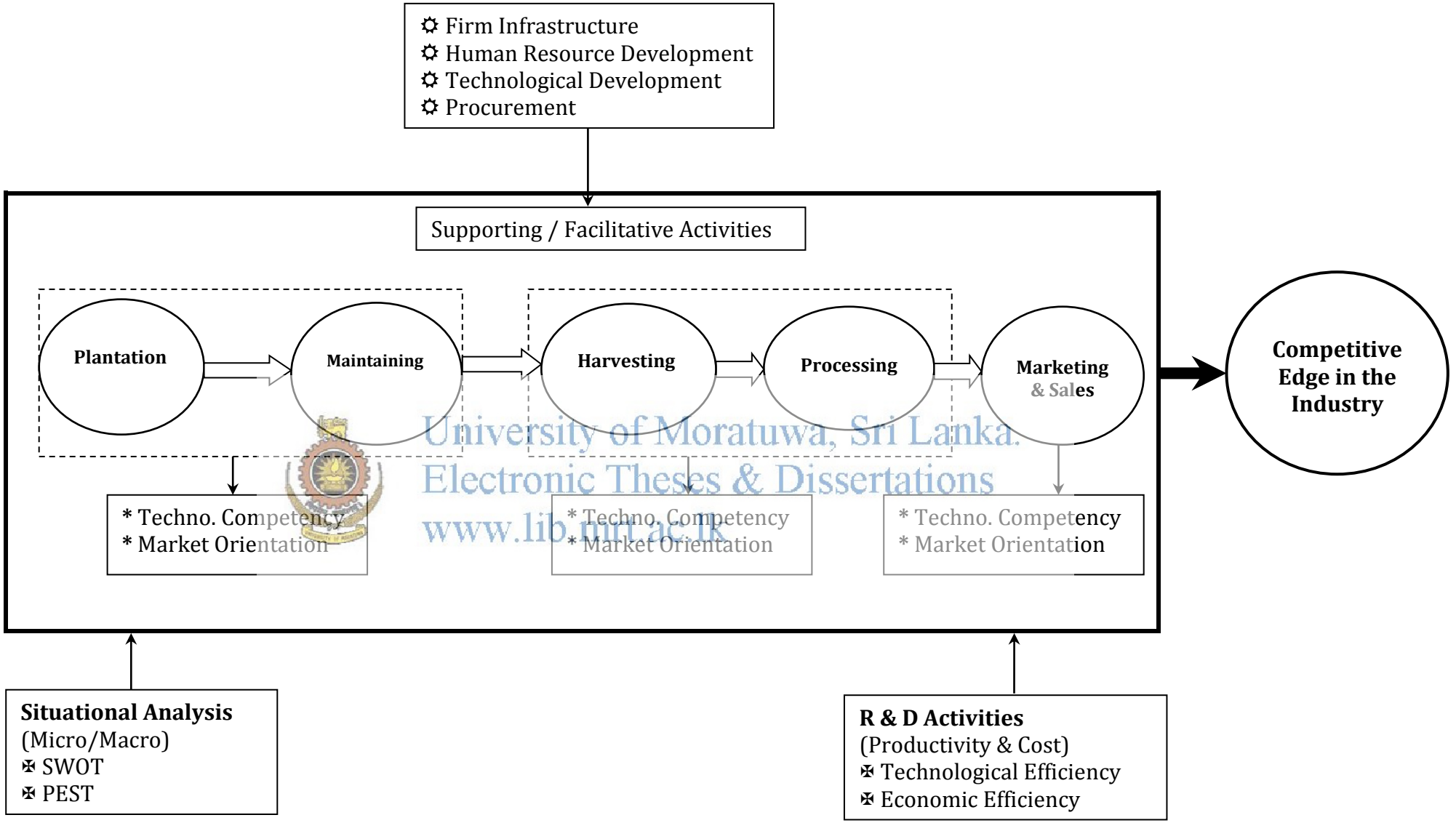
Consistency of any industry is dependent on the degree to which the edge could be achieved from the market conditions. But it had been constrained by different issues created within the industry. These issues could be considered under the three processes Plantation & Maintaining, Harvesting& Processing & Marketing & Sales. In order to assess the existing situation it is necessary to carry out situation analysis to identify the internal and external factors affecting. Then continuous product and process improvement should be focused to upgrade the performance and the cost efficiency. These aspects are focused through the incorporation of new technological applications to couple with sustainable growth in the long run.

Technology Competency and Market Orientation are the main concerns in the whole industry processes. These two aspects help to meet research objectives and achieving the final outcome (i.e.: Gaining the competitive edge of the Cinnamon industry).

The reason for special consideration on Marketing and sales aspects is that the industry crucially needs to plan for the long term sustainability with the short term survival. Because the current environment doesn't provide any information on what is actually taken place for the Cinnamon beyond the Sri Lankan boundary. Therefore this study has to limit at that level while hindering the evaluation of the economic aspects too.

The sampling methods and techniques are designed for the purpose of justification and the selection of the best sample in obtaining necessary data for the study. Then it is discussed the questionnaire design portraying the development employed in the study. The method of data collection and data analysis are briefly summarized in the final part of the chapter and the actual implementation would be done in the next chapter in detailed form.

CONCEPTUAL FRAME WORK



✠ SWOT- Strengths / Weaknesses / Opportunities / Threats
✠ PEST - Political / Economical / Social /Technological
✠ Technological Efficiency - Improved Operational efficiency
✠ Economical Efficiency - Improved Cost efficiency

Figure 3.1 : Conceptual Model of the Study

3.2 Conceptual Framework of the Study

Design stage of the conceptual frame work mainly emphasized to the 3 phases identified under the Porter's value chain model for agricultural sector. It has been significant by focusing the final outcome to be the competitive edge in the industry through technological application and proper marketing program selection for the long run. Therefore it is necessary to consider Technology Competency & Marketing Orientation as main constructs to gain the competitive edge as the final outcome of the total process.

These 3 phases combined with value chain activities has to be focused for the development of the current situation. These activities have to be coupled with supportive activities such as Firm Infrastructure, Human Resource Development, Technological Development and the Procurement to gain the required results as expected.

The model is further elaborated by emphasizing the importance of the situation analysis for the whole industry considering internal and external factors. R&D activities considering the productivity and the cost aspects related to the industry will be analyzed subsequently to improve the effectiveness and the efficiency of the industry performance.

3.2.1 Competitive edge

It is a great benefit to obtain the competitive advantage from the other rivals in the market through proper market alternative strategies proposed by the Ansoff. It has become a vital aspect in the Cinnamon industry to consider the price elasticity of demand for the products. But it is also necessary to give a high weight to the technological development and marketing strategies since they are very dynamic and complex in nature at global level.

It is an important aspect for the total industry to focus on long term sustainability. In achieving this objective it is necessary to add value to entire product range and enhance the processing technology in an effective manner to gain the edge in the global market.

3.2.2 Impact of technological competency

'Competency is the ability to do something well'

- Cambridge Advanced Learners Dictionary

According to the above definition Technology Competency means how to use scientific discovery or latest findings and apply it in a more practical manner in improving the product or process effectiveness and efficiency to meet required industrial objectives.

Therefore from the industry's point of view effectiveness of technology is not only based on the competency that an individual organization is acquired but also up to what extent it has been used and developed to convert into value added, cost efficient products and processes to meet target customer requirements.

3.2.3 Impact of market orientation

Market orientation is one of the key inputs to gain the competitive edge from the industry. It is vital to consider how market orientation has evolved and helped to overcome the industry's competitiveness. Lafferty and Hult (2001) reported five different major attempts to conceptualize the construct which has emerged on market orientation. They are described as perspectives as follows:

- the decision-making perspective
- the market intelligence perspective
- the culturally based behavioural perspective
- the strategic perspective
- the customer perspective

Chapter 2 also revealed that Market orientation has to be considered not only as an external activity (customer orientation & competitor orientation) but also as an internal activity (inter-functional coordination). Therefore from the Market Orientation's perspective it is not only a strategic driver to achieve business objectives but it also should focus the sustainable growth of the industry.

3.2.4 Porter's value chain model

Conceptual frame work was primarily designed depending on the Porter's Value Chain model for entire plantation industry. According to the value chain explanation Cinnamon industry's prime activities could be categorized into 3 main sectors as shown in the conceptual model namely Plantation & Maintaining, Harvesting & Processing and Marketing and Sales. However the sequence of the processes could be changed based on value chain players' role and their degree of involvement. In the case of Cinnamon industry traders, they generally used to visit and collect the harvest from the cultivators in a directly manner. This will change the sequence considerably and the processing and the rest of the forward activities will not be followed in such situation.

The other important aspect to note under these three main processes is that the Technological applications and the Market orientation activities need to function through these prime phases successfully. As per the Porter's Value chain explanation all the supportive activities should have to be aligned with these individual processes to upgrade the performance of the entire process.

For the purpose of improving the productivity and cost efficiency, situation analysis is carried out to identify the important factors contributing to the long term sustainability of the industry. But to ease the analysis main decision making unit is compounded within above three processes under the conceptual model.

3.2.5 Supportive / Facilitative activities

Porter's Value Chain model highlights many supportive / facilitative activities to assist the main functions on improving the value addition of the total process. It has become a very vital factor for any industry to be distinct nowadays, merely due to the high competition and homogeneity among the products and the services being offered. The only possibility to make it different from competitors' strategies is to change these supportive activities as much as possible. This solution being common for most of the products/services in the current scenario it has become the much easier aspect with respect to the implementation too. Therefore it would be necessary to keep the core activities within the control limits and if possible sub contract the other secondary or supportive activities depending on the cost effectiveness. These supportive activities and their nature are discussed as follows:

a. Firm infrastructure

Especially in the plantation & maintaining and harvesting & processing sectors of the Cinnamon industry, infrastructure plays an important role. But transportation facilities for delivering the seeds/crops/fertilizers, raw materials and finished products to relevant destinations, electricity for processing mills and telecommunication for communicating with regards to certain information…etc. and decision making activities have to be carried out very successfully to complete all these three functions without any constraints. Information has become a very important fact under competitive environment enabling to make right decision at the right time. Therefore it is purely based on gathering right information at the right time. It needs the right mechanism to gather relevant information through the sources such as internet, satellite communications, video conferencing, other simulation technologies …etc. in operating at international level.

b. Human resource development

Cinnamon is labour intensive industry. Therefore it is very essential to manage the Human Resource in a proper manner to improve the productivity and keep them bound within the industry in the long run. It affects all the three processes and the factors such as people's attitudes, perceptions, motivations and positive thinking which provide substantial impacts to the main functional activities of the industry.

c. Technological development

Improvement in any activity incorporates new machines, new skilled labour and/or reducing them without losing the existing level of operation. But it is necessary to consider the cost aspects for the compatibility. As a total research study, it is based on the Technological impact and its competency. This will be discussed in details in future topics on how it affects and make use of it in all three processes and how it could be upgraded based on the findings.

d. Procurement

Cinnamon industry has commercial aspects & due to the expansion of its operational area at global level the procurement has become an important aspect in day to day operations of the business. When it considers the international business, the transactions and export procedures require many forms of various documentations and approvals for smooth running of the total process. Good procurement management will assist timely receipts and delivery of the required materials. The smooth running of the manufacturing process becomes dependent on it and ultimately & most importantly the customer receives the goods in expected quality without any delay as a result.

3.2.6 Situation analysis

The conceptual model compound with situation analysis is identified as a requirement to measure the correct position of the industry. This is vital to suggest and implement any product or process development activity to focus the improvements ahead from the existing position. The situation analysis is performed at two different levels named micro and macro levels.

a. SWOT analysis

Micro level situation analysis could be done through SWOT analysis (Strengths, Weaknesses, Opportunities and Threats). This analysis will help to identify internal industry strengths & their abilities to capitalize towards success while the weaknesses which need to be rectified or controlled for the purpose of overcoming prevailing issues. At the meantime it is identified the external opportunities and industry threats which lead to convert the strategic activities in a more appropriate manner to gain the competitive advantage.

b. PEST Analysis

On macro point of view, the industry could be analyzed for environmental factors such as Political, Economical, Social and Technological situations on how they affect the industry's strategic position. Since the industry is consistently connected with domestic and international market, all these factors are equally important and affecting to drive the industry towards any direction. Therefore it is important to do continuous survey with regard to these macro factors as it provides a substantial impact (positive or negative) not only for industry decisions but also to bottom line. Economical influences (duties/taxes) affect the Sri Lankan Cinnamon industry to face price variations and the ultimate profits and the returns. Social habits and perceptions lead to up bring the Cinnamon handicraft industry and protect the

cultural values. Technological applications lead to competitive edge will help to manufacture finished products in a more customer oriented and novel manner.

3.2.7 R&D activities

Since the industry is in the maturity stage of its life cycle, R&D has become a vital factor for the industry's survival in both short & long run. It has become further important when the industry is facing stiff competition in the global market conditions. Like any commercial industry R&D activities provide two main contributions. One is to improve the operational efficiency (could be achieved through technological efficiency) and the other one is to improve the cost efficiency (could be achieved through economic efficiency).

a. Technological efficiency

For the purpose of improving the industry it is important to upgrade all three processes based on the situation analysis. The main expectation of the task is to upgrade operational performances through product and process development. Technological efficiency is a method of production which involves the minimum number of combinations of different factors. This is carried out mainly through acquiring and transferring right technology at the right time to cater new domestic and international market needs. It plays a significant role in the industry by supporting the manufacture of value added products and improving the manufacture process. Ultimately it upgrades the plantation sector by improving the Cinnamon yield.

b. Economic efficiency

In the context of the model it is implied on how to arrive at the industry goal in a more cost effective manner. The Economic efficiency is the use of resources to produce any given output level at a minimum cost. In the functional form cost is based on capital, labour, land and material. Therefore it is not only to gain the

competitive edge in the industry but also to achieve business objectives. It is crucial to seek the possibilities combined with the suitability in reducing the cost funcional factors and their degree of success in order to sustain the industry in a consistent manner.

3.3 Operationalization of Variables

Operationalization of the constructs of the research model proposed in this study is considered in this section. As indicated in Figure 3.1, the model of the study comprised of two main constructs namely Technological Competency & Marketing Orientation linked with the 3 main processes. According to the research model's main objective of gaining the competitive edge in the industry these two constrains must be operational and enabled to measure relationships. Therefore the abstract notions of the constructs must be reduced into observable behaviour or characteristics. Operational definitions provide meaning to the constructs and a tangible way to measure them.

Additionally the two constructs uses multi item measures and a five point Likert scale. The constructs were adopted from various relevant literatures. For the purpose of identifying the relationship each construct compounds with experimentally designed variables. These variables measure through a structured questionnaire from industry source by conducting a survey.

3.3.1 Measurement of variables

For the purpose of measuring variables and to identify relationship through operationalization two main constructs are incorporated. These two constructs are empirically measured from all the relevant variables.

The definitions and how these constructs measured are discussed in details as follows.

A. Technology Competency

The technology competency is one of the main constructs and the leading factor to gain the competitive edge of the entire industry. In reaching the ultimate objective for the industry it is required the positive effects of this construct to be applied and implemented throughout the value chain activities. According to Goedde (2006) and Sheffield (2007) observable behaviour of the Technology Competency compounded with four variables listed below:

- Knowledge & experience
- Innovativeness & creative ability
- Exposure (both internally & externally) and
- Attitudes and perception.

They will be discussed in detail as follows:

1. *Knowledge & Experience:*

This variable indicates the knowledge that is learnt and the experience that is acquired during a period of time. It provides substantial impact to the Technology competency performances. Not only the learnt knowledge but also the ability to acquire the correct and required knowledge at the right time to improve the process as needed in an effective manner is also taking into consideration.

2. *Innovativeness & Creative ability:*

If there is a Technological solution it generally incorporates some novel applications, which help to improve the productivity. It is needed to evaluate and measure up to what extent the innovative solution leads to improve the process effectiveness or cost efficiency to meet industry objectives.

3. *Exposure:*

This is also one of the key observations under Technological Competency. The exposure could be internally or externally oriented. Internally, the management support and culture has to be aligned with technological solutions. At the same time external factors like infrastructure facilities, marketing impact and political policies play a significant role under technology competency. Therefore the exposure on these aspects is very vital in taking strategic decisions which will ultimately affecting the success of the industry.

4. *Attitudes and Perceptions*

It has been practically proven that people don't like change. Therefore in introducing new methods, technological applications…etc. the stakeholders have to be very positively oriented to face such changing environments. In this situation attitudes and perceptions towards technological improvements are very important aspects to get the required results. Because the right attitudes and the right perceptions will naturally provide definite motivation and the power to the entire industry to reach expected level.

