

## CHAPTER 8



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### 8.0 CONCLUSIONS AND RECOMMENDATIONS

## CHAPTER 8

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#### 8.1 CONCLUSIONS

National yield levels, which have been on a declining trend since 1996, continued to drop further and declined by 4% and reached the lowest level ever on record in 2001. One main reason for production drop is that tapping was abandoned in certain areas in response to poor domestic prices. According to a recent study conducted by the RRISL, tapping has been abandoned in over 8,200 hectare, i.e.6% of total trappable area. Some small holders who employed tappers could not even cover the wage cost. Some other smallholders could not properly maintain the lands due to the low prices that have prevailed over a considerable period of time.

Although with the backup given by RRISL by introducing high yielding clones as well as new field practices, the national rubber yield has been on a declining trend during the last few years. At the beginning of the study, it was emphasized that our raw rubber production is in a downward trend compared to the other emerging countries in raw rubber production like Malaysia, Thailand and Indonesia though we have some sort of competitive advantage in several areas in the rubber industry such as the world largest solid tyre exporter, the first rubber planter in the Asian region, and the 5th largest NR exporter. Researcher therefore made a hypothesis that there can be a major component missing in the whole supply chain of this industry and that would have been the technology component, which is more advanced in above countries.

For that researcher has used the APCTT model, 1988- Increasing degrees of sophistication of Technology components, and the framework for technology based development, technology content assessment developed by Asian and Pacific Center for Transfer of Technology (APCTT)- UN-ESCAP (1988) to assess the technology status of this industry.

According to the model analysis, it can be concluded that technologically Sri Lankan raw rubber industry is lagging behind to the technology status of global industry leaders like Malaysia, Thailand and India and that has resulted in a lower productivity of this industry. According to the statistical analysis, especially lower status of technology factors like Inforware, Orgaware and Humanware as well as non-technology factors like lower number of tappable trees per hectare have affected the Sri Lankan raw rubber industry productivity i.e. actual annual yield per hectare though there are hardly any relationship with the industry

productivity and the status of technoware component. Factors affected to lower the status of each technology component was evaluated with the qualitative techniques like, SWOT analysis, value chain analysis and the cause an effect diagrams and found out that lower consideration on workforce and their education background as well as training and retraining facilities, bad management practices due to the poor Managerial competence, rigid organizational structure has become major drawbacks of this industry. The importance here is not the recommendation of high yielding clones or good field practices by the RRISL, but the proper management of such high yield by the plantations.

Therefore productivity of this raw rubber industry can be mainly upgraded with the upliftment of the workforce as well as the organizational behavior, by incorporating proper management practices and making arrangements for proper information flow.

The World Bank report says that as Sri Lankan rubber commands 15% of the world market for industrial tyres and its top plants have secured a reputation for low-cost, quality goods. the Sri Lankan rubber industry has a competitive edge in natural rubber production, as its production cost is lower than its competitors. Further it says that in 1994, after the private management companies improved plantation operating conditions, productivity peaked at an average of 960 kg per hectare. However, this was much lower than its neighboring producers - who averaged over 1,400 kg per hectare. Although natural rubber, as produced in Sri Lanka, is considered superior. About 60% of the world rubber production is of synthetic variety - with production concentrated in European, American, Japanese and multinational companies.

However, the report says that the differences in properties of natural and synthetic rubbers are gradually reducing, so in the long run, it will be the cost differential that matters. The report also says that world rubber consumption has increased substantially in the last three decades from 8.8 million tons in 1960 to 15.1 million in 1990. Sri Lanka's future in the rubber industry, the report concludes, rests on its ability to compete in the global market, increase high grade rubber productivity and lower the cost of production.

## 8.2 RECOMMENDATIONS

Shortage of dry rubber and latex which are the major output of the raw rubber industry has become the basic problem faced by the Sri Lankan Rubber product industry, which is a growing industry today. According to the research findings, to cater this NR demand for local industry, productivity should be improved with the upliftment of Inforware status, Orgaware status and the Humanware status of the industry and also it is necessary to maintain high stands per hectare.

### *High stands per hectare*

RRI recommend to plant 500 trees per hectare in fields. but due to poor maintenance of clearings, the average actual extent at maturity in Sri Lanka is less than 250 trees per hectare. This is mainly the neglecting infilling during the first 3 years after plantation.