Table 3.1 : Operationalization of Technology Competency

Construct	Dimension/ Variables	Indicators	X	Q. No.
Technology Competency *Factors predicating preserved technology competency*: Goedde 2006 *Necessary Variables for Technology Integrations* : Sheffield 2007	**Knowledge & Experience**	1. Amount of knowledge to provide technical support to fulfill the basic operation successfully	K1	1
		2. Period of experience to carry out the duties & meet the targets	K2	2
		3. Ability of acquiring technology knowledge and implement in a more practical manner to support organization strategies to achieve business objectives	K3	3
		4. Ability of understanding any operational issues in a technical point of view & provide technological solution to improve operating effectiveness	K4	4
		5. Ability to use technology as a tool to increase the productivity	K5	5
		6. The extent of making use of experience to overcome any practical issue which come across during the operations	K6	6
		7. Capability of making use of not only limited resources internally but also to handle external factors in an appropriate manner to meet technical objectives	K7	7
		8. Having adequate knowledge & experience to evaluate the technological performances	K8	8
		9. Ability of training & developing the staff to build technological competency	K9	9

Operationalization of Technology Competency Contd…

	Innovative & Creative Ability	1. Ability of creative thinking in an innovative manner to propose technological solutions	C1	10
		2. Degree to which innovative solutions help to improve operational effectiveness (quality & productivity) & cost efficiency (reduce cost / time)	C2	11
		3. Ability of supporting the business /.marketing objectives through innovative solutions	C3	12
		4. The amount of resource/constraints effect for innovate solutions (ability of making use of current resources/working conditions in an effective manner)	C4	13
		5. Ability of providing the most social/ethical/environmental friendly innovate solutions (reduce legislation & at the same time to gain competitive edge)	C5	14
		6. Degree of motivating human resource aspect for the purpose of improving performance of production process	C6	15
	Exposure - within & outside organization	1. Organizational vision aligning with technological objectives	E1	16
		2. Internal management to support technological competency	E2	17
		3. Organizational resources (Assets) assistance to fulfill technological aspirations	E3	18
		4. Internal & external infrastructure impact to provide technological oriented solution	E4	19
		5. Support org: culture to improve Technological competency	E5	20
		6. Get the assistance from the latest tech: developments & industry related new findings to improve the performances	E6	21
		7. External marketing push/pull impact to motivate tech: competency	E7	22
		8. Political assistance to the industry (Decisions supporting technological industry solutions)	E8	23

Operationalization of Technology Competency Contd…

	Attitudes & Perception	1. Likeness & positive thinking towards technological solutions	A1	24
		2. Industrial & social influences for technological solutions	A2	25
		3. Overall management perception / attitudes towards technological oriented applications for the production / process system	A3	26
		4. Extent of motivation of technology for operational activity (believe it gives positive results)	A4	27
		5. The amount of technology literacy & also using non obsolete equipment	A5	28
		6. Complexity of technology & simplicity of understanding the proposing methods	A6	29
		7. Social living standard, which leads to have different types of values and perception against technology	A7	30

B. Market orientation

As the research study has provided special emphasis on improving the technological aspects related to the Cinnamon industry, Marketing and Sales promotion too has to be provided a similar emphasis to function in hand to hand with the improvements and diversifications that may result in. Because Market orientation too plays an important role similar to the above construct and becomes the other most important construct in achieving the research objectives. According to the conceptual model the main outcome is to gain the competitive edge in the industry. Narver and Slater (1990); Lado, Olivares and Rivera (1996); Sargeant and Mohammad (1999) observations reveal that marketing orientation consists of external and internal dimensions. Under External dimension there are two factors such as Customer orientation and Competitor orientation and the Inter-functional co ordination falls under internal dimension.

1. *Customer Orientation:*

Customer is the most important factor in any business and therefore it will become the main target for whole industry's sustainable performance. Their buying decision and perception towards the product will give impact to the entire industry's position. Customer Orientation will directly depend on the factors such as product modifications, pricing strategies and extent of after sales services …etc. Therefore these indicators can be used to measure the customer orientation variable and that shows the direct linkage with Market Orientation construct.

2. *Competitor Orientation:*

Although this product has native characteristics for Sri Lanka and enabled to secure the highest market share at global market the competitive level and the stiffness of the competition is growing slowly day by day. It is very important to measure the Competitor Orientation under different indicators such as:

- how strong the products and services against the other competitive products in the market

- relative capacities of the strengths and weaknesses with the competitors
- ability to capitalize external opportunities against the threats
- competitive strategic ability to incorporate against competitive forces...etc. to sustain as an industry in the long run.

3. Inter functional Co ordination:

Being the single internal dimension that will affect the Market Orientation construct, it has a high impact on the marketing aspects. This variable indicates the ability to integrate the multi functional divisions to fulfill customer needs as necessary. This will be further decomposed to indicators such as ability to share resources, communicating information in an effective manner and working ability as a team for the purpose of creating customer value…etc. to achieve common business objectives.

Table 3.2 : Operationalization of Market Orientation

Construct	Dimension / Variables	Indicators	X	Q. No.
Market Orientation Narver and Slater (1990); Lado, Olivares and Rivera (1996); Sargeant and Mohammad (1999)	**Customer Orientation**	1. Monitor level of commitment in serving customer needs	U1	1
		2. Business objective of customer satisfaction	U2	2
		3. Competitive advantage based on understanding customer needs	U3	3
		4. Business strategy driven by greater customer value	U4	4
		5. Measuring customer satisfaction	U5	5
		6. After-sales services	U6	6
		7. Corrective actions taken immediately	U7	7
		8. Modifying products / services based on customer ideas	U8	8
		9. Meet customer quality expectations	U9	9
		10. Pricing is appropriately designed according to customer expectations	U10	10
		11. Supplies on time without any shortage	U11	11
		12. Promotional campaigns meet customer awareness objectives	U12	12
	Competitor Orientation	1. Rapidly responding competitive actions	P1	13
		2. Sharing information on competitors' activities	P2	14
		3. Discussing competitors' strengths & strategies	P3	15

		4. Differentiation from competitors	P4	16
		5. Targeting opportunities for competitive advantage	P5	17
		6. Analyzing evolution of substitutes	P6	18
		7. Precautions been taken for new entries	P7	19
		8. React with strategies for suppliers bargaining power	P8	20
	Inter Functional Coordination	1. Integration to serve target customers' needs	T1	21
		2. All activities are responsive to each other's needs & requests	T2	22
		3. Activity (Plantation, Processing, Marketing) heads try to identify total market requirements	T3	23
		4. Communicating market experiences among the activities processes	T4	24
		5. Everyone understands how to create customer value	T5	25
		6. All three processes are working as a team	T6	26
		7. Sharing resources with other sections (among processes when it is needed)	T7	27
		8. All sections involving in product / service modifications	T8	28
		9. Informal information exchange to fulfill industrial Expectations	T9	29
		10. All three processes common perception is to achieve overall business objectives	T10	30

Each indicator listed above is linked to a relevant question and it will be measured according to the Likert scale through interviewing the necessary sample. Then the total information gathered was analyzed to identify the relationships within the entire industry.

This will lead to propose industry related most appropriate solutions with the combination of technology and marketing aspects to gain the competitive edge within the industry.

3.4 Sample of the Study

In general the population comprises of the total value chain players of the Cinnamon industry in Sri Lanka. Cinnamon Cultivators, Processors (Peelers and other producers), Traders and Cinnamon related products manufacturers and Marketers taken altogether could be considered as the Population. Therefore in data collecting it was focused the subsets from each unit (Plantation, Processing & Marketing sectors) and considered the perspectives of each sector in fulfilling the research objectives.

3.4.1 Sampling technique

Sampling technique is one of the important tools required to guide the research study in the right direction. On the other hand it should enable to select the most appropriate number of elements as a sample from the population according to the statistical analysis. So that the properties and characteristics decided on the sample analyzed would make it possible to generalize for the entire population.

The research study is carried out by focusing the entire Cinnamon industry, which is scattered in many parts of the country. Objectives of the study are significantly qualitative in nature. Due to the time limitations and other factors it was chosen the convenient sampling technique. Therefore the Galle district (where the most number of Cinnamon value chain players are dispersed in almost in the entire district and the

major extent of Cinnamon cultivated lands are available) was chosen as the geographical area for the study.

Cinnamon **C**ultivators' **A**ssociation (CINCA) Galle is one of the major associations comprised of more than 5,000 membership base. These members are actively involved in the Cinnamon industry value chain activities mostly within the southern province. Since the author has experience in working closely with these members it became a great asset. Also CINCA is expecting positive results and suggestions for their current industry to implement through this research since the team of top level CINCA officials helped me a lot to carry out this research successfully.
It was made easier for me to select the members of their association and the other closely working stakeholders of the industry for interviewing purposes. Especially they showed a higher interest in answering the questionnaires without hiding any information to make this research a success.

3.4.2 Unit of analyzing

Cinnamon cultivation has dispersed largely over the western & southern coastal areas and Sabaragamuwa province. Convenient data collection was carried out focusing only the Galle district due to the above highlighted reasons.

Majority of the Cinnamon processing centers are located in the Galle district. But it was observed that these centers can be categorized in to different scales namely large, medium and small depending on the sales revenue. But there is no any reliable source to attain the sales figures on individual basis. Therefore the experience of the CINCA officials helped to categorize these members considering the business domain as well. The questionnaire focused all these 3 levels of revenue capacities in the plantation sector to gather the actual data for current situation.

There are many Cinnamon exporters registered in the EDB for Cinnamon diversified products for the international market. Out of these exporters there are only few exporters who are doing the regular international transaction mostly in the bulk form

(Cinnamon Quills and Cinnamon Oils) within the global market. Since the study targets to develop the marketing aspects combined with the overall technology applications, the selection of the sample was fine tuned to select the active exporters who have industrial knowledge to a certain depth.

Therefore in conducting interviews Cinnamon value chain players were selected as indicated in Table 5.1. On the other hand industry stakeholders such as the DEA, EDB, Sri Lanka Standard Institute (SLSI) respective officials who are actively involved and well experienced in the relevant field were interviewed for effective and up to date data gathering. Focused group discussions were also conducted as necessary by selecting CINCA officials to check and gather more technical information and their viability.

3.5 Questionnaire Design

Research survey needs to be carefully carried out to gather useful information, especially when very busy and multi educational level target groups are interviewed. Questionnaire design is one of the most critical stages in the research process. A questionnaire is a pre formulated written set of questions to which respondents record their answers, usually with in rather closely defined alternatives. Questionnaires are efficient data collection mechanisms when the researcher knows exactly what is required and how to measure the variables of interest.

It is further explained that a good questionnaire design should focus upon three areas; the wording of the questions, the principle of measurements, the general appearance of the questionnaire and they were discussed broadly in the latter parts.

Questionnaire development is guided by the field observations. In order to address the research objectives, two separate questionnaires were developed based on the two main contributors ‘Technological Competency’ and ‘Marketing Orientation’. Each construct compounded with the necessary variables & they were measured from different indicators leaded to separate questions.

According to the research carried out by Mendis (2010) it was incorporated a similar model to analyze the coconut industry and also followed similar constructs in evaluating the industry position. Since this research too follows the similar objectives but reference to the Cinnamon industry it is pushed towards incorporating the similar assessment methodology. In the questionnaire designing some relevant wording with the special focus to suit the Cinnamon industry was concerned as necessary.

Then a pilot survey was conducted using 7 industry experts and also several other experts attached to the Technology & Marketing fields. Then it was further fine tuned and finalized the questionnaire. The expertise of a language specialist in improving the wording to a more understandable format for the industry players was also incorporated in an effective manner.

The full questionnaire comprised of 60 questions detailed under two different sections to identify the relationship of two constructs through measuring relevant variables. First section comprised of 30 questions under different variables such as Knowledge & Experience, Innovativeness & Creativity, Internal & External Exposure and Attitudes & Perception targeting the technological competency and their individual impacts are measured through 5 -10 questions.

Second section is emphasized on Market orientation having 30 questions to measure the relevant variables namely customer orientation, competitive orientation and inter functional coordination. All these questions are measured similarly incorporating five point Likert scale ranging from strongly agreed (5) to strongly disagreed (1).

The set of questions are well revived through industry experts and professionals in order to target the questions more towards Sri Lankan industry and to get the best appropriate answer of analyzing. The questionnaires are shown on appendices 3 &4.

3.5.1 Wording principles

Wording and questioning is very essential since the meaning of words vary in a wider scale depending on the knowledge level, locality, facial impressions, tone…etc. Therefore certain aspects need to be carefully attended and sometimes considered as principles in conducting the survey. These principles relate to biases resulting from respondents' responses and the questionnaire itself. Consistent with the following principles were considered very essential during the development of the questionnaire:

- Questionnaire incorporated a simple language to approximate the understanding level of the respondents where ever possible
- The questions have a sequence order for the purpose of the responder to drive his/her thinking in a logical manner
- Most of the questions try to communicate through industry language to understand better
- Closed questions with alternative answers were chosen as they help the respondents to make a quick answer much easily
- Contents and purpose of the question always focus for the specific variable under consideration
- The purpose of each question was scrutinized to minimize unnecessary question
- The length of the questions was kept as short as possible
- Ambiguous, double barreled, leading, and loaded questions were also considered to minimize confusion and bias of responses
- Avoid questions which has impact to personal life or individual/organizational informal activities where ever possible

It was needed to field test the questions before starting the real survey with the actual interviewees in the field. The team of interviewers required to be trained considering the above necessary aspects. In certain situations the reliability was cross checked from time to time after interviews were carried out.

3.5.2 General appearance

Introduction of the research objectives at the inception of the interviews and the establishment of contacts through their organizational heads helped a lot to improve the interviewing. Because they knew this study is going to benefit them to uplift their current level of business. It helped the interviewees to understand the purpose of answering the questions and the importance of the questions being asked.

Both questionnaires focused industry related variables and they were easy to answer. But gradually it drives to deeper aspects of the constructs and finishing with questions which are not much related to the industry. But they were focused on elaborating their own personal opinions. This type of flow helped a lot to answer with positive mindset.

3.6 Summary of Methodology

The methodology of the research study in achieving the first and the second objectives are discussed. The developed conceptual model depicted in figure 3.1 was incorporated in developing the structured questionnaire to measure the variables of specific theoretical constructs. A semi structured questionnaire /interview guide will be used to identify major technological problems and current status of the Sri Lankan Cinnamon industry.

The convenient sampling technique was incorporated and around 30 members from each category were selected for the interviews. Therefore the total number interviewed became 170. In finding a relationship among the members under cultivators it was further divided into 3 scales namely Large, Medium and Small.

Under Technology Competency construct there are 4 variables discussed and they were further subdivided into 30 indicators altogether. Therefore there are 30 indicators and corresponding 30 questions under Technology competency in the Questionnaire. Likewise there are 3 variables under Market Orientation construct. Again there are 30 indicators under 3 variables and therefore 30 questions included under market orientation.

Important factors to be considered by the interviewer while conducting the interview are discussed in details. It became an important aspect to guide the interviewers since they are meeting the low level to high level educated people. Therefore proper usage of the language is vital and the meanings of certain technical terms should be clearly illustrated prior to getting the answers for the questions.

Based on the model the final questionnaire plans to gather the maximum possible extent of data with accuracy and the relevancy to identify the Cinnamon industry situation. That identification is vital for proposing appropriate industry related recommendations to turn the Cinnamon industry from a declining stage to a positive direction in a consistent manner.

CHAPTER 4: SITUATION ANALYSIS

Situation analysis focuses both the micro and macro level aspects. From micro level's perspective the SWOT analysis is better illustrative of the situation while for the macro level it will be PEST analysis.

4.1 Economic Viability of Cinnamon

The importance of this spice to the country's economy was highlighted in the previous chapters. The Honourable Minister of Finance & Planning has identified this aspect and highlighted his future endeavours in his budget speech as follows:

"…Sri Lanka produces more than 90 percent genuine cinnamon (Cinnamomum Zeylanicum Blume) in the world. Our exports account for 63 percent of all spice exports in the world. Cheap low quality alternatives have begun to enter the global market leading to increased competition. There is an urgent need for increased investment in research and product development for value addition in Cinnamon. Efforts to give 'Ceylon Cinnamon' maximum protection under WTO agreement are being intensified. Investments in marketing Ceylon Cinnamon are essential to combat this competition. I propose to impose a CESS of Rs.2.50/kg or 0.5% of the value whichever is higher for the development of this industry. The Government will contribute Rs.10 million to set up a Cinnamon Development Fund…"

- Budget speech by Hon. Minister of Finance and Planning
(Sri Lanka 2005)

Cinnamon at present is the dominant spice in Sri Lanka in terms of the foreign exchange earnings. The share lies on Cinnamon in terms of the export of agricultural products in 2004 and 2005 were 0.86% and 0.96% respectively. In 2005 total foreign exchange earnings from Cinnamon was above the earnings from rubber by 11.3 million dollars. Cinnamon revenue growth in 2005 was 23.1% above the export earnings over 2004 figures (Table 4.1).

Table 4.1 : Agricultural Exports in US $ (mln)

Commodity	2004 Share %		2005 Share %	
Total Agric. Export	1065.2	18.5	1153.8	18.2
Tea	738.9	12.8	810.2	12.8
Rubber	51.3	0.9	46.9	**0.7**
Coconut	113.1	2.0	113.3	1.8
Cinnamon	49.7	0.86	61.2	**0.96**

Source : Central Bank Report-2009

Apart from the many uses of the Cinnamon it was recently found out there are many other areas for which it could be diversified with positive results.

According to new research studies Cinnamon oil has the ability to kill mosquitoes better than DEET. Cinnamon oil shows promising great smell and environmentally friendly pesticide characteristics with the ability to kill mosquito larvae more effectively than DEET. *"...The existing diseases spread by the mosquitoes have highlighted the need for new strategies for mosquito larval control..."* natural products chemist Peter Shang-Tzen Chang, a professor in the School of Forestry and Resource Conservation at National Taiwan University. Chang and his coworkers tested eleven compounds in Cinnamon leaf oil for their ability to kill emerging larvae of the yellow fever mosquito, *Aedes aegypti*. The LC50 value is the concentration that kills 50 percent of mosquito larvae in 24 hours. All four compounds had LC50 values of less than 50 ppm with Cinnamaldehyde showing the strongest activity at an LC50 of 29 ppm. For comparison, the LC50 of DEET is an extremely popular pesticide and mosquito repellant is more than 50 ppm (Cabello et al. 2009, 220-231; American Chemical Society).

People have a spice inside of the kitchen cabinet that helps to regulate their diabetes without their knowing. It was found out that Cinnamon controls diabetes naturally.

"...Cinnamon may help by playing the role of insulin substitute in type II diabetes. Cinnamon itself has insulin-like activity and also can potentiate the activity of insulin. The latter could be quite important in treating those with type II diabetes. Cinnamon has a bio-active component that we believe has the potential to prevent or overcome diabetes..." - Don Graves Cellular and Molecular studies at the University of California, Santa Barbara, Iowa State University and the U.S.

Cinnamon helps people with diabetes by metabolizing sugar in a better way. In adult-onset (Type II) diabetes, the pancreas produces insulin, but the body can't use it efficiently to break down blood sugar. Researchers discovered that Cinnamon reduces the amount of insulin necessary for glucose metabolism.

"...One-eighth of a teaspoon of Cinnamon triples insulin efficiency..." says James A. Duke, Ph.D., a botanist retired from the U.S. Department of Agriculture and author of The CRC Handbook of Medicinal Herbs. Taking 1⁄2 to 3⁄4 teaspoon of ground Cinnamon with each meal may help control blood sugar levels.

The most recent studies showed that, after 40 days, 30 diabetics who had taken 1 to 6 g of Cinnamon extract daily reduced their risk factors for cardiovascular disease. Specifically, their mean fasting glucose fell to 18-29%, their triglycerides to 25-30%, their LDL which is bad cholesterol to 7-27% and their total cholesterol to 12-26% (Wondrak et al. 2010, 3338-3355).

This fragrant spice fights tooth decay. Several toothpastes are Cinnamon-flavored-for good reason. *"...Cinnamon is an antiseptic that helps kill the bacteria that cause tooth decay and gum disease. Cinnamon also kills many disease-causing fungi and viruses..."* says Daniel B. Mowrey, Ph.D., Director of the American Phytotherapy Research Laboratory in Salt Lake City and author of *The Scientific Validation of Herbal Medicine.*

Like many culinary spices, Cinnamon helps calm the stomach. But a Japanese study of animals revealed that this spice may also help prevent ulcers. To brew a stomach-soothing tea, ½ to ¾ teaspoon of powdered Cinnamon per cup of boiling water will provide better results.

One German study showed that Cinnamon "suppresses completely" the cause of most urinary-tract infections (*Escherichia coli* bacteria) and the fungus responsible for vaginal yeast infections (*Candida albicans*).

Cinnamon bark as well as other Cinnamon products has a wide range of applications in food and perfumery industries. They are also used in pharmaceutical and essence industries. Cinnamic Aldehyde, the major constituent in the Cinnamon bark oil, is an important food flavouring agent. Cinnamon oleoresin, an important product of Cinnamon, has similar applications in the food industry. Euginol extracted from Cinnamon leaf oil is often used for flavouring toothpaste along with mint and eucalyptus oils (American Chemical Society).

The potential production level of quills as per the estimates made by the DEA in the year 2003 is about 1000 kg/ha in the age of 7 year plantation. But it can be maintained at this harvest level till about 40 years with the adoption of good management practices. Gross income and expenditure analysis for a new establishment of a plantation is given in the table 4.2.

Table 4.2 : Annual costs and returns for Establishment and Maintenance of a 1 ha. Land of Cinnamon

Item	Year								
	1	2	3	4	5	6	7	8	Rest
Labour Cost (Rs)	36,049	10,370	1,.284	30,617	41,481	46,420	51,358	56,296	56,296
Material Cost (Rs)	10,150	7,370	9,250	9,250	9,250	9,250	9,250	9,250	9,250
Total Cost (Rs)	46,199	17,740	26,703	40,206	51,577	58,208	65,684	74,006	74,006
Gross Income (Rs/ha)			60,720	151,440	214,600	253,300	296,600	343,500	343,500
Net Return (Rs/ha)			34,017	11,234	163,023	195,092	230,916	269,494	269,494

Source : Report DEA, 2003

Sri Lanka being the largest producer of Cinnamon in the world (about 65-70% of the global production), Seychelles, Madagascar, India and other suppliers collectively contributes to the balance (30-35%). Sri Lanka exports spices to about 70 countries in the world with Mexico, India, USA and Europe being the major buyers.

Export market data for Cinnamon are given in Table 4.3. Major Cinnamon quills importers are Latin American countries, which constitutes 83.1 % of the total export earnings. Share for the EU countries was 1.8% while for USA it was 9.4%. Thus major importing countries are Spanish speaking countries with Mexico, Colombia, Peru, Guatemala in front line and USA. According to the reports of the customs 39 countries have imported the Cinnamon quills including the EU countries.

Table 4.3 : Major Ceylon Cinnamon Quills Export Countries during 2004

Country	Total export (Tons)	Value (Rs mln)	Share from total export (%)
Mexico	4,773	2,140	59.0
Colombia	648	250	8.0
Peru	463	171	5.7
Guatemala	204	97	2.5
Ecuador	533	199	6.5
El Salvador	108	43	1.4
EU	150	80	1.8
USA	752	328	9.4
Other	459	171	5.7
Total	**8,090**		100%

Source : SL Customs report 2005

With growing concern on health hazards associated with synthetic flavouring agents used in the food industry, there is an increasing preference for natural flavours all over the world. Thus the demand for Cinnamon oil is expected to grow steadily in the future with the growing population and expansion and sophistication of the food industry (Senanayake *an*d Wijesekera 1989, 103-120).

Considering all these multiple uses along with the cost and revenue aspects of the Cinnamon Industry it is evident the Cinnamon is a better economical industry which has future prospects to grow very rapidly.

4.2 Micro Perspective for the Cinnamon Industry

Cinnamon industry has an impact not only to the existing domestic and international markets but also to the potential future markets. The micro perspective helps to give a good picture and related issues of the industry's plantation sectors for small scale owners, processing units operated by rural people and also other small scale value chain players. SWOT analysis is incorporated for the entire Cinnamon industry as follows:

4.2.1 Strengths – S

- This product – *'Cinnamon Zeylanicum'* is native to the country and known as the Ceylon Cinnamon/ True Cinnamon in the global market and there is no any substitute with required quality aspects (Although Cassia is considered to be the near substitute it also contains Cancer causing substance and very harmful for consumption)

- The crop is ideally grown in Sri Lankan soil conditions and the climatic conditions prevail provide conducive environment for plantation (Sunshine throughout the year and the rain pattern)

- Plantation of Cinnamon best suits most parts of the southern coastal belt of the island but recent studies shows improved cultivating potential in inlands with improved quality aspects of the bark

- Industry has maintained a good reputation in the global market and has given tremendous strength for the foreign countries and proceeded in a positive direction due to high prominence

- Industry can easily turn around to a profitable path with minimum effort in a cost efficient manner with the diversified uses identified by the global researchers and scientists through R&D and research studies

- Different parts of the tree has different commercial usages and entire tree is extensively used without throwing away any single part and various additional usages are still being identified
- Most of the Cinnamon industry people are used to some traditional method of processing to make finished products in small and medium levels and the knowledge of processing Cinnamon is at a higher level
- Industry has secured the fourth place in the export market among the exporting crops and the first place among the spices export and thereby contributing very much for the country's economy
- Most of the innovative and practical methods could be identified through industry applications in a wide range and it is possible to produce standard products in bulk and value added form with high quality
- A large number of Cinnamon planters/ producers live in the country producing variety of products and there are possibilities for collective actions to be undertaken among different value chain players identified (i.e.: The cluster approach could be implemented effectively)

- There are some processing centers of Cinnamon with the GMP certification and therefore high quality levels are achieved for the export market
- New technology oriented techniques could be introduced and possibility to expand with market needs
- Availability of enough resources for investment considering the current situation of Sri Lanka – aligning with the countries intention to develop the agricultural sector

4.2.2 Weaknesses – W

- Lack of concentration and poor management practices incorporated in the plantations sector leading to yield shortages and other long term problems due to decreasing yield capacity affecting the entire industry
- Negative perception of the industry due to slow progress of the income initially since it needs minimum of 3 years to get return from the inception
- Although the Cinnamon tree is successfully grown in some parts of the country it's not spread to cover a considerable percentage of the land area of the entire country to meet future demand
- Since the product has many usages there is the possibility for various product ranges causing the price elasticity to be at higher level against the demand
- Most of the people who are incorporating the traditional methods of processing have reluctance to change for new methods
- Social and economical implications (since there is no proper recognition for the industry employees) affecting to recruit more skillful employees to the industry and eventually loses the most essential young crowd for future sustainability
- Industry doesn't have proper standard mechanism to collect the high quality yield and send it to the relevant international market or domestic supplier to gain the maximum benefits from the entire industry
- This crop is of much importance even at international level and has been grown in Sri Lanka for centuries but there has been hardly any improvement in its productivity in the last few decades
- High loss due to high moisture content in Cinnamon bark and it is estimated to be US $ 2.2 mln/year which is about 3% of the foreign exchange earnings from total EACs

- Inability of most of the Cinnamon value chain players to face the trade monopolies created by few in the industry
- Lack of marketing research and R&D activities to find solutions meeting the current issues in the market
- No coordination and strategies developed among the suppliers to meet the Cinnamon market demand
- Some of the processing mechanisms lead to pollute the environment especially during oil extraction process
- Inability to offer higher grades of Cinnamon quills in a consistent manner to the market
- No sufficient improvement in the Cinnamon industry due to financial limitations of the value chain players
- Most of the plantation owners have no control over the processors (especially peelers) and their skilled number is also limited. Therefore at last the owners gain a lower return

- Many of the value chain players concentrate on quantity achievement but not on quality achievement
- Most of the value chain players have subsistence mentality
- Most of the value chain players do not work with positive attitude and a clear vision aligned with the Cinnamon industry

4.2.3 Opportunities – O

- It is always trying to provide more concentration for these types of agricultural products aligning with the government's current policies to develop the national economy

- Many institutes, government organizations and departments have identified the importance of this invaluable industry and the necessary activities are being implemented to develop the industry
- Technological applications have been developed up to a certain level by some organizations to improve productivity and they could be incorporated mechanisms which are not very complicated
- Since industry has been for a very long period of time, it has given an opportunity to penetrate to new markets with the least minimum affect
- Political stability of the country after ending the civil war leading to invest more and more in Sri Lankan soils
- Creativity can lead to commercialize more new products which has many avenues due to the high applicability of the Cinnamon based products to satisfy different target markets, which could generate additional income to the country – High potential for product diversification
- Special encouragement for SME development by the Government and provision of low interest loans for prospective value chain players
- A large business community is involved in the Cinnamon industry both at national and international levels
- Many supports from EDB, SLSI, DEA in export development activities of Cinnamon
- Rise in the demand for True Cinnamon and government takes actions to promote it through proper branding (Launched few days back under 'Ceylon Cinnamon' brand name)
- INGOs such as JAICA, GTZ supporting the DEA and Cinnamon Research Centers for Technological improvements and Consultancy Services
- Institutions available to obtain quality certifications and standardization at global level

4.2.4 Threats – T

- Threat from near substitute product Cassia due to its considerable low price compared to Cinnamon in the international market and it is demanded very highly by the most of the export countries
- Due to relative low price of the competing countries it provides an opportunity to import Cinnamon oils to the domestic market (E.g.: Cinnamon Leaf and Bark Oils from time to time)
- Economical adverse factors (recessions) lead to low demand and prices
- Inappropriate & imbalance taxes and duties affect to reduce industry volumes
- Negative influences from exporters and intermediates at auctions
- Prices not stable throughout the year and it is controlled by the few traders creating monopolistic situation and this Trade monopoly exists at considerable high level

- No fertilizer subsidy scheme is given for Cinnamon planters
- No enough awareness among international community regarding true Cinnamon Vs substitutes
- Next generation is slowly switching in to other industries and unavailability of high skilled processing personnel
- Use of chemicals as Pesticides and Weedicides which will harm the environment in the long run

4.3 Macro Perspective for the Cinnamon Industry

Since the industry has gone beyond its local borders and penetrated to the global market, it is indeed a requirement to look at the industry wide external factors to get

a great knowledge about the environment. This will provide a long term impact to keep sustainability in an effective and efficient manner. As a result industry PEST analysis has been done as follows:

4.3.1 Political – P

- Political perception and their practical applications are in a very slow process which gives an adverse affect to the progress of the industry. But it seems some smaller changes during the recent years
- Political stability in the country leads to give positive impressions for international buyers motivating them for investments
- Through political relations with other countries it is needed to identify market oriented products and identify their new prospective markets very closely. Although some linkages have been developed currently for some sectors no proper mechanism focused to this Cinnamon industry

- Bureaucracy and unnecessary regulations reduce the efficiency of the process
- Not providing political compensations for the industry and they are playing a greater role to sustain the Cinnamon as an industry
- There are government policies and programs for development of the rural economy and it could be coupled as necessary to promote the industry
- Pro-private sector development policy of the present government and provision of government subsidies for plantations and processing of Cinnamon
- There is no national policy for Cinnamon industry and it should be established with clear vision
- Politicians and other necessary parties are unaware of the importance of the Cinnamon to the local economy and the value it could reach

4.3.2 Economical – E

- Since this industry affects the country's economy through occupying the No.1 export spice, the domestic and international buying power of the customers affects country's GDP directly
- Currency fluctuations, taxes and economical understanding with other countries (such agreements are not there for Cinnamon industry and should be promoted) has affected to change the export volumes
- Adverse effects of economical factors lead to increase the cost of production of the final product
- Due to the nature of the price elasticity of the products, it gives a negative impact in the international market
- Cinnamon Auctions affect very much and bulks of Cinnamon could be sold giving high profit margins for the direct peelers and the planters
- Private sector involvement is very low (specially banks and financial institutes) due to the constraints of their internal policies and objectives
- More women participation in the Cinnamon cultivation and processing as a home based employment helps improve the family units and ultimately the total economy of the country
- Global economic fluctuations like recession hindered the industry supply

4.3.3 Social – S

- Social adamant about some processing methods and is therefore very difficult to change and introduce new technology
- Social link to the industry always gives optimistic outcome in all three processes
- Since the social recognition of the industry is not at the expected level, it will lead people to get away from the industry related activities affecting to lose the young crowd being not attracted to the industry. This will ultimately cause the lack of experienced personnel in the industry
- Creativity awareness is not in a required level and also the consumers reluctant to use Cinnamon as a best substitution in day to day probable usages
- No permanent labour force is available at social level in the country

4.3.4 Technologically – T

- Industry has not applied technological applications as expected to get the required outcome and necessity in meeting business objectives has not been identified
- Perception with regard to technology is not very positive. But to get the competitive edge it is essential to improve industrial activities aligned with technology and increase the effectiveness to meet global demand
- Technology is not being applied where it is most important and get away from the actual needs. The innovative findings also should be more positive and also should be practical
- Research findings always need to pair with the latest methods to benchmark new findings if possible and convert into such a manner to use it appropriately

- Lack of R&D institutes for Cinnamon industry
- Need more training and consulting institutes for the industry on simple applications which will enhance the quality and the return on investment very much
- New innovations are found which helps to increase the productivity
- Several Processing centers with GMP certification help to benchmark for other value chain players in the same section.
- DEA, SLSI and Cinnamon research centre support in technological aspects to improve the industry

4.4 Near Future Expectations

It is very important to identify the issues in all three sectors (Plantation, Processing & Marketing) in depth and propose most economical practical solutions immediately to lift the industry to a better position. According to the above SWOT & PEST analysis the industry has many numbers of positive factors to drive the industry to the above position. But the other negative factors should be closely analyzed and effective strategies should be implemented to get rid of or/ and minimize the effects as needed.

4.4.1 Domestic market expectations

Although the Sri Lankans use this spice in cooking daily meals the domestic market expectations are at medium level. The reason is that the total consumption is relatively low with compared to other potential areas. It will be a big opportunity for Sri Lankans to consume mother country products not only it in many different forms, but also to align with modern fast life with a medicinal value to refrain from many diseases. Because the high quality Cinnamon is hard to purchase from the local market conditions prevailing in Sri Lanka and since it is possible to earn more profits through exporting.

4.4.2 International market expectations

International market expectations could be to obtain more quality Cinnamon at lower price compared with the existing products. Therefore right technological applications to improve the quality and process efficiency in developing the current product portfolio, incorporating product diversification and value addition plays a major role. Identification of new market segments for above diversifications needs to be properly administered and thereafter efficient applications could be implemented.

Since the global attitude is gradually diverting to natural / organic consumer patterns and habits, this industry could play a substantial role to meet future international market expectations very easily.