### *Human capital development*

While the various national workforce development initiatives have helped raise skills levels, shift the occupational structure upwards, improve earnings and raise productivity, the findings suggest that more attention needs to be paid to improve the education level of the workforce and the competence of managers. Although the investments in workforce development in the last two decades have raised the education level of the workforce, the bulk of workforce still has secondary qualification and below. About 40% have less than secondary education. With education becoming even more critical in the constantly changing new age, it is imperative that the education level of the current workforce is raised. The productivity of the workforce and in any success is in the new Knowledge Age and that will depend very much on how its managers influence change. Change will be positive if managers are able to encourage their staff to learn new skills and work together to do not only new things but also old things differently.

### *Development of Inforware component:*

Introducing IT tools for whole supply chain of this industry in order to facilitate the production with introduction of training program for the workforce.

There is currently a lack of serious efforts to undertake continuous comprehensive market research. We are really not doing any marketing either. Just do the selling only and highly dependent upon brokers.

It is needed to identify and monitor overseas market opportunities and accordingly change our production. Government should provide to the entrepreneurs and investors the needed information on the types of rubber products recommended for investment and their market potential and local manufacturers must look beyond the traditional domestic market to capture higher end value markets and diversify geographically. The Sri Lankan market is very small indeed compared with the combined markets of the industrialized and newly emerging economies.

To compete internationally, local manufacturers have to venture into large-scale operations where benefits from economic of scale for lower unit costs and hence more competitive prices can be realized. It will be difficult for Sri Lanka to compete against its giant Asian competitors - Thailand, Indonesia, and Malaysia - in the general rubber market. Therefore, Sri Lanka must focus on what it does best, high quality latex rubber - the preferred medium for items such as high performance automobile tyres, surgical gloves and contraceptives.

Introducing Management Information System (MIS) and monitoring systems

#### *Orgaware development.*

At present there is ample scope for establishing enterprises for producing value added rubber products. This can be understood from the fact that only 35 per cent of Sri Lankan rubber is converted into products and 65 per cent of rubber continues to be exported in primary form. Therefore it is necessary to focus on forward integration of value chain by merging some rubber product manufacturing companies producing belts, hoses, latex crepe rubber based products for surgical pharmaceutical purposes, which has higher value addition at the world market.

The prospects for other products such as rubberized coir mattresses, rubber thread etc. also need to be examined and needed to identify all resources available with the plantation sector and design projects accordingly.

It is happy to notice that traditional setup in the organizational structure is being changing slowly in this sector in order to be matched with the today's scenario. At present there are some rubber manufacturing companies, which have taken the initiative to do get cooperative decisions in order to do a backward integration of their value chain.

#### *Technoware component development*

Diversification of rubber plantation in to non- traditional area - plant in non-traditional areas like Moneragala and in high elevation is now possible with the new clones developed by RRISL

Up to 30% raining interruption on harvesting can be seen in other areas. Planting in these areas will facilitate nearly 300 days of tapping without any rain interruption.

Usage of Rain guards - as a rapid method of increasing the yield by about 30%, rain guard can be introduced in to the plantations future.

Usage of high yielding clones – there are 6 high yielding clones recommended by the RRISL for the plantations among which RRIC 100 and RRIC 102 bred by Sri Lanka are occupying 1<sup>st</sup> and 3<sup>rd</sup> places among high yielders internationally.

Proper manuring - manuring has been neglected by the industrialists due to high cost, but it was evaluated that an average of 20% yield increase resulted in proper usage of fertilizers alone.

Proper exploitation techniques – Poor exploitation practices causes very high Tapping Panel Dryness (TPD), even in plantations.

Other factors:

Government support for the extension services in this industry should be improved. Further industry should be facilitated with the financial markets or available with the venture capital in order to expand their businesses. To compete internationally, local manufacturers have to venture into large-scale operations where benefits from economic of scale for lower unit costs and hence more competitive prices can be realized.

It can be concluded that as the situation has changed today recording the highest ever prices since World War II, giving very attractive prices for all grades of rubber in the market, now it is time to reap the harvest by foreseeing future. Proper management plan should be initiated in order to update Without technology, the alternative is getting stuck in labor-intensive industries. Successful transfer of technology, where relevant, is recommended. This requires the availability of a well-educated workforce and a corporate culture eager for change for the better. Therefore, the appropriate training has to be made available for all levels of skill required in order to realize the expectation from the rubber product sector. Managerial competence is critical for continuously improving systems and work processes, motivating the workforce and raising productivity. Besides, unlike their counterparts in the last decade, today's manager needs a new set of skills. With change as the only constant, managers today have to be more entrepreneurial. Thereby Humanwar can be improved with the facilitation of good environment for Inforware component.

The potential yield can be achieved only if the plantations plant them methodically maintaining correct stands and following other agronomic practices such as manuring, careful exploitation without damaging the bark etc. When the processing technologies are concerned, Sri Lanka is not far away to the global best in the NR producing countries.