4.5 Summary of Situation Analysis

Important aspects with respect to the entire Cinnamon industry are considered giving a special attention to identify *'why Cinnamon industry is so important?.'* Economic viability of the industry is conducted to identify the various usages of Cinnamon found out through the newest researches and findings. It provides a broad understanding of the potential of the Cinnamon for various usages and also the financial returns that could be gained for any investor concerned.

The micro and macro level aspects which are affecting the Cinnamon industry in Sri Lanka are highlighted through SWOT and PEST analysis consecutively. The value chain players who fall under micro and macro level could receive benefits through the suggestions focused under these two categories since their level of problems are focused separately. Under micro perspective it reveals although there are many strengths and opportunities available they were not capitalized as they should have been. At the same time some of the weaknesses and threats have arrived at very crucial stages. They need to be attended as early as possible before the industry falls into a great difficulty to meet future aspirations.

The domestic and international market concerns and the effectiveness are considered since it links with many ways to Sri Lankan economy. GDP, employment generation, increase the life standard, bring the foreign revenue and many such related indicators are important factors that linked proportionately with the proper exploitation of the industry.

Macro point of view the industry is struggling with marketing expectations and up grading of technology to improve the productivity. The cost of production gives a huge impact and also acts as a bottle neck to propose any innovative and competitive solution to gain the edge.

CHAPTER 5: DATA ANALYSIS AND INTERPRETATION

The primary data gathered from the value chain players in the Cinnamon industry will be analyzed using Descriptive and Inferential statistics. The essential statistics will be drawn for data sets and their interpretations are justified as necessary.

In the qualitative analysis the collected data will be analyzed in a tabular form to identify the operational aspects of the findings. The interpretation and the combination of the qualitative findings will lead to achieve the research objectives.

5.1 Quantitative Analysis

Primary data collected through interviews consists of three main sectors namely Plantation, Processing and Marketing. They are used for the quantitative analysis and evaluated against the two main constructs *Technology Competency* and *Market Orientation*. Each component comprised of many variables as discussed in Chapter 3 and are measured by many indicators. This collection of industry data is summarized in an appropriate manner to ease the analysis.

5.1.1 Descriptive statistics

This section presents a descriptive analysis of the sample data collected. It aims to provide an overview of the responders and an insight into their perception. Therefore the technology competency and market orientation constructs will be analyzed in relation to the Cinnamon industry in Sri Lanka.

Composition Based on Sectors:

Table 5.1 represents the total number of interviews conducted under each category of the value chain players:

Table 5.1 : Composition of the Responders – Sector wise

Category	Number
Cinnamon cultivators	
• Large Scale	30
• Medium Scale	30
• Small Scale	30
Cinnamon peelers	30
Cinnamon oil producers (Leaf and bark oil producers)	15
Cinnamon traders	30
Other Cinnamon diversified product manufacturers	5

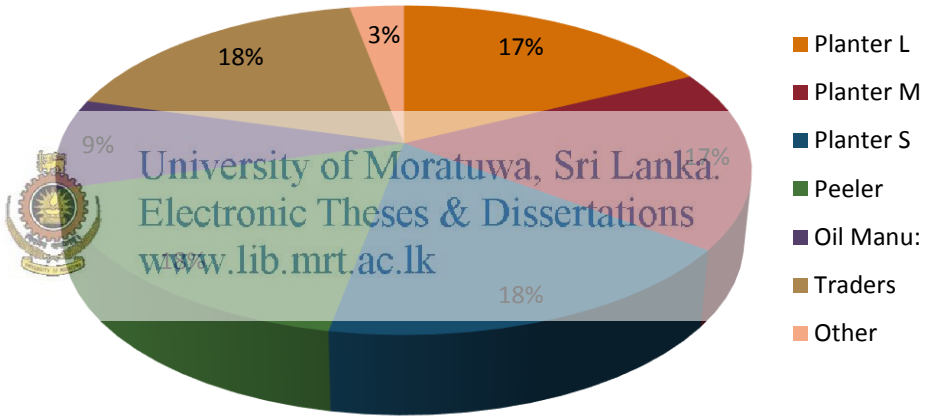


Figure 5.1 : Composition of Responders (%) - Sector wise

Analysis based on variables:

For Technology Competency Construct

The sample analysis for the above construct is as follows:

Construct # 01: ***Technology Competency***

Technology Competency is associated with 04 variables as defined in the previous chapters. These variables were identified through the degree of consent of each indicator.

Variable #1: *Knowledge & Experience*

Indicator K1 : Amount of knowledge to provide technical support to fulfill basic operations

Table 5.2 : Composition of the perception with regard to (Knowledge & Experience) Vs (Amount of knowledge to provide technical support to fulfill the basic operations)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	1	.6	.6	.6
	3	55	31.6	32.4	32.9
	4	86	49.4	50.6	83.5
	5	28	16.1	16.5	100.0
	Total	170	97.7	100.0	
Missing	System	4	2.3		
Total		174	100.0		

Table 5.2 revealed a majority i.e. about 65.5% from the entire industry agreed for the above indicator and there is only 0.6% disagreed. Therefore it is evident there is a significant percentage of the industry value chain players agree with *Amount of knowledge to provide technical support to fulfill the basic operations* within the industry and it has become an important aspect. Because there is only 31.6%, falls under undecided level.

Likewise the degree of agreeability in the form of composition percentage of each indicator with regard to the Technology Competency is summarized in Table 5.3.

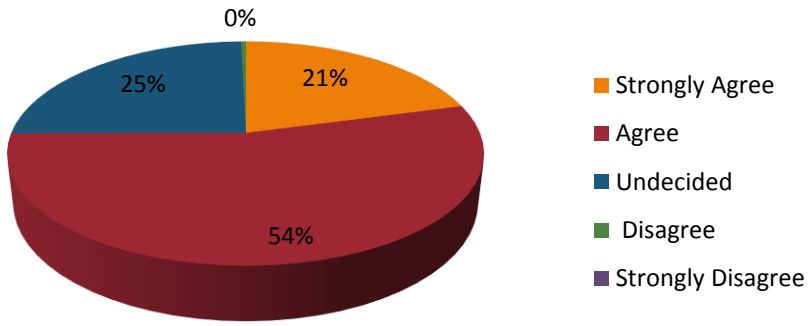
Table 5.3 : Technology Competency Composition Percentages

Variable	Indicator	1	2	3	4	5
Knowledge & Experience	K1	0	0.6	31.6	49.4	16.1
	K2	0	0	20.7	51.7	25.3
	K3	0	0	21.3	59.2	17.2
	K4	0	0	30.5	47.7	19.5
	K5	0	0	16.7	61.5	19.5
	K6	0	0	21.3	51.1	25.3
	K7	0	0	26.4	52.3	19.0
	K8	0	0	20.7	56.9	20.1
	K9	0	2.9	27.6	46	21.3
	Ave:	**0.0**	**0.4**	**24.1**	**52.9**	**20.4**
Innovative & Creative ability	C1	0	6.3	37.4	43.7	10.3
	C2	0	5.7	34.5	45.4	11.5
	C3	0	4.6	38.5	46.6	8.0
	C4	0	13.2	58	26.4	0
	C5	0	1.7	24.1	55.2	16.7
	C6	0	4	35.1	51.7	6.9
	Ave:	**0**	**5.9**	**37.9**	**44.8**	**8.9**
Exposure (Internal & External)	E1	0	1.1	49.4	28.7	8
	E2	0	4.6	43.1	43.1	6.9
	E3	0	8.6	37.9	42.5	8.6
	E4	0	4.6	40.2	44.3	8.6
	E5	0	9.2	50.6	33.3	4.6
	E6	0	5.2	41.4	46.6	4.6
	E7	0	2.9	36.8	51.1	6.9
	E8	0	0	33.3	52.9	11.5
	Ave:	**0**	**5.8**	**41.6**	**42.8**	**7.5**
Attitude & Perception	A1	0	2.9	37.9	47.7	9.2
	A2	0	0.6	28.7	62.6	5.7
	A3	0	1.1	24.1	57.5	14.9
	A4	0	0.6	20.1	63.8	13.2
	A5	0	3.4	46	42	6.3
	A6	0	0	13.8	64.4	19.5
	A7	0	4	31	54	8.6
	Ave:	**0**	**1.8**	**28.8**	**56.0**	**11.1**

Note: For Indicators refer Table 3.1.

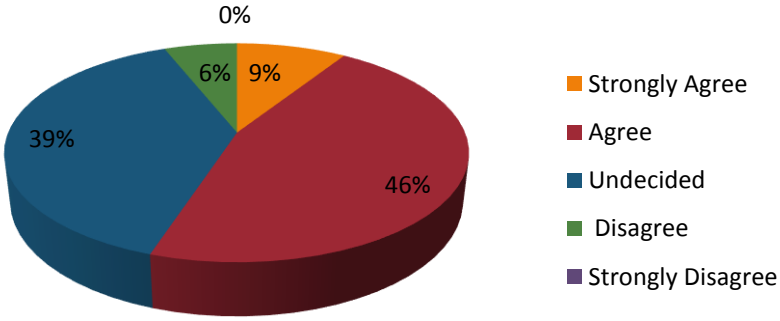
Considering the variables of Technology Competency, on average there are more than 73.3% of the industry value chain players agreed to the total of Knowledge and Experience's indicators (Figure 5.2). There is a situation where the agreed percentage increased beyond 80% level for individual indicator. Indicators relating to period of experience (K2) and experience leads to solve any practical issues (K6) …etc. provide substantial impacts for the technology competency.

Figure 5.2 : Knowledge & Experience Composition %



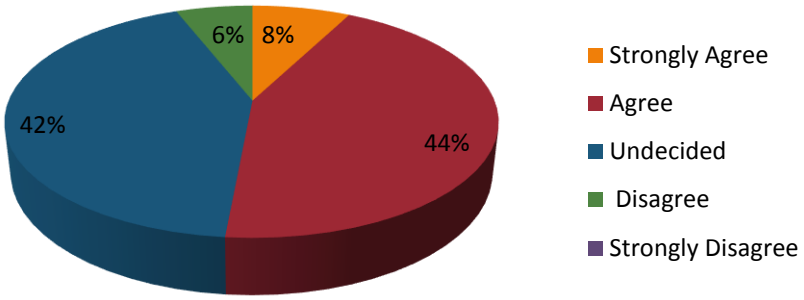
For Innovative & Creative ability the agreed amount on average for all the indicators is 53.7%, while 37.9 % stayed undecided (Figure 5.3). This is a clear indication that the industry value chain players don't have a clear understanding on producing value added innovative products by incorporating Cinnamon and they only concentrate on producing the existing traditional products. Further it is important to note that the indicator C4 highlighting there should be a possibility to incorporate existing resources for implementing the technological solutions was disagreed by 13.2%, while 58% remained undecided. The reason is the value chain players don't incorporate many resources apart from the land for plantations and the very limited amount of equipments for Cinnamon processing.

Figure 5.3 : Innovative & Creative Ability Composition



For internal and external exposure the total responses show even lesser percentages. The agreed amount remained at 50.3% while 41.6% undecided and 5.8% disagreed. The fact being the majority of the value chain players don't have any considerable exposure to the technological means matching the Cinnamon industry, they have a doubt on how to gain positive impacts through these implications (Figure 5.4).

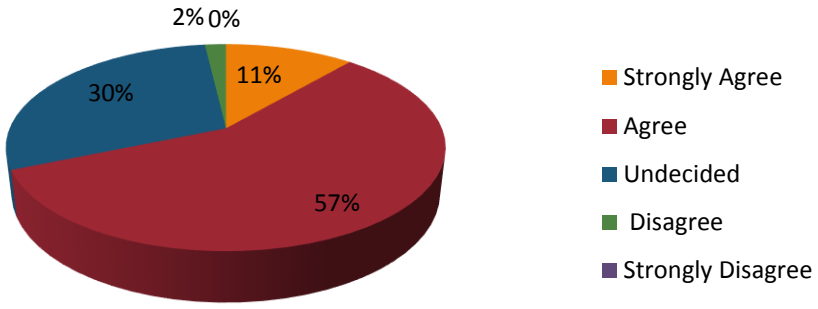
Figure 5.4 : Internal & External Exposure Composition



Attitude and perception indicators are comparatively agreed with the highest percentages. A total of 67% agreed for all the indicators on average and there is a situation where the total agreed amount reached 84% as well. This indicator suggests there should be a proper technological knowledge through very simple mechanisms for the industry employees. It is correctly implied for the industry since the majority of the value chain players involved in the business activities has a low education level.

But *the management should have a self motivation to persuade the others towards the technological aspects* is equally highlighted as an important indicator (A3). It also should be considered simultaneously with the indicator (A4) highlighting *Extent of motivation of technology for operational activity believing it gives positive results,* which is also having a positive result of 77% (Figure 5.5).

Figure 5.5 : Attitudes & Perception Composition



For Market Orientation

The Market Orientation construct consists of 3 variables as discussed previously. All the indicators were considered similar to the above analysis under technology competency:

Variable #2: *Customer Orientation*

Indicator U1: Monitor level of commitment in serving customer needs

Table 5.4 : Composition of the perception with regard to (Customer Orientation) Vs (Monitor level of commitment in serving customer needs)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	1	.6	.6	.6
	3	55	31.6	32.4	32.9
	4	86	49.4	50.6	83.5
	5	28	16.1	16.5	100.0
	Total	170	97.7	100.0	
Missing	System	4	2.3		
Total		174	100.0		

It indicates that 65.5% agreed for *Monitor level of commitment in serving customer needs* establishing a high impact on customer orientation. At the same time there is no one

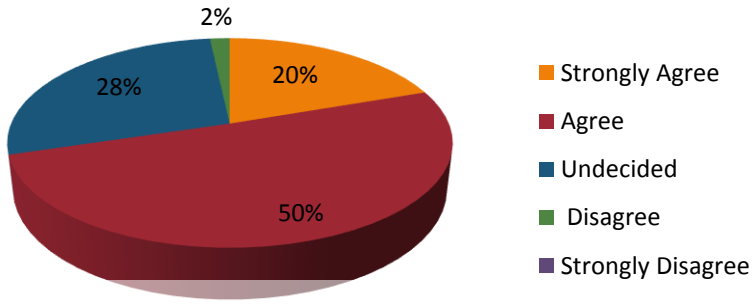
strongly disagreed and 0.6% at disagreed level and 31.6% at undecided level within the industry.

Table 5.5: Market Orientation Composition Percentages

Variable	Indicator	1	2	3	4	5
Customer Orientation	U1	0	0.6	31.6	49.4	16.1
	U2	0	0	20.7	51.7	25.3
	U3	0	0	21.3	59.2	17.2
	U4	0	0	30.5	47.7	19.5
	U5	0	0	16.7	61.5	19.5
	U6	0	0	21.3	32.7	36.4
	U7	0	0	26.4	51.1	25.3
	U8	0	0	20.7	56.9	20.1
	U9	0	2.9	27.6	46	21.3
	U10	0	6.3	37.4	43.7	10.3
	U11	0	5.7	34.5	45.4	11.5
	U12	0	4.6	38.5	46.6	8
	Ave:	**0.0**	**1.7**	**27.3**	**49.3**	**19.2**
Competitor Orientation	P1	0	13.2	58	26.4	0
	P2	0	1.7	24.1	55.2	16.7
	P3	0	4	35.1	51.7	6.9
	P4	0	11.5	49.4	28.7	8
	P5	0	4.6	43.1	43.1	6.9
	P6	0	8.6	37.9	42.5	8.6
	P7	0	4.6	40.2	44.3	8.6
	P8	0	9.2	50.6	33.3	4.6
	Ave:	**0**	**7.2**	**42.3**	**40.7**	**7.5**
Inter functional Coordination	T1	0	5.2	41.4	46.6	4.6
	T2	0	2.9	36.8	51.1	6.9
	T3	0	0	33.3	52.9	11.5
	T4	0	2.9	37.9	47.7	9.2
	T5	0	0.6	28.7	62.6	5.7
	T6	0	1.1	24.1	57.5	14.9
	T7	0	0.6	20.1	63.8	13.2
	T8	0	3.4	46	42	6.3
	T9	0	0	13.8	64.4	19.5
	T10	0	4	31	54	8.6
	Ave:	**0**	**2.1**	**31.3**	**54.3**	**10.0**

One of the most important variables of the Market Orientation aspect is the customer orientation which was agreed by 68.5% of the value chain players on average. More than 80% agreed that the after sales services should be focused and satisfied in a more effective manner. The agreed amount reached 77% level, both for the U2 and the U8 indicators and 76.4%, both for the U3 and U7 (Figure 5.6). It is therefore implied the importance in identifying the customer needs in a more appropriate manner and reasonable pricing mechanisms become very important from the industry perspective.

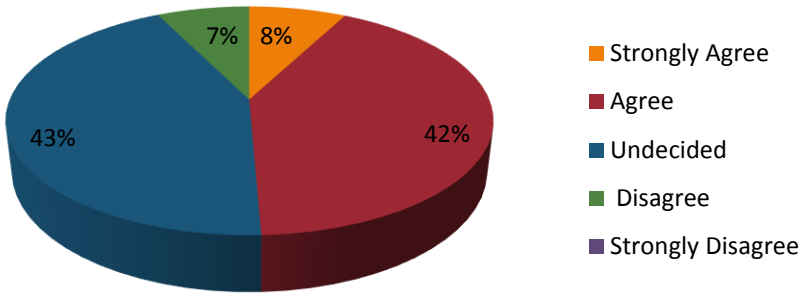
Figure 5.6 : Customer Orientation Composition



Competitor Orientation was agreed only by 48.2% on average, which is at lower level compared to other situations. The highest percentage of 42.3% on average is under undecided option. Having the feeling that the industry is not giving the required competitiveness in practice or no competition is understood by the value chain players for this native product to Sri Lanka may be the reason. On the other hand lack of supplying to meet the required demanded quality products may also be the reason. This is significant when considering the indicator P1, where it is only 26.4% agreed and being the lowest among the rest. It implies no actions taken to face the competitiveness.

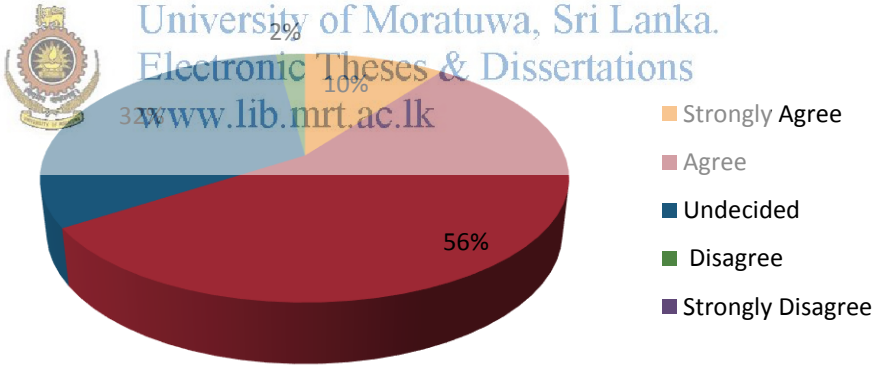
On the other hand the agreed amount for actions taken against the bargaining power of the raw material suppliers' is also at a minimum level (37.9%). Aspect of changing against the competitiveness is also at a lower level of 36.7%, implying there are no proper linkages built among the value chain players and no strategic measures in doing so (Figure 5.7).

Figure 5.7: Competitor Orientation



Inter Functional Coordination is also explained as a valuable variable for the entire industry and 64.3% agreed on average for the indicators and 2.1% disagreed. The undecided amount remains at 31.3%, since most of the industries are small holdings and operating day to day activities without clear vision and objectives set for the future.

Figure 5.8 : Inter Functional Coordination



Although the T9 indicator - *Informal information exchange to fulfill industrial Expectations* shows a high percentage (83.9%), *the ability to come to an agreement in producing the same product units* remain at a lower level of 48.3%. The reasons may be the individual companies and the small holders have got used to supply the same old products demanded from many years back and dislike to change and focusing on producing new product ranges (Figure 5.8).

Mean & Standard Deviation

The following descriptive statistics were considered for the sample comprised of Cinnamon industry value chain players. The construct Technology Competency is linked with certain number of indicators representing variety of specific characteristics. Since the analysis limits the incorporation of total number of indicators on individual basis, the mean values were calculated to denote such indicators as necessary. But the contribution from these different indicators may not have the same weight. But to continue with the analysis it was assumed these indicators have the same weight and equally contributing to the variable. The minimum, maximum, mean & standard deviation statistics were considered to describe the sample characteristics from the statistical perspective (Appendix 10).

For *Knowledge and Experience* variable the minimum value is 3.3, which is just above the undecided level and remain on the agreeable-side. The maximum value is 4.8 and it is very much closer to strongly agreed level. The Mean value is 4, almost on the agreed consent. The deviation from Mean is 0.2659 implying that the values are almost distributed around the mean value and this will show positive implications for the entire sample for representing the variable.

Minimum value is 2.7 and the maximum value is 4.5 for the *Innovative and Creative ability*. Minimum value although lies below the undecided level, it is much closer to the undecided level than the disagree level. The maximum value on the other hand lies exactly in between agreed and strongly agreed levels. However the Mean value is 3.6 which show an overall opinion in the agreed position. Compared with the *Knowledge and Experience* level the acceptance is lying below by 0.4 points. This is further emphasized by having a standard deviation of o.34 implying the whole responses lay very close to the mean value. Therefore this too is accepted by the sample very positively.

Internal and External Exposure variable with regards to the Technology Competency shows minimum and maximum values of 2.6 & 4.4 respectively and these figures are almost the same with the above figures of the variable discussed.

Since the mean value is 3.54 and the standard deviation is 0.33, a similar conclusion could be drawn in this regards as well.

However the *Attitudes and Perception* is playing a medium role compared with other variables under *Technology Competency*. The above discussed 3 variables could be placed in two separate locations without much difficulty. Because the last two variables almost at the same level. Therefore *Attitude and Perception* remains in between those two levels. By simple comparison we can place this variable just second to the first variable and conclude this too is positively accepted by the value chain players in the industry. Since the standard deviation is just below the first variable it shows a good solid distribution around the mean value than the first case.

Descriptive statistics of variables under *Marketing Orientation* are shown in Appendix 10. These variables also behaved in a very much similar manner to the earlier case. Since the mean values are almost equal and above the undecided level it shows that these variables are also accepted. Since the minimum, maximum and the standard deviation figures of the *Customer Orientation* and the *Inter Functional Coordination* are almost similar, it implies they were highly accepted by the industry value chain players. But *Competitor Orientation* shows a small decrease with comparison to the above two and a higher value is shown for the Standard deviation. Therefore it could be concluded that although this variable is also accepted it remains lower level than the above two.

5.1.2 Inferential statistics

This section incorporates inferential statistics such as Pearson Correlation to analyze the relationships among the variables. This will help to identify the significance of these variables and form regression models for future modeling purposes if necessary. But this aspect is beyond the target of this study.

Correlation

Correlation measures the strength of the linear relationship between the two variables. This is also known as the degree of linear relationship. This study focuses the behaviour of the two main constructs and the associated indicators as required.

A. Technology Competency

The correlation among the *Technology Competency* variables could be analyzed using the Persons coefficients as follows. The following correlation table explains there is a positive but weak relationship among all the variables. It could be concluded since the correlation coefficients of all the pairs are positive and lies between 0 and 0.5 (Appendix 11).

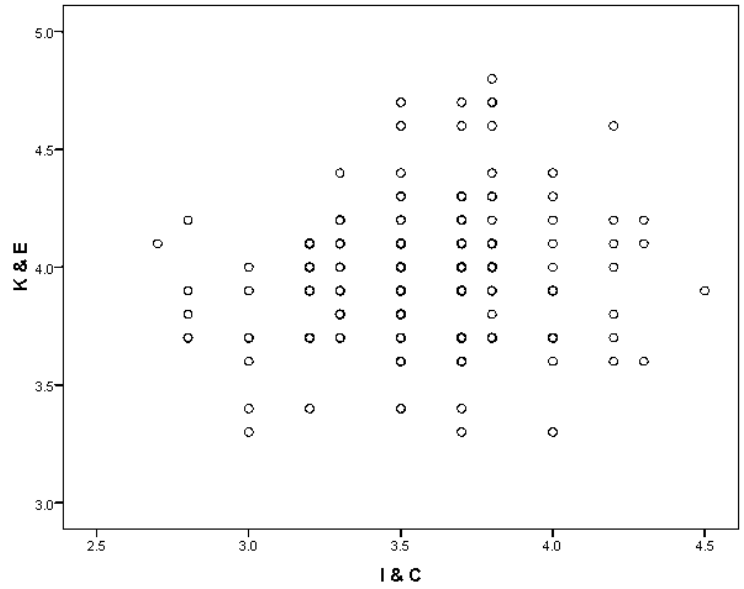
Accordingly the boxes which are shaded show a P - value less than the corresponding α – value and denotes a significant correlation in between those variables. But for the other boxes the correlation between the variables isn't significant. It is proved that there is a significant correlation in between the following variables:

- ✓ (Knowledge & Experience) Vs (Attitude & Perception)
- ✓ (Innovative & Creative Ability) Vs (Internal & External Exposure) and
- ✓ (Internal & External Exposure) Vs (Attitude & Perception).

But among the remaining three possible combinations, among the variables there is no significant correlation.

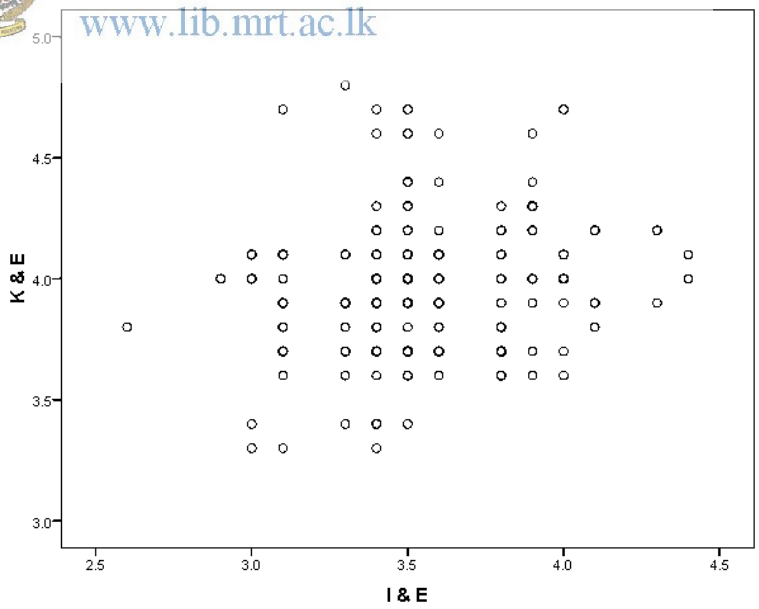
- × (Knowledge & Experience) Vs (Innovative & Creative Ability)
- × (Knowledge & Experience) Vs (Internal & External Exposure)
- × (Attitude & Perception) Vs (Innovative & Creative Ability).

Figure 5.9 : Correlation of (Knowledge & Experience)- (K&E) Vs (Innovative & Creativity Ability)- (I&C) variables in Technology Competency



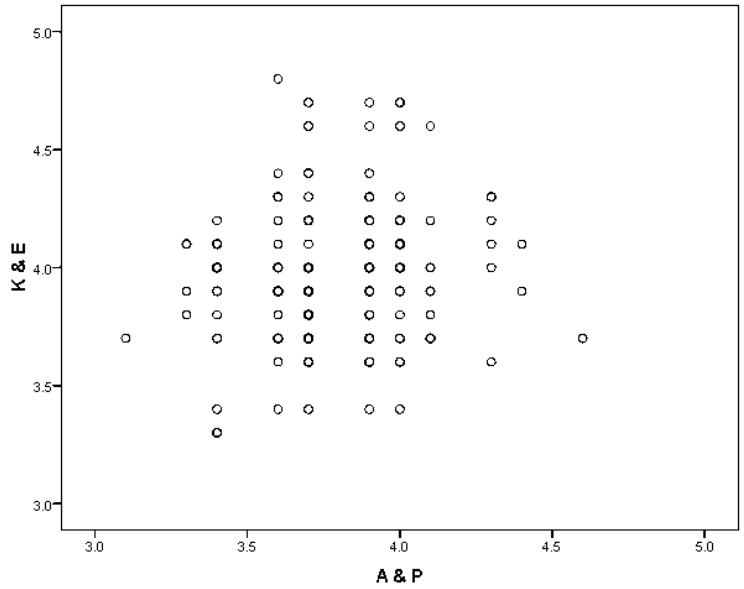
Although there is a positive weak correlation between the above variables it is evident that correlation isn't significant (Figure 5.9).

Figure 5.10 : Correlation of (Knowledge & Experience)-(K&E) Vs (Internal & External Exposure)-(I&E) variables in Technology Competency



It is also evident that the (Knowledge and Experience) Vs (Internal & External Exposure) too has no significant correlation, although they have a positive but weaker correlation (Figure 5.10).

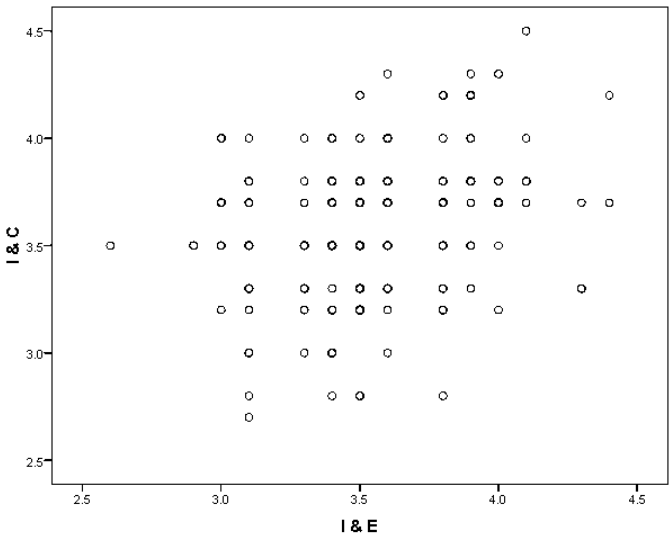
Figure 5.11 : Correlation of (Knowledge & Experience)-(K&E) Vs (Attitude & Perception)-(A&P) variables in Technology Competency



Since the correlation among the above variables (K&E Vs A&P) is significant, it is at weak level in positive direction. Therefore it could be concluded a weak positive linear relationship among the variables. The (Knowledge and Experience) has a linear relationship with the (Attitude and the Perception). This is agreeable since there is a possibility to change the attitude and the perception with the change in knowledge and the experience. Therefore it leads to a positive linear relationship. It is clearly visible in the above graph too (Figure 5.11).

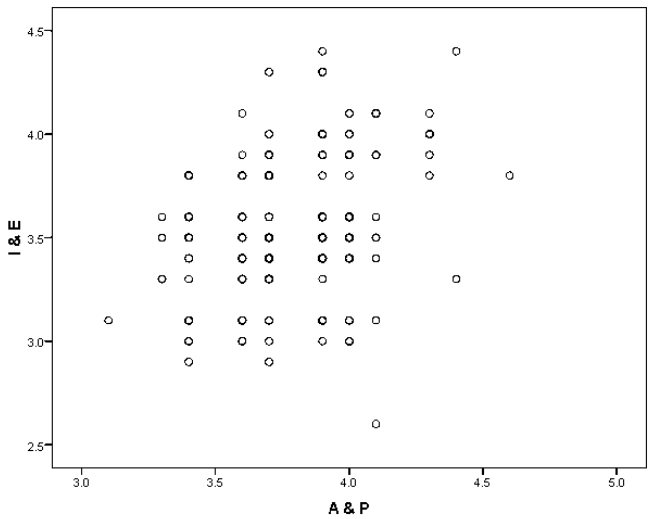
Under *Technology Competency* (Innovative & Creativity Ability) and (Internal and External Exposure) significantly related with positive but weaker correlation. But this linear relationship is the most powerful among the 3 positive relationships. It implies the (Internal and External Exposure) becomes an effective factor for the (Innovative & Creative ability) (Figure 5.12). When the HR is provided the opportunity to gain the exposure it will directly become a reason to benchmark with the others applications and apply the new things within the organization. Therefore it is also agreeable.

Figure 5.12: Correlation of Innovative & Creativity Ability (I&C) Vs Internal & External Exposure (I&E) variables in Technology Competency



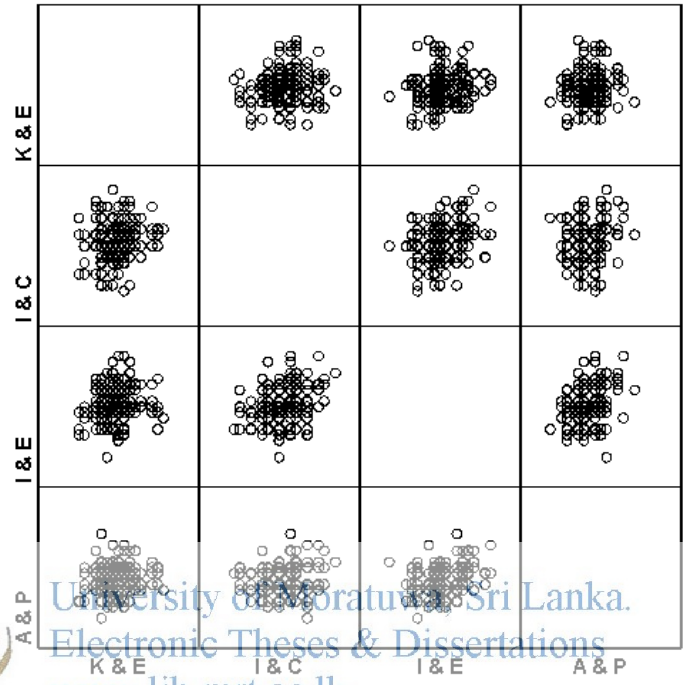
It is proved there is a positive but medium level (with respect to the other two variables which are lower and higher than this) linear relationship among the (Attitude & Perception) and (Internal & External Exposure). It also could be described as the (Attitude and the Perception) will drive towards the (Internal & External Exposure) gaining (Figure 5.13).

Figure 5.13 : Correlation of (Attitude & Perception)- (A&P) Vs (Internal & External Exposure)- (I&E) variables in Technology Competency



Similarly the variables under Technology Competency discussed above could be summarized (Figure 5.14) and therefore it could be easily seen there is a positive but weaker relationship among the all variables.