It is not because that we are in a good position when processing technology is concerned, but other major NR producing countries are also have not developed this area up to a satisfied level. Thereby it is important to introduce machinery that yield higher productivity, not with much sophisticated, but to be applicable to Sri Lankan context considering that we are a labor intensive country. For that government backup for the investment of modern production machinery through and incentive inducement is required.

In addition to that in-house development with or without assistance from local R&D establishments, academia, and etc. is essential as our major competitors like Malaysia and India are much faster than us in adopting new technologies. It is needed to be regular updating on new technologies and market trends as well.

### **8.3 FURTHER RESEARCH**

As this research area is so broad there is no time to investigate significance of other factors like conducive environment, experienced labour, indigenous technology, to the industry productivity. If we can identify the most significant area where we can create a competitive edge in the whole chain of the Sri Lankan rubber industry, it will be a good start to draw a road map for this industry development. It is therefore important to continue this sort of research in order to get a policy decision.

For the raw rubber industry, of crucial importance is less labour-intensive systems, particularly in tapping. Mechanization appears to be also an important component. This holds promise in areas of land preparation and, more importantly, in transplanting of more and more advanced materials. In addition, mechanization including robotics has a key role in tapping and collection and this is being pursued with vigor. Concurrently, the approach to rubber as a monocrop, solely for latex, is slowly phasing out. It appears that rubber trees will be planted for the timber as a primary product and latex will only be an important by product, which will pay for the upkeep of the stands until they are harvested for timber.

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## Annexures

### Annexure 1

#### Research Survey - Questionnaire

This research survey is done in partial fulfillment of the requirements for the postgraduate degree of Master of Business Administration in Management of Technology in University of Moratuwa, Sri Lanka. The aim of this survey is to assist The Sri Lankan rubber plantation and processing sector in assessing the technology level of this sector with compared to the global best and give recommendations to upgrade the industry. Responses from individual organizations will be kept confidential. Data will be aggregated and any individual comments will not be attributed to their originators. A copy of the final report will be provided to all organizations participating in the survey. The aggregated results will be provided to the local authorities as well as the interested parties related to this sector.

#### PART I- GENERAL PARTICULARS

##### Company information

Contact name: .....  
 Organization: .....  
 Phone: .....  
 Address: .....  
 Email: .....  
 Reference number: ..... *(to be filled in by interviewer)*  
 Number of employees:  
 Number of employees:  
 (a) Workers: ..... (b) Supervisors: ..... (c) Managers & Executives:.....  
 Planted Area: .....

1.3 How long has company been established? .....

1.4 Nature of business *Tick one box only*

(a) Rubber Plantation and Processing only	
(b) Latex Collecting & Processing only	
(c) Other (please describe).....	

*Not: If your organization is only a rubber products manufacturing firm you are outside the scope of this survey*

Actual yield (in kg/hectare/year):.....

Tappable trees per hectare:.....

1.7 Tapping days possible for annum:.....

1.8 No. of days tapped out of all possible tapping days:.....

#### Part II -TECHNOLOGICAL PARTICULARS

##### 2.0 YOUR COMPANY'S R&D ACTIVITY

Approximate R&D expenditure in latest year..... (Rupees)

R&D expenditure as % turnover .....

2.2 Number of staff involved in R&D (full time equivalent).....

As % total staff .....

2.3 Areas concentrated in last decade (tick & please specify)

- (a) Development of New Rubber varieties  
 .....
- (b) Soil fertility & conservation  
 .....
- (c) Mechanization of Rubber production & collection  
 .....
- (d) Genetic Engineering & Biotechnology  
 .....

- (e) Introduction of a new rubber (Value added product) to the market  
(E.g. EBR (Epoxidised NR), DNR (Deproteinised NR), TPNR (Thermoplastic NR), LNR (Liquid NR))
- (f) New product or service, or a new process introduced

**YOUR COMPANY'S PRODUCTION**

**3.1 What is the resource management / inventory control system you adopt in your organization?**

- (a) Computerized resource management system like PRMS
- (b) Partially computerized system
- (c) Manual base

**3.2 RUBBER PLANTATION**

**3.21 Field practices adhered in land preparation (tick all that apply)**

- (a) Clearing, roads, fences and buildings
- (b) Lining & terracing
- (c) Drainage, construction of silt pits and contour bunts
- (d) Pitting and refilling
- (e) Procedures for prevention of white root diseases