Figure 5.14: Correlation among Technology Competency variables



K&E - Knowledge & Experience
I&C - Innovative & Creative Ability
I&E - Internal & External Exposure
A&P - Attitude & Perception

B. Market Orientation

Market Orientation comprised of the variables *Customer Orientation*, *Competitor Orientation* and *Inter Functional Coordination*. The correlation relationships among these variables are analyzed in the similar manner.

All the variables have a positive but weak relationship among each other and importantly all of them have become significant correlations. Because the P - value is less than α - value (0.01 for two tailed test) in this case (Appendix 11). Therefore it implies there are significant but low strength linear relationships among all the variables. All the significant and important correlations are shaded in the table.

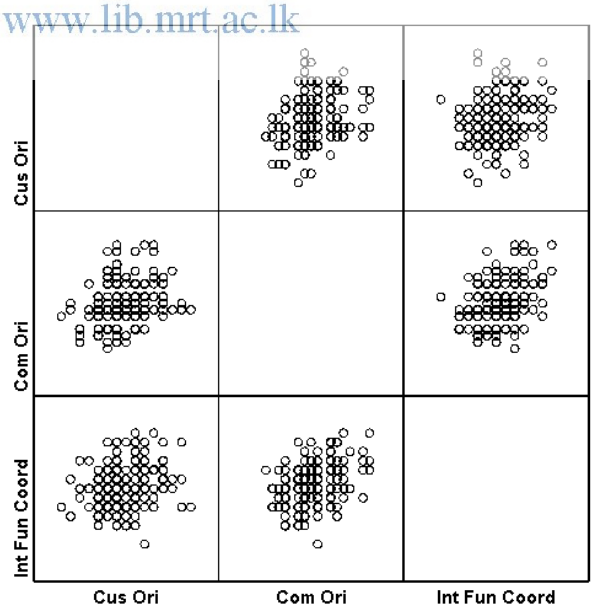
The correlation between customer orientation and inter functional coordination has the lowest level positive relationship compared with other correlations. But this correlation is almost the same as the correlation between customer orientation and competitor orientation. Since they are towards the positive side being significant it could be concluded the relationship is an important one.

The highest correlation exists among the competitor orientation and inters functional coordination. Comparative to the other correlations this is at a higher level but it also falls under weak positive relationship.

Depending on the industry behaviour the customer orientation, competitor orientation and inter functional coordination are operating almost at independent levels. This is proved through proper analysis of the existing Cinnamon industry position.

Market Orientation variables have a low linear relationship. This means responders agreed them in almost independent manner. The figure 5.15 explores in the summary form how these variables are correlated among each other and fall into the same direction.

Figure 5.15 : Correlation among Marketing Orientation Variables



5.1.3 Factor analysis

The factor analysis indicates up to what extent each variable is explained to the relevant contributor. It doesn't show the affect or the impact of the variable contributing towards the contributor, but it statistically explains the numerical contribution.

This further helps to reduce a large number of variables to a meaningful, interpretable and manageable set of factors when the situations arise. A principal-component analysis transforms all the variables into a set of composite variables that are not correlated to one another.

Viability test:

It is focused to find out the relationship among the variables and the construct through calculating the inter relation among them. i.e.: it is evaluated the fact 'what is expected through the analysis was measured correctly'. It is analyzed under the two constructs separately as follows:

- **Technology Competency**

Technology Competency was measured through four sets of variables with different indicators linked to different questions. The below mentioned factor analysis confirmed how much each variable explains and measures the concept correctly.

The analysis informs that all the variables have explained above average relation to the main construct Technology Competency (Appendix 12). Especially *Innovative and Creative ability*, *Internal and External Exposure* and the *Attitude and Perception* performances explained the concept to a very much greater extent compared with the other variable. The reason being the factors obtained above shows the variables are linked with the construct with above average values.

- **Market Orientation**

Market Orientation incorporated a concept with three variables and below indicates how these variables explained and measured the concept (Appendix 12).

These variables too explained the *Marketing Orientation* concept to a greater extent. Especially the internal factors such as *Competitor Orientation* and the *Inter Functional Coordination* have explained to higher extent while the *Customer Orientation* showed a much lower extent. This could be explained since the targeted industry customers are not meeting face to face for many value chain players and the current buyers in the industry are solely traders and they just act as the mediators in most of the cases. However compared with the *Technology Competency*, the *Market Orientation* concept is explained by the relevant variables in a much stronger manner.

Reliability test:

Under the reliability test it is tested for the consistency of the data. i.e. it is measured the consistency that the results being the same, when the data is gathered over and over again. The two constructs were analyzed in the same manner as follows:

- **Technology Competency**

Following results are obtained for the Technology Competency construct under the reliability test (Appendix 13). The data analyzed are agreeing with a Cronbach's Alpha value with 0.69. Although this value is expected to be above 0.7 generally new studies agree for a value of greater than 0.6 for larger data set like this. Therefore the reliability of the data is established for the construct Technology competency.

- **Market Orientation**

Appendix 13 shows the results of the reliability test performed for the Market Orientation construct. Similar to the above argument under the Technology

Competency construct almost equal value is obtained for the Market Orientation construct. Therefore it also could be concluded that the reliability of the Market Orientation construct is maintained.

5.2 Qualitative Analysis

It is intended to acquire an in-depth understanding of the entire Cinnamon industry behaviour and the reasons concerning such behaviour. The qualitative method investigates why and how type of decision making, but not what, where & when. Therefore the importance of the qualitative method is to analyze the collected data through the qualitative model. This helps to identify the industry real issues at current stand in achieving the research objectives.

For the qualitative analysis the samples have been selected from all three sectors (Plantation, Processing and Marketing) to represent a substantial coverage of the entire industry. The semi structured questionnaire (Appendix 2) is used as a guideline to carry out the discussion to find out relevant information in detail. The stakeholders are selected from various organizations, departments, boards, private institutions…etc. comprising large, medium and small scale operational entities. Most Responders are top level decision makers from the entities (E.g.: Chief Executive Officers, Directors, Deputy Directors, Mangers, Plant/processing Mangers, Presidents and the committee members of Cinnamon cultivators associations…etc.). Other than the top authorities the research has basic discussions in other capacities to get the different views and opinions according to their perceptions.

5.2.1 Operational impact of technology competency variables

Semi structured questionnaire was very useful to gather data from industry stakeholders. The operational issues concerning the technology and their impacts to the Cinnamon industry were the main focus to identify.

Individual perceptions on the industry were targeted on different aspects. It was classified into several groups depending on the degree to which they agree with the respective aspect. Sample taken from different sectors and the summarized operational opinions are considered in the analysis (Appendix 04).

Apart from the summary and high level of indications the rest of the findings were discussed under the following chapters as required. Plantation and maintenance sector has a positive state for knowledge and experience, since the industry has been in operation from many centuries back and the knowledge and experience already has given some amount of contribution to the technological impact.

For innovative and creative state it holds the medium level, which is also reflecting that there is no considerable improvement in the industry. Exposure through external factors such as government assistance and political supports are not taken place within the industry. Also it doesn't have good attitudes or perception with regard to the technology competency at operational level. Lack of technological applications has become the main reason for such behaviour.

Harvesting and Processing sector too shows a high level of response for the *Knowledge and Experience* construct. There are very few technical applications in the industry and most of them are not viable in the long run or not suitable at all. As a result it indicates a low level state for the innovative and creative ability.

It has medium level overall result with regard to the exposure. Further there is an almost equal, medium to low level variation for the attitudes and perception with regards to the operational aspects of technology applications.

Marketing Sector has different types of opinions of the technology operational aspects. Knowledge and experience vary from high to medium level since this sector doesn't incorporate right technology to improve the productivity. Attitude and perception are staying at the medium level too. But exposure is very important for the sector.

5.2.2 Operational impact of market orientation variables

Operational issues regarding the Cinnamon industry are considered under market orientation. This again explores through all three sectors industry involvement to get their views on marketing operation. This has given a great outcome because the responses came not only from marketing and sales sector but also from other sectors providing different views. These responses and views are summarized (Appendix 04) using a Likert scale. It explains how all three sectors look into the operational aspects of the industry.

Plantation sector explores some medium level concern on the customer orientation. But they believe overall marketing operations are not in a satisfactory (at medium level) position. And inter functional coordination is too at the same level. Processing sector is similar to plantation sector but the knowledge and experience is at the top level. Even though the export sector is in positive state of market orientation they believe operational aspects needs to be improved a lot. The sector emphasis the lack of identification of new markets and manufacturing the suitable value added customer oriented products is the major problem faced.

5.3 Summary of Data Analysis

Through the primary data gathered it has been carried out in-depth quantitative and qualitative analysis. The two main contributors were focused with many variables and they were measured through different indicators. Results of these analysis and the interpretations explain that there is not only overall strong perception opinion for the given variables but also positive correlation among the variables.

Qualitative analysis helped to achieve the research objectives and discuss on the findings and the recommendations relative to the industry. Similarly it has been conducted semi structured interviews for all the three sectors. Outcome of this has proved though there is a strong perception for the variables, there is a poor operational aspect in the implementation. This has become the main cause for the industrial and many technological issues in the industry.

Combination of the quantitative and qualitative methods provided substantial contribution to achieve research objectives. The statistical analysis with quantitative interpretations and qualitative judgments helped to arrive at in-depth conclusions of the industry. The following chapter will discuss the conclusions and recommendations of the study.

CHAPTER 6: CONCLUSIONS, FINDINGS, RECOMMENDATIONS AND DIRECTIONS FOR FUTURE RESEARCH

Among many renowned names used for Sri Lanka from the past 'the Pearl in the Indian Ocean' is very popular among the global nations. Most of such names were implying this heavenly country is a splendid, superior one. It is full of many natural resources which can be easily used in achieving the development of the country. The potential to grow almost any type of a plant within the natural conditions is one of the most vital aspects. If this agricultural sector contributes to the economy it will become a vital gift of nature. This kind of an impact is substantial and not privileged by most of the countries. Cinnamon plant has given this contribution from many centuries back for Sri Lanka. Therefore the importance of this study is maximized in improving the industrial technological aspects. Because the ultimate objective of this study is to convert Sri Lanka to a better country through obtaining the competitive edge in the Cinnamon industry.

Concerning this aspect the first section of this chapter discusses the conclusions derived from the outcomes of the quantitative and qualitative analysis followed by the findings in detail. The next section details the policy recommendations to uplift the Cinnamon industry to a positive growth in a consistent manner. At last the direction for future research is discussed to support for future researchers in the related category.

6.1 Conclusions

Cinnamon industry in Sri Lanka is currently not performing to its maximum potential level. But the industry has a strong belief if the appropriate measures are under taken effectively, the industry could be carried towards a profitable venture with the minimum effort. It becomes a reasonable aspect, since the industry is native to Sri Lanka. Therefore simultaneous development of both the products and processes are crucial with the support of modern technological applications.

This research study revealed that there is a positive thinking and good hopes with regard to the industry growth potential. But the poor operational implementations become a real cause in many issues. In summarizing the research study it could be explored and drawn the following conclusions:

- The quantitative analysis revealed that the entire industry is in a positive perception and believes that the technological applications and marketing strategies are very much important aspects of the industry

- In the qualitative analysis, it was explained the importance of the application of operational aspects which could be generalized to the industry in increasing the Cinnamon yield. Further it explores the gravity of some key areas which give a high impact to the industry growth (e.g. Price sensitiveness of the export market under comparative conditions)

- The outcome of the statistical Factor analysis revealed most of the variables explained the contributors of the industry. Therefore it is a necessity to get the support in an appropriate manner in overcoming these focused industrial issues.

- Correlations of the constructs *Technology Competency* and *Market Orientation* are significant for the variables defined as per the conceptual model. It indicates that there is a common understanding of the issues interrelated among each sector within the industry.

- The observations further emphasize, there are some related sectors that are comparatively performing well in the export market (The product range which incorporated Cinnamon as a raw material for many essential industries). If these products (Specially Cinnamon bark oil) could be manufactured while overcoming basic issues then it will be a great influence to perform more effectively in the export market.

6.2 Findings

Focused group discussions, direct interviews and indirect discussions were held with the stakeholders of the industry. But more concern was given to the value chain players in the Cinnamon industry. There were many important aspects found out regarding the entire activities of the industry. But the major important findings were discussed as follows:

- The final market price of the Cinnamon Quills is decided by the existing buyers at most of the time. Because these few buyers had developed high bargaining power over the situation and well organized to match the situation.

  Since price is the major factor directly affecting the progress the current situation is discouraging them to stay in the industry. Because the low margins they receive will not be enough even for carrying out the next cycle of harvesting. Therefore it hinders the sustainable development of the industry as planned.

- These quills have a standard length (106.7 cm), weight (45kg) in order to facilitate the exporting process by being packed inside of a container. But these standards were also imposed by the importers to support their own processing activities in the next step of value addition which is not exposed to us. The importers therefore dislike the products being diversified by our value chain players since it becomes a problem for their existence.

- In the plantation sector one major issue is that most of the trees/ bushes are very old. Some are even more than few centuries years old. So it needs to be replanted with the assistance from the necessary institutes and incorporate the newly developed species of Cinnamon which provide increased yield.

- Most of the planters are fed up with the industry and keep away from the plantation. They do not pay their fullest concentration/ contribution due to the attitudes and/or poor opinions of the industry. This negative perception needs to

be changed immediately and convert the thinking pattern to a positive direction through motivating them.

- ❖ The supportive activities such as providing fertilizers at reasonable price, providing necessary irrigation arrangements, providing high tech processing centers to get a high quality product, consult the planters and related value chain players…etc. should be concerned and provide them as required.

- ❖ Traditionally Cinnamon is cultivated as a mono-crop in large holdings. At present about 90% of Cinnamon holdings are cultivating as a mono-crop .There is a possibility to carry out the intercropping cultivating method with Coconut for Cinnamon plantation and improve the revenue. About 10% of the holdings have Coconut as an intercrop, and in areas such as Ratnapura and Kalutara it was found cultivated with other types of perennial crops as well. Therefore most of the small and medium planters don't practice or not willing to practice this method as an alternative mechanism in the field. The reason is these planters were not fully educated on implementation of the intercropping cultivation methods and also it doesn't seem to suit the market need at their individual levels too. But most importantly it will improve the productivity of the land.

- ❖ Cinnamon processing steps concerns most of the traditional applications and practices which lead to deteriorate the quality and on the other hand increasing the cost. Especially the peeling process is taken place in a traditional manner with the involvement of intense labour resource. This process needs to be changed by incorporating the new technology. Although there are some new technological applications introduced and incorporated in the field, their viability needs to be evaluated for practical applicability, since most of the users dislike using some of them.

- ❖ Cinnamon leaf oil processing incorporates leaves that were left out after using for the distillation process. It is a productive firing material for the industry but the environmental pollution is at a very high level (Figure 6.1). Neighbours'

complaints have increased over this pollution problem and it needs a quick solution.

Figure 6.1 : Environmental Pollution at Leaf Oil Stills

- There is a gap between the Research institutes & relevant authorities and planters & processing sector due to the lack of communication and confidence. This is mainly because of the poor understanding between those two parties.

  Further some of the proposed research findings which are unsuitable and has become hard to implement in practice lead to develop the distrust towards them. As such the industry needs the assistance from research institutes in a high level with proper practical applications.

- It needs to have a continuous assessment for any technological application from time to time. It will help to maintain or upgrade the standard with the satisfactory improvements. This has not taken place for some applications on a regular basis and therefore the process efficiency has come down. The tools & equipment

associated with the processing process has not been upgraded since many years back.

Figure 6.2 : Set of Hand Tools used for Cinnamon Processing

- One important factor is the necessity of giving the correct status, recognition and prestige to the industry related employees. This social factor plays a major role in all levels not only to keep the current employees but also to get new generation involvement in the industry. This lack of recognition at the lower level will create scarcity of labour in the long run and there won't be any development. Some organizations have considered this aspect and have produced some Tele-dramas focusing on improving the recognition and changing the attitude within the society (Specially GP de Silva (Pvt.) Ltd.).

  Although up to 35-50% of the sales revenue of finished products is paid as wages which is an above average rate compared with the market conditions, due to the social attitudes the younger generations of peelers don't not readily involve in the industry.

- Current product portfolio should be improved by incorporating more technological applications. In the mean time manufacturing of more value added products also should be focused to suit niche markets exist in local and global context. This is primarily a marketing issue faced by the industry since there is no any strategy to exploit new markets and even the customer needs. This is indeed a necessity if the industry wants to perform high and earn more returns.

- ❖ Cinnamon promotion activities are not incorporating Cinnamon brand development activities which affect positioning of Sri Lankan products in the global market. This will give resistance not only to cater up-end market segment but also to generate revenue from the high markups.

  The government very recently launched '*Ceylon Cinnamon*' brand promotion activities but it needs to be speed up and broaden.

- ❖ Lack of awareness creation activities and poor involvement in trade promotions to identify new market segments is another crucial aspect for the development of the industry (i.e.: more International trade fairs and advertising campaigns to promote True Cinnamon).

- ❖ Finding peeling labour with high skill is very difficult and on the other hand they demand very highly. This job was traditionally done by a special group of people and now that trend has been changed and social groups which are not traditional peelers are also carrying out the same. At times the skilled peelers scarcity seems to be a limiting factor in increasing Cinnamon production.

- ❖ Cinnamon leaving the farm gate includes a high amount of moisture. That is the reason why all traders have to dry the product and grade them as necessary. This indicates that while the Cinnamon being transported along the trade channel, due to the presence of moisture it starts to deteriorate the quality. That type of quality degradation could not be improved to satisfactory level even after drying at the latter stages. Almost 40% of the volume will have to be degraded as low quality products even after reprocessing. Such low quality products are exported sometimes at lower price and the balance will be sent to the local markets directly. Therefore this will result in a loss of export volume and a loss of foreign exchange income. That estimated loss will be about Rs 70 million per year.

- ❖ Even after drying to about 30% of the volume, exporters get only 60% of the avail volume as Grade 1 Product. When we analyze the trade channel it is

obvious that a large amount of volume gets dried at each point along the channel. As much as 83% of the volume of Cinnamon bark products are dried and treated with Sulfur at the wholesale level. Therefore a considerable proportion of Cinnamon bark products in the local markets are in inferior quality.

- Lack of basic economic infrastructure, high production cost, shortage of skilled labor and low labor productivity and lack of rural credit mechanisms were identified as main problems encountered by the growers. Further their future prospects through institutional interventions in Cinnamon production are at very low level.

- The local merchants purchase the major portion of the leaf oil directly from distillers and most of the distilleries are single owned, homemade, low efficient, outdated and need modification. Facilities also available in distilling sheds need modifications to abide with quality requirements.

- Low price and market fluctuation are the major problems faced by the distillers. The amount of leaves available for processing (average 415 bundles/ month) is decreasing due to seasonal supply, labour shortage, utilization of leaves as mulching material in plantations…etc.

- Unlike the leaf oil market, the bark oil market remains in few hands of exporters, who have the direct linkage with the foreign buyers. They generally keep their technology as a secret weapon even without disclosing to the employees. They are satisfied with the quality levels of the product being supplied to the market as per the cost effectiveness, appropriateness of the technology, oil quality and easiness of handling.

- Machineries and equipment so far developed for Cinnamon processing is proved to be an appropriate approach to break down the social stigmas associated with Cinnamon peeling. It will help to convert Cinnamon processing in to a flow line operation while attracting more people to combat the labour shortage and expenses incurred on labour. By deskilling these tasks by mechanization and

automation it will help to design flow line production process enabling much greater productivity.

- ❖ High quality Cinnamon receives a premium price in the market. Although the peelers are paid on income share basis, they tend to make medium grade quills more. Because the quantity of fine grade quills a peeler can produce within a day is less. This will lead to less production volumes of high quality Cinnamon.

- ❖ Currently Peeling and post harvest operations are carried out under poor hygienic and working condition. They will not meet the Euregap, HACCP, Food Safety, Health & Safety and Phyto sanitary standards. Only very few companies have received the GMP standard and they are relatively performing well.

a. b.

Figure 6.3 : GMP certified Company Employees a.) at work b.) the Uniform

- ❖ Although grown in Sri Lanka for centuries there has been a little improvement in productivity in peeling technologies as well as the distillation process. Therefore there has been no improvement in harvesting, post harvesting and leaf distillation technologies over the years.

  ITI has introduced improved versions of distilleries already but however those are still to be popularized among the Cinnamon industry.

6.3 Recommendations

This section focuses the views provided by the industry professionals, findings of the research and already avail literature to propose policies and strategies in promoting the Cinnamon industry to gain the edge. Therefore following recommendations and polices were suggested in almost the same logical order to implement:

- Since there is no clear understanding of direct and indirect customers, the level of demand, the supply and the usages of these separate products…etc. which are very vital factors of the entire industry, it is the most important aspect to design and conduct an accurate and effective market survey for the entire industry. Up to date such a survey has not been carried out for the target markets. Further finding out the purposes they incorporate Cinnamon is a challenge and it is of great importance.

  At the same time these market research and development activities should be done in a continuous manner from time to time. This will become very essential not only to identify new market segments with product diversification opportunities but also to keep moving the volumes in a profitable manner with the competition.

  It is also very important to communicate with the customers and obtain the feedback for further development of the products. These structured market feedback mechanisms will help not only to develop the existing market & identify new market segments but also to implement strategically controlled measures through proper monitoring and evaluation systems to take the industry into the right direction.

- Developing a strategic plan for the entire Cinnamon industry is very vital at the next level. The entire stakeholders should be gathered together and their responsibilities and the expected supports should be clearly defined and the short term and long term objectives, targets, visions and missions should be clearly identified. Then it should be communicated to each party in the entire industry

and a proper action plan on individual basis should be prepared and submitted with clear deadlines and milestones.

- *Direct seeding in the field method* and *Seed bed/Cinnamon ball method* are two of the methods incorporated by the farmers popularly. But these methods are not recommended. Seeds are sown after filling the hole with top soil in the first method and due to high competition between seedlings it was observed a poor rate of establishment. In the latter method, raised beds of about 1 m breadth and convenient length are prepared to facilitate good drainage. Planting holes of about 4 cm in diameter and 4 – 8 cm in depth are prepared at 10 x 20 cm spacing using a peg. After filling these holes with some fine structured soil and 7 – 10 seeds they are covered with a layer of soil and may be watered daily if necessary. Artificial shade is provided until plants are about 12 cm tall and the removal of the shade is also done gradually.

  Therefore the *Raising seedlings in poly bags method* should be followed and recommended for every plantation. In this method polythene bags of 12.5 cm x 20 cm size and thickness of 250 gauges with a potting mixture composed of equal parts of top soil and well decomposed cow dung used to raise seedlings. At least 8 seeds per bag is sown and thinning out is done if necessary to keep 5 to 10 seedlings per bag. Field planting is done after 3 months.

- The harvesting of the Cinnamon should be carried out within the proper time period to achieve benefits in two folds. They are the quality of the tree is saved for the long run and higher quantities of the bark yield are available.

  When there are no flowers and fruits in the tree the harvesting process should be carried out. The tree stems should look like as shown with watery surface:

Figure 6.4 : The Cinnamon Stem with Watery Surface : Suitable for Peeling Process

- Educating and training the peelers will help to make them understand the importance of making quills of finer grades. Therefore the training of new peelers is too important to make a good quality product.

  Alternatively, product diversification without depending only on quill form of Cinnamon as well as the attempts in mechanization of peeling under process improvement help to revitalize and safeguard the Cinnamon industry. In this endeavor new market opportunities and strategies have to be developed for product diversification.

  Comparing with the other facts and costly peeling process with labour-intensive nature for quills preparation becomes the most acute problem in the Cinnamon Industry. Hence the said mechanization of the peeling process is very important in order to safe guard the Cinnamon industry in the future.

- The environmental pollution taken place at leaf oil stills should be analyzed and the corrective measures should be suggested as necessary. Proper standards should be introduced for such situations after carefully analyzing the process involved. The contents should be analyzed and subsequently the economic aspects of using the Cinnamon leaves as the firewood material should be evaluated and compared with the other purposes (e.g.: as organic manure for plants).

- The most critical issue giving limitation for the entire industry is the shortage of high quality Cinnamon to fulfill the export volume. Therefore necessary measures should be implemented to improve the Cinnamon cultivation, since there is a good opportunity to cultivate in the Northern & Eastern parts of the country as well. The potential lands for Cinnamon cultivation should be explored and promoting measures could be easily incorporated according to the current level.

- The cultivation has to make use of bio technology to cultivate short term high quality breeds to generate more income to the planter with improved productivity aspects. Therefore more concern on developing the research centers to improve the R&D activities should be focused with intended long term and short term targets to align with the industry strategic vision.

  The necessary infrastructure and other required facilities should be provided through proper mechanism for the cultivators as per their individual requirements. This will motivate more people to get involved with Cinnamon planting. Thereby the technology aspects could be extended to areas such as water irrigation systems, manufacture of high yield Cinnamon fertilizers and novel methods to implement intra crop which will enhance the productivity…etc.

- Since the majority of planters are small holders (more than 80%) it is essential to have a subsidy schemes (E.g.: Fertilizer subsidy) and other necessary supports (arrange systems to collect Cinnamon harvest and/or quills to a regional hub at a good price) to take the daily operation smoothly.

- At the same time it is very vital to pre plan for the unexpected crisis situations which may arise due to natural hazards like Cinnamon diseases, market variations in the export market, the natural disasters like Tsunamis…etc. Therefore there should be some pre arranged relief mechanisms to assist. These supporting activities could be arranged through the relevant Cinnamon industry related authorities at regional levels.

- Identifying the right technology applications well suited for Sri Lankan environment and convincing the value chain players for the purpose of motivating them to achieve high productivity are very essential. Relevant Cinnamon related authorities should be given the responsibility to create such awareness coupled with the penetration mechanisms. These activities should be introduced to build the good relationships and improve the thrust among the industry players as necessary. These types of ongoing arrangements help to build the confidence among the entire industry enabling the whole industry to proceed towards a common objective.

- Manufacturing of value added products and diversification strategies to suit the global customer base are the timely requirements. In order to achieve this there should be a good understanding and strong relationship among the entire value chain players (as discussed above) and in this case especially it should be targeted and aligned the all three sectors plantation, processing & marketing to obtain the competitive edge.

Therefore it is a very important aspect to form the clusters among the different sectors and take improvement strategies within the group in meeting the industry objectives. Through this clustering approach the entire sector will be benefited and the collectivism of the members within the same category will enable them to explore many new avenues to develop and reach a more common and sovereign situation.

Especially the Cinnamon oil distillers don't have a proper formal association or above highlighted clusters for the market promotional and expansion strategies to sustain within the economies of scale limits of the industry. Therefore strengthening of distiller associations and clusters have a positive move towards empowering them in marketing and sharing the knowledge towards sustainable development.

- At the same time government should speed up the promotion of the *Ceylon Cinnamon* or *True Cinnamon* brand name globally to identify new market requirements and policy strategies which have to align with industry volume growth. Although there are few quality standards available, it will be a necessity to form a Ceylon standard aligning with the existing ones since this product is native to Sri Lanka. Because it provides a sense of royalty and ownership to Sri Lankan soils in the minds of customers due to the historical value related to Sri Lanka.

  The balancing duty structures to protect the industry in all directions and to penetrate the new global markets through viable agreements/ joint ventures/ foreign collaborations are other valuable aspects of immense consideration for the development.

- It should be focused the differentiation strategy to position the Cinnamon products as necessary. There is a high need to uplift the industry standards to a top level to gain the due respect (i.e: similar to Tea sector/ Apparel sector…etc.). This recognition could be done through generating high markups by penetrating new upend market segments and by looking at the industry through new dimensions like promoting products with green concept and eco friendly environment…etc. However it is the recognition and perception that needs to drive forward from the community for the purpose of protecting the entire industry.

- Own capital is the main source of finance in the Cinnamon industry. They don't have enough capital to invest in more diversified areas, research and development activities or any other quality upgrading systems and mechanisms. Therefore it is needed to establish certain mechanisms to provide credit and other required facilities for the expansion and improvement of the technology to develop the entire industry.

- A technology shift for the modification of traditional plants for bark oil distillation is very essential. There are occasional moves for the extraction with Super Critical Carbon dioxide (CO_2 Extracts) for quality markets. These CO_2 extracted Cinnamon products seem to have higher demands from the developed countries. (PGI Exports Limited has a one pilot plant which can produce about 25 kg/month. This rate of production is far below to meet the required demand. The cost of a similar type of commercial plant is estimated to be around US$ 1.2 mln). Therefore such plants could be targeted to install through proper technology transfer mechanisms.

- There is an information gap for the distillers on avail technology as well as the market information. Most of the processors get the information from private and foreign companies or from ITI. Establish sources of information to provide required information through electronic media for this important sector to arm with latest trends and demands.

Non availability of the expertise in the field of essential oil fractionation, expensive technology, and hidden markets are the barriers encountered in the bark oil trade. The incorporation of the modern technology, research in to the specific areas, training of personals giving foreign exposure and international collaborations are the strategies to overcome these barriers and develop the bark oil sector as needed.

6.4 Direction for Future Research

The way this research was conducted helped a lot to achieve the objectives in a more logical manner. But there are many ways with more opportunities to carry out these research activities in many directions. It gives an empirical and theoretical significance for academic purposes and for the entire industry to cause direct impacts for the economy of Sri Lanka. Directions of the future research could be carried out to find empirical and theoretical aspects as follows:

6.4.1 Empirical direction

- This research has practical difficulties and limitations of getting validity of certain data especially related to the data collected on qualitative aspects. In that respect it is a necessity to stay for a considerable time period in relevant sectors to evaluate and measure the validity of these findings. That is an important area to be studied and allowed to make the right industry decisions based on the valid findings. This will automatically convert the entire study more towards qualitative aspects and the constructs associated in this research should be directly measured through their individual level of performances.

- The other important research that could be carried out simultaneously is identifying the practical solutions for the operational issues. It may be practical, since the research study had been done while in the actual operations. Those solutions have a greater validity not because of its practicability but it also leads to motivate and help the industry to overcome certain issues and to improve as an industry in a positive direction.

- Since the technology is one of the influential criteria to gain the competitive edge, there is the potential for a research to be conducted on how the technology impact could affect marketing trends in other plantation sectors in Sri Lanka. i.e.: Since Sri Lanka has the strength of producing best quality Cinnamon and other spice products research could focus in to those sectors as well. Therefore it will contribute very much to the Sri Lankan economy.

- Finding solutions for the environmental pollution caused by the stills is of great importance. Therefore it is a better research area to find out suitable practical solutions for this boiling process. Since the Cinnamon leaves used for the distillation process would be a better solution with some improvements for the firing material.

- Also at high level it could be suggested to perform the research on finding out the ingredients of the cola soft drinks. Then it could be extended towards famous cola drinks like Coca Cola, Pepsi…etc. drinks. If it is found that there is a considerable amount of Cinnamon is included, then that is where it opens up many other opportunities.

6.4.2 Theoretical direction

- Identifying the relationship between the Cinnamon industry with the technology competency & market orientation is very beneficial. Because the possibility of testing hypothesis which had been built as a proposition from the variables will help to analyze many different behaviours under various conditions. This will also provide confidence level of the research sample and prove the significance of the relationship with the industry. Therefore it will greatly help to simulate situations very effectively and plan necessary decisions depending on the various situations.

- One research objective might be to identify the level in which the technology stands in Sri Lankan Cinnamon industry. It could be done mostly through qualitative findings due to certain limitations. Therefore studying the prevailing technological aspects in another country will help to benchmark the production processes as required. Identifying the relationship of the technology standards of the two countries could be done through the quantitative methods, since the results of qualitative finding propositions are weak. This gives a greater impact to identify Sri Lankan comparative technology stand with respect to Cinnamon industry and to take relevant measures to gain the competitive edge in the export market.

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Appendix 01

Meetings held with the Cinnamon Stakeholders

Discussions were held with the following Officials in finding out the necessary macro level information with respect to the Cinnamon industry:

Ms KT Paligasinghe	-	Deputy Director, DEA, Galle
Mr Saman Ranasinghe	-	Fmr. President CINCA Galle, Cinnamon Planter
Mr Nihal De Silva	-	Managing Director, GP De Silva (Pvt.) Ltd.
Mr KU Thabru	-	Operations Manager, GP De Silva (Pvt.) Ltd.
Mr C Jeffrey Roice Perera	-	Stores Manager, GP De Silva (Pvt.) Ltd.
Mr KL Wimalasena	-	Director, LB Spices (Pvt.) Ltd.
Mr WT Rathnasiri	-	Cinnamon Planter and Processor
Mr NHM Senanayake	-	Cinnamon Planter
Mr KTG Kumara	-	Cinnamon Oil Producer
Mr Kingsley Perera	-	President-CINCA Galle, Cinnamon Oil Producer
Mr Elton Perera	-	Cinnamon Oil Employee
Mr Asitha	-	Cinnamon Planter

Also the pilot survey was conducted through meeting the value chain players highlighted above. Further the following large scale Cinnamon manufacturers were met in conducting the interviews.

Name	Factory Address
Mr Chandana De Silva (Galle)	Eththdiya Estate, Kiralagahawela, Meetiyagoda
Mr G Lal De Silva	Katuwila Estate, Ahungalla
Mr Devmith N Kaggodaarachchi	Kosggodaarachchi Watta,Cinnamon Factory, No182/A, Metiwala,Telwatta
Mr Wijith Jayathilleke	Dasanayake Wallauwa Plantation, Nape, Kosgoda
Mr Shelton	Diduwa Estate, Ambalangoda

As stated above the CINCA member associations were selected as follows for the interviews. 7 associations out of 57 CBOs were selected in this study. Total membership base of CINCA is 4,944 and since this is relatively a larger scale

database. Therefore in selecting the relevant number of value chain players it was careful enough to selected on proportionate basis and to cover as much geographical area as possible.