**3.22 Clones Used**

Year of Plantation	Before 1990	1990-1999	After 2000	Total planted area
Clone type	Planted area			
PB 86				
RRIC 100				
RRIC 102				
RRIC 121				
Other				



**3.23 Planting materials used**

- (a) Field green budding
- (b) Green budding in bags and transplanting in the field as one to two-whorled plants
- (c) Stumped budding
- (d) Polybag-raised young buddings of two to five whorls
- (e) Polybag-raised young buddings of two to five whorls brought from our own nursery

**3.24 Cover crop management-Legume Used**

- (a) Mixture of Pueraria phaseoloides & Calopogonium mucunoides
- (b) Pueraria phaseoloides
- (c) Calopogonium mucunoides
- (d) Mucunabraceata
- (e) No legume is used

**3.25 Rain guarding methods**

- (a) Polythene skirt type rain guarding.
- (b) No rain guarding is available

**3.26 Pests and disease control**

- (a) No pests/disease controlling is done
- (b) With the use of sulphur-dusting using a shoulder
- (c) With the use of sulphur-dusting using tractor-mounted motorized duster
- (d) By mechanical fogging with tridomerph-in-oil.

**3.27 Fertilizer application**

- (a) Annual basis
- (b) Based on analysis of soil & leaf
- (c) Any other (please specify)

**3.28 Control of weeds**

- (a) Manually/No weed controlling is done
- (b) Conventional knapsack spraying sodium arsenite/ spraying non-toxic chemicals such as alachlor
- (c) The tractor-mounted motorized sprayer
- (d) Controlled droplet applicators

**3.3 LATEX PROCESSING**

**3.31 Tapping**

- (a) Once a day manually/in a d/2 frequency (once in two days) manually / In a d/3 frequency manually
- (b) In a d/6 frequency manually but using puncture tapping technique
- (c) Using battery-driven mechanical tapping machines
- (d) Auto-tap (using mechanized tapping knife attached to trees)

**3.32 Latex collection**

- (a) Is done manually collecting into coconut shells
- (b) Is done manually collecting into polythene bags/Plastics shell
- (c) Collection of latex by pipe systems
- (d) Any other (please specify).....

**3.33 Crop collection is done**

- (a) Manually
- (b) With the help of small tractors/Carts
- (c) Fully automated

**3.34 Straining**

- (a) Manually with the use of bundle of straw/ bundle of grass/fern
- (b) Manually with a 30 or 40 stainless steel mesh
- (c) Automated

**3.35 Weighing & D.R.C. determination**

- (a) With a Metrolac
- (b) Any other laboratory methods (please specify).....

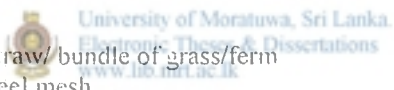
**3.36 Coagulation- Formic acid or Acetic acid is added**

- (a) Manually
- (b) Partially automated
- (c) Automated

**CENTRIFUGED LATEX PRODUCTION**

**3.371 Concentration method used (If relevant),**

- (a) Creaming
- (b) Centrifuging
- (c) Evaporation
- (d) Electro-decantation
- (e) Any other (please specify).....



3.372 These questions are related to your highest level of technology acquisition (One machinery data from one section is enough.)

Type of Machinery	Energy consumption (kWh)	Capacity (Kg/hr)	Manufacturer (country) & the Brand name

**CREPE RUBBER PRODUCTION**

3.381 These questions are related to your highest level of technology acquisition (One machinery data from one section is enough.)

Type of Machinery	Energy consumption (kWh)	Capacity (Kg/hr)	Manufacturer (country) & the Brand name
Wet Mill			
Dimension Mill			
Nice Mill			
Any other			

3.382 Drying of sheets (If relevant)

- (a) In direct sunlight
- (b) Only smoking, no sun drying
- (c) Using Electric Heating elements
- (d) Other (please specify).....

3.39 Are you satisfied with quality of the final product?

- (a) Exactly, firm is awarded by ISO quality standards
- (b) Yes, firm is in par with local industry standards
- (c) Yes, but there is lot to be improved
- (d) No, there are several problems attached with the quality of the final product
- (e) No, not at all

3.4 QUALITY IMPROVEMENT ENVISAGED (tick all that apply)

- (a) Technically grading system instead of Visual grading system
- (b) Standard Formulation
- (c) Product improvement /Process improvement
- (d) Other (Please specify).....

3.5 ADDITIONAL INCOME GENERATION (tick all that apply)

- (a) By intercropping in Rubber Plantation
- (b) Rubber honey (commercial bee keeping in rubber plantations)
- (c) Rubber tree use for the timber as a by-product
- (d) Rubber seeds
- (e) Other (please specify).....

4.0 MARKETING

- (a) No marketing is done/No extra effort is done for marketing, only through brokers
- (b) Large amount of money is spent for local marketing
- (c) Large amount of money is spent for local as well as international marketing
- (d) Hoping to market products through Internet - E-business
- (e) Internet has already been used to facilitate marketing

**5.0 MAN POWER & EDUCATION (tick all that apply)**

**5.1 Training**

- (a) No training is given
- (b) Though training is needed, no local institutes are capable enough to cater the demand
- (c) In-house training is available for Executives only
- (d) In-house training is available for technicians as well as shop-floor workers
- (e) Institutional training is available for Executives only
- (f) Institutional training is available for technicians as well as shop-floor workers
- (g) International training is available for Executives only
- (h) International training is available for Executives as well as Technical staff

**5.2 Competence Characteristics**

**Workers:**

% of target attained per year with respect to out put (rough figure) .....

**Supervisors:**

% Effective capacity utilization of the plant (rough figure) .....

Minimum Education level:.....

**Managers & executives:**

% Effective capacity utilization of the plant (rough figure) .....

Minimum Education level:.....

**(d) R&D Personnel**

% Level of innovative activity as evaluated by type of contribution made (rough figure) .....

Minimum Education level:.....

**5.3 Employees' behavior**

Please fill each section with V, S or NS

Where *V* - Very satisfied

*S* - Satisfied

*NS* - Not satisfied

Character	Workers	Supervisors	Managers/ Executives	R&D personnel
(a) Attitudes				
(b) Motivation				
(c) Ability to meet dead lines				
(d) Ability to face challenges				
(e) Ability to adopt				
(f) Sufficiency in technical knowledge				
(g) Ability to come up with innovative solutions				
(h) Ability to communicate with the others				
(i) Performance of assigned tasks				
(j) Ability to work in a team				

**6.0 WASTE MANAGEMENT - Effluent Treatment is done with**

- (a) No proper effluent treatment method is adhered
- (b) Rubber Trap Equalization
- (c) Compositing tank/Activated sludge process /Oxidation ditch
- (d) Anaerobic and aerobic ponding cum rubber trap system
- (e) Aeration system
- (f) Sand Bed Filters / Sludge Drying Beds

**7.0 LABORATORY SERVICES AVAILABLE (tick all that apply)**

- (a) Laboratory facilities are not available
- (b) Latex testing
- (c) Rubber effluent testing
- (d) Chemical analysis of rubber & rubber components/rubber ingredients
- (e) Any other (please specify).....

**8.0 ORGANIZATIONAL STRUCTURE**

**8.1 Direction**

(a)  High futuristic (b)  Moderate (c)  Medium (d)  Less (e)  No futuristic

**8.2 Autonomy**

(a)  Completely deregulated (b)  Moderate (c)  Medium (d)  Controlled (e)  Completely controlled

**8.3 Freedom for new ideas/innovations**

(a)  High (b)  Moderate (c)  Medium (d)  Low (e)  Not at all

**8.4 Willingness to change**

(a)  High (b)  Moderate (c)  Medium (d)  Low (e)  Not at all

**Availability of operating and maintenance manual for operators**

(a)  It is a must (b)  Yes (c)  Available, but not all (d)  Very limited (e)  Not available

**8.6 Availability of management information (extent)**

- (a) Total industry information
- (b) To a satisfied level
- (c) Partially
- (d) Only the cooperate information
- (e) Not at all

**8.7 Extent of networking**

- (a) Online access for customers as well as suppliers even
- (b) Online cooperate networking
- (c) There is a network, but not online
- (d) Though all data are computerized, no network is there
- (e) Manual data handling



**Rubber industry database availability/Availability of a technical library for employees**

- (a) Yes
- (b) Some of them
- (c) Sharing from another firm
- (d) Very limited
- (e) Not available

**8.9 Extension services obtained (tick all apply)**

- (a) Technical advice from RRISL and other institutes related to rubber industry
- (b) Incentive programm from the government
- (c) Training facilities from local institutes related to rubber industry
- (d) International funding
- (e) Finance assistance from banks
- (f) Any other (please specify).....

**9.0 FUTURE RESEARCH**

- (a) Value added activities
- (b) Process development/Product development
- (c) Development of less labour - intensive/ long flow tapping systems
- (d) No plan
- (e) Any other (please specify) .....

**10.0 COMMENTS (OPTIONAL):** In the space below, provide any additional comments or any other information you wish to include regarding your operations or other related issues that impact your firm. In addition, what industry needs and concerns did this survey fail to address?.....