Farmer Organization	***Secretary of the Organization***	***Address***	***No. out of***
Mithuru Kurudu Farmer Association	TT Ariyaratne	Withanagedarawatta, Nakiyadeniya	35/140
Kiridiela Cinnamon Association	WT Ratnasiri	Kiridiela, Meetiyagoda	30/88
Natagama Cinnamon Farmers Association	LA Robert	Natagama, Meetiyagoda	30/181
Dorala Cinnamon Cultivators Association	AA Premalatha	Siridamma Road, Batapola	25/92
Maduwa Organic Cinnamon Farmers Association	Gamini Gokula de Silva	Maduwa, Balapitiya	5/23
Sithumina Cinnamon Farmers Association	HH Chandraratna	Maddewila, Ethkadura	25/84
Sinha Cinnamon Cultivators Association	TG Seelawathi	Gurusinha goda, Ampegama	20/41
	Total		170/649

Appendix 02

Semi-Structured Interview Guide

Interviews have been conducted through face to face discussions by visiting their business premises or offices. It helped to acquire in-depth knowledge of the industry while observing their current position within the plantation, processing or marketing sector. The interview begins with a brief introduction highlighting the importance of the research study. Subsequently research objectives and how the responder's answers & suggestions will affect final outcome of the study were briefed as necessary.

Interviewee will be reminded the duration of the interview (takes approximately 30 minutes) and answers or views are only written down without any form of recording and the data is used purely for the academic research purpose while protecting the privacy and the confidentiality.

The interviewer will then move into questions as follows:

- Opening questions (to get participants talking/ to help ice break and feel comfortable). But limited to 30-45 s.
  - Some views of the current situation in company/ country as necessary
  - Family background
  - Tell me something about what made you to arrive to this industry
  - Tell me about your experience in the Cinnamon industry
- Transition questions (to move into the key questions)
  - Tell me how your industry experience helps/contributed to the relevant sector that you are currently engaged (plantation/processing/marketing)
- Key questions (to elicit information about the key areas)
  - <u>Plantation Sector</u>
  - Why do you think people are reluctant to actively involve with Cinnamon plantation/ why people are getting away from the industry?

- Why some estates cultivate high crop but not others?

- What are the major constrains (issues) to generate profitable income from Cinnamon land? Your proposed solutions
- Why do you think some proposed solutions could not be implemented as expected? If so what are your recommendations to overcome those practical problems?
- Why do you think government should support the industry? How could it be done?
- How do you think technology could assist the Cinnamon plantation sector to improve the productivity?
- Any suggestions or views to upgrade the Cinnamon plantation sector

o <u>Processing Sector</u>

- Why do you think processing plays a greater role in a country like SL?
- What are the major issues faced in the processing sector and your proposed solutions
- Tell me something about positive & negative impacts of traditional methods of processing mechanism?

- Explain practical difficulties of getting used to novel methods over traditional uses? (E.g.: Social attitudes or lack of training)
- Explore your views up to what extend technology could assist in the processing sector? (not only improve the process effectiveness but also improve the cost efficiency)
- Explain practical difficulties that could be faced at the time of technological implementations?
- Where do you think Sri Lanka stands with regard to technology applications to uplift the industry's standard?(E.g. Quality standard to meet international market requirements)
- What are your suggestions to improve the product/process effectiveness and cost efficiency of the Cinnamon processing or manufacturing sector

- Marketing & Sales Sector

- What is the current market (international) situation for SL Cinnamon products? (according to demand &supply)
- Explain industry issues pertaining to sustain the Cinnamon market share in the global market? And your proposed solutions
- As price plays a major role in the global market up to what extent it affects our international market share?
- Your views with regard to other external issues which could affect the market demand? (E.g.: Currency fluctuations & world market demand)
- Why do you think marketing communications (to create awareness) & sales promotion activities (to build the brand image) are playing a greater role to improve the market share?
- Briefing the type of constrains of identifying potential new/niche markets?
- Are we in a position to supply Cinnamon products to meet international competitiveness? (E.g. value added products)
- Do you think brand image could play a greater role in the global market?
- Explore your views by emphasizing types of support that could be done by technology to Ceylon Cinnamon image in the global market?
- What are your suggestions and recommendations to take the industry towards the positive direction while maintaining the profitable growth in a consistent manner?

- Probe or follow-up questions (to elicit more information during the discussion)
  - Tell me more about that……
  - Would you explain further…..
  - Has anyone else had a different experience…?
  - Why do you say like that…..?
  - When do think it happens…….?

- Ending questions (to summarize information and bring closure to the discussion)

- Considering the discussion, please summarize the top factors that would be most helpful in driving the Cinnamon industry (considering entire 3 phases plantation, processing and marketing) to a positive direction
- Considering the discussion, please summarize the top three barriers or challenges for implementing in the Cinnamon industry
- Considering the discussion, please summarize what is your personal opinion in overall industrial point of view and proposed solutions to overcome the above mentioned barriers and to become a greater contributor to Sri Lankan economy

Appendix 03

Questionnaire I: Technology Competency in Sri Lankan Cinnamon Industry

Select the best suitable answer and mark "X" in the relevant box

Abbreviations:					
5	:	Strongly Agree	4	:	Agree
3	:	Undecided	2	:	Disagree
1	:	Strongly Disagree			

No.	Question	1	2	3	4	5
	Knowledge & Experience					
1	Amount of knowledge to provide technical support to fulfill the basic operation					
2	Period of experience to carry out the duties successfully					
3	Ability of acquiring technology knowledge & implement in a more practical manner to support organization strategies					
4	Ability of understanding any operational issues in a technical point of view & provide technological solution to improve operating effectiveness					
5	Ability to use technology as a tool to increase the productivity					
6	The extend of making use of experience to overcome any practical issues which come across during the operations					
7	Capability of making use of limited resources internally and handle external factors in appropriate manner to meet technical objectives					
8	Having adequate knowledge & experience to evaluate the technological performances					
9	Ability of training &developing the staff to build technology competency					

		1	2	3	4	5
	Innovative & Creative ability					
10	Ability of creativity thinking in a innovative manner (novel way) to propose technological solutions					
11	Innovative solution help to improve operation effectiveness (quality & productivity) & cost efficiency (reduce cost /time)					
12	Ability of supporting business /marketing objectives through innovative solutions					
13	The amount of resource/constraints effect for innovate solutions (ability of making use of current resources/working conditions in a effective manner)					
14	Ability of providing social / ethical / environment friendly innovate solutions (reduce legislation & same time to gain competitive edge)					
15	Degree of motivating human resources aspect for the purpose of improving performances of production process					
	Internal & External Exposure					
16	Org: vision align with technological objectives					
17	Internal management to support technological competency					
18	Organizational resources (equipment /materials) assistance to fulfill technological aspirations					
19	Inter & external infrastructure have an impact to provide technological oriented solution					
20	Support organizational culture to improve Technology competency					
21	Get the assistance from latest tech: developments & industry related new findings to improve the current performances					
22	Externally marketing push/pull impact to motivate tech: competency					

		1	2	3	4	5
23	Political assistance to the industry (Political decisions which support technology related industry solutions)					
	Attitudes & Perception					
24	Likeness & positive thinking towards technological solutions					
25	Industrial & social influences for tech: solutions					
26	Overall management perception / attitudes towards technological oriented applications for the production /process system					
27	Extend of motivation of tech: for operational activity (believe it gives positive results)					
28	The amount of technology literacy & also using non obsolete equipment/methods					
29	Complexity of technology & simple understandable proposing methods					
30	Social living standard of the relevant, which leads to have different types of values and perception against technology					

Questionnaire II: Market Orientation in Sri Lankan Cinnamon Industry

Select the best suitable answer and mark "X" in the relevant box

Abbreviations:					
5	:	Strongly Agree	4	:	Agree
3	:	Undecided	2	:	Disagree
1	:	Strongly Disagree			

No.	Question	1	2	3	4	5
	Customer Orientation					
1	Monitor level of commitment in serving customers' needs					
2	Business objective of customer satisfaction					
3	competitive advantage based on understanding customer needs					
4	Business strategy driven by greater customer value					
5	Measuring customer satisfaction					
6	After-sales services					
7	Corrective actions taken immediately					
8	Modifying products / services based on customer ideas					
9	Meet customer quality expectations					
10	Pricing are appropriately designed according to customer expectations					
11	Supplies on time without any shortage					
12	Promotional campaigns meet customer awareness objectives					
	Competitor Orientation					
13	Rapidly responding competitive actions					
14	Sharing information on competitors' activities					
15	Discussing competitors' strengths & strategies					
16	Differentiation from competitors					

		1	2	3	4	5
17	Targeting opportunities for competitive advantage					
18	Analyzing evolution of substitutes					
19	Precautions been taken for new entries					
20	React with strategies for suppliers bargaining power					
	Inter Functional Coordination					
21	Integration to serve target customers' needs					
22	All activities are responsive to each other's needs & requests					
23	Activities (Plantation: Processing: Marketing☺ heads try to identify total market requirements					
24	Communicating market experiences among the activities processes					
25	Everyone understands how to create customer value					
26	All three processes are working as a team					
27	Sharing resources with other sections (among process when it is necessary)					
28	All sections involving in product / service modifications					
29	Informal information exchange to fulfill industrial expectations					
30	All three processes common perception is to achieve overall business objectives					

Appendix 04

Operational Impact of Variables

Technology Competency

	Technology Competency Variable												
	No.	***Knowledge & Experience***			***Innovative & Creative Ability***			***Exposure (Internal & External)***			***Attitude & Perception***		
Plantation and Maintaining		H	M	L	H	M	L	H	M	L	H	M	L
Summarized Total	***10***	***9***	***1***	***-***	***1***	***6***	***3***	***2***	***3***	***5***	***-***	***8***	***2***
Harvesting and Processing													
Summarized Total	***10***	***7***	***3***	***-***	***1***	***3***	***6***	***1***	***8***	***1***	***-***	***5***	***5***
Marketing and Sales													
Summarized Total	***10***	***4***	***5***	***1***	***6***	***4***	***-***	***5***	***3***	***2***	***2***	***5***	***3***

Market Orientation

	Market Orientation Variable									
	No.	***Customer Orientation***			***Competitor Orientation***			***Inter Functional Coordination***		
Plantation and Maintaining		H	M	L	H	M	L	H	M	L
Summarized Total	***10***	***6***	***4***	***-***	***2***	***6***	***2***	***1***	***9***	***-***
Harvesting and Processing										
Summarized Total	***10***	***9***	***1***	***-***	***4***	***5***	***1***	***5***	***5***	***-***
Marketing and Sales										
Summarized Total	***10***	***10***	***-***	***-***	***9***	***1***	***-***	***5***	***4***	***1***

Appendix 05

Cinnamon Cultivation Information

Cinnamon Lands Distribution – (On extent of land)

District	Classification of lands according to the extent							
	< 0.25 ha		0.25< & <1 ha		>1 ha		**Total**	
	Quantity	Extent	Quantity	Extent	Quantity	Extent	**Quantity**	**Extent**
Galle	27,151	2,557	8,219	4,411	1,240	2,852	**36,610**	**9,820**
Matara	22,602	1,883	6,345	2,830	1,060	2,669	**30,007**	**7,412**
Ratnapura	7,718	1,632	2,285	1,202	102	308	**10,105**	**2,562**
Kalutara	8,337	926	2,035	1,015	191	422	**10,563**	**2,363**
Other							**6,482**	**2,521**
Total	65,808	6,418	18,884	9,458	2,593	6,281	**93,767**	**24,678**

Source : Technical Publication-DEA, 2005

Extent of Cinnamon Cultivation on District Basis

District/ Province	Land extent (ha)	Remarks
Galle District	10,644	***Major Areas***
Matara District	7,926	
Hambantota District	2,313	
Kalutara District	2,633	
Central Province	232	***Minor Areas***
Sabaragamuwa Province	3,269	
Uva Province	112	
Colombo	151	
Gampaha	117	

Source: Technical Report – DEA, 2006

Appendix 06

Various Purposes of Cinnamon Sticks

Cinnamon Sticks prepared to transport to Colombo for firewood purpose

Ornamental Products made by Cinnamon Sticks

Appendix 07

Cinnamon Exports from 1998 to 2008

Year	Cinnamon Quills		Cinnamon Leaf oil		Cinnamon Bark oil	
	Volume (MT)	Value (millions.)	Volume (MT)	Value (millions.)	Volume (MT)	Value (millions.)
2002			61	108	5766	150
2003			150.8	114.8	4430	109.5
2004			141.6	104.5	5535	138.2
2005	12,365	5,855	187.7	131.2	5818	132.6
2006	12,336	6,879	206	250.	5900	124.8
2007	12,138	8,380	256.5	433.9	5811	140.2
2008	12,350	43,450	114	262.2	7013	157.9

Source: Sri Lanka Customs, 2002-2008

Appendix 08

Cinnamon Cultivation Details

Variation of the Spacing with the Land type

Land Type	Spacing of the Cinnamon plants (m)
Flat land	1.2 m x 1.2 m
Flat land/Gentle slope	1.2 m x 0.9 m
Steep land	1.2 m x 0.6 m

Recommended Fertilizer Mixture

Composition	Ratio by Weight	Mineral content in the Mixture
Urea	2	N – 23%
Rock phosphate (28% P_2O_5)	1	P_2O5 – 07%
Muriate of Potash (60% K_2O)	1	K_2O – 15%

Fertilizer requirement for young plantations

Year	Fertilizer requirement (kg/ha/annum)
1st year	200
2nd year	400
3rd year	600

Source : Technical Publication – DEA, 2006

Appendix 09

ISO 6535:1997 for Cinnamon Classification

Category	Maximum Quill Diameter (mm)	Minimum No of Quills per kg	Rough Qty Max. %	Minimum length of a Quill (mm)
Alba	6	45	0	200
Continental				
C00000 Special	6	35	10	200
C00000	10	31	10	
C0000	13	24	10	
C000	16	22	15	
C00	17	20	20	
C0	19	18	25	
Mexican				
M00000Special	16	22	50	200
M00000	16	22	60	
M0000	19	18	60	
Hamburg				
H1	23	11	25	150
H2	25	9	40	
H3	38	7	60	

Note : The quality level is in the descending order starting from the high quality being the Alba grade.

Appendix 10

Descriptive Statistics

Technology Competency Variables

	N	Minimum	Maximum	Mean	Std. Deviation
Knowledge & Experience	170	3.3	4.8	3.959	.2859
Innovative & Creativity	170	2.7	4.5	3.584	.3375
Internal & External Exposure	170	2.6	4.4	3.541	.3299
Attitude & Perception	170	3.1	4.6	3.787	.2583
Valid N (list wise)	170				

Market Orientation Variables

	N	Minimum	Maximum	Mean	Std. Deviation
Customer Orientation	170	3.2	4.6	3.879	.2540
Competitor Orientation	170	2.8	4.4	3.514	.3307
Inter Functional Coordination	170	3.1	4.3	3.740	.2283
Valid N (list wise)	170				

Appendix 11

Correlation Analysis

Technology Competency Variables

		K & E	I & C	I & E	A & P
K & E	Pearson Correlation	1	.147	.150	.158*
	Sig. (2-tailed)		.055	.051	.040
	N	170	170	170	170
I & C	Pearson Correlation	.147	1	.294**	.138
	Sig. (2-tailed)	.055		.000	.072
	N	170	170	170	170
I & E	Pearson Correlation	.150	.294**	1	.282**
	Sig. (2-tailed)	.051	.000		.000
	N	170	170	170	170
A & P	Pearson Correlation	.158*	.138	.282**	1
	Sig. (2-tailed)	.040	.072	.000	
	N	170	170	170	170

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Market Orientation Variables

		Cus Ori	Com Ori	Int Fun Coord
Cus Ori	Pearson Correlation	1	.257**	.231**
	Sig. (2-tailed)		.001	.002
	N	170	170	170
Com Ori	Pearson Correlation	.257**	1	.377**
	Sig. (2-tailed)	.001		.000
	N	170	170	170
Int Fun Coord	Pearson Correlation	.231**	.377**	1
	Sig. (2-tailed)	.002	.000	
	N	170	170	170

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix 12

Viability Test

Technology Competency Construct

Component Matrix[a]

	Component 1
K & E	.508
I & C	.633
I & E	.737
A & P	.629

Extraction Method: Principal Component Analysis. a. 1 components extracted.

Total Variance Explained

Component	Initial Eigen values			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.597	39.928	39.928	1.597	39.928	39.928
2	.891	22.266	62.194			
3	.859	21.467	83.661			
4	.654	16.339	100.000			

Extraction Method: Principal Component Analysis.

Viability Test for Marketing Orientation Construct

Component Matrix[a]

	Component 1
Cus Ori	.642
Com Ori	.773
Int Fun Coord	.756

Total variation Explained

Component	Initial Eigen values			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.582	52.724	52.724	1.582	52.724	52.724
2	.797	26.556	79.280			
3	.622	20.720	100.000			

Extraction Method: Principal Component Analysis.

Appendix13

Reliability Test

Technology Competency Construct

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
K & E	10.912	.427	.214	.483
I & C	11.288	.357	.292	.419
I & E	11.331	.338	.370	.336
A & P	11.085	.427	.283	.430

Reliability Statistics

Cronbach's Alpha	N of Items
.693	4

Market Orientation Construct

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Cus Ori	7.254	.218	.295	.521
Com Ori	7.619	.143	.400	.374
Int Fun Coord	7.392	.217	.393	.398

Reliability Statistics

Cronbach's Alpha	N of Items
.679	3