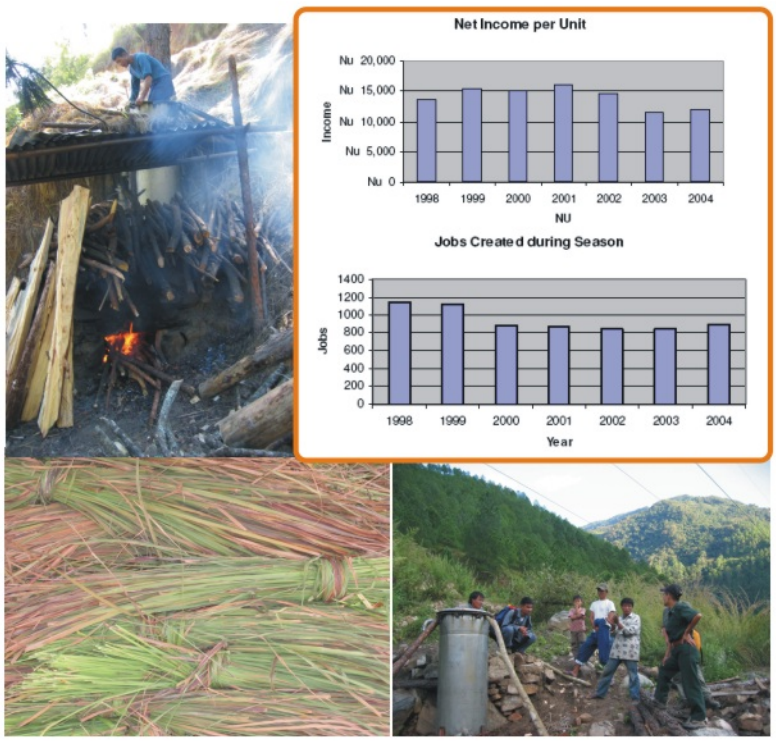
Lemon grass distillation in Eastern Bhutan - A scenario analysis



Wolfgang Prommegger, CORET
Kinley Budur, SFD
Dorji, RC-Wengkhar
Purna B. Chhetri, RC-Wengkhar

CORET

Acknowledgment

The study team would like to express its profound gratitude to Prof. Georg Gratzer and Mr. Andras Darabant, Conifer Research and Training Partnership (CORET), BOKU University, Vienna, Austria, to Mr. Kinzang Wangdi, Program Director, RNR-RC Jakar, MoA, RGoB, to Mr. Chado Tshering, Joint Director, Social Forestry Division, DoF, MoA, RGoB and to Mr. Karma Tashi, Program Director, RNR-RC Wengkhar, MoA, RGoB.

Funding of all local costs came from a grant of the Bhutan Trust Fund for Environmental Conservation.

We gratefully acknowledge their support and commitment towards this work.

The study was a collaboration between RC Jakar / CORET, SDF and RC Wengkhar and would not have been possible without financial and technical assistance provided by them.

The team gratefully acknowledges the contribution of the Essential Oils Development Program, MTI, RGoB, which provided important inputs for economic analysis.

Furthermore, the team would like to thank all distillers, harvesters and officials representing the different stakeholders in the lemongrass industry for their participation to accomplish this study.

May this document promote balanced rural development in the eastern Dzongkhags of Bhutan.

Wolfgang Prommegger
Kinley Budur
Dorji
Purna B. Chhetri

Table of Contents

List of Tables

List of Figures

Abbreviations

CB-NRM	Community Based Natural Resource Management
CORET	Conifer Research and Training Partnership
DoF	Department of Forests
EODP	Essential Oils Development Program
FAO	Food and Agriculture Organisation (UN)
FMU	Forest Management Unit
HH	Household
LG	Lemongrass
MoA	Ministry of Agriculture
MT	Metric Tonnes
NWFP	Non Wood Forest Products
RGoB	Royal Government of Bhutan
RNR-RC	Renewable Natural Resources – Research Centre
RRA	Rapid Rural Appraisal
SFD	Social Forestry Division

Executive Summary

With the inception of lemongrass industry in the eastern part of Bhutan, initiated by Tashi Commercial cooperation in 1981, the occurrence of fire is said to have increased, as fire is supposed to improve lemongrass growth for oil extraction in the Chir Pine forest ecosystem. In past years the numbers of man-made fires could be reduced due to efforts by the DoF mainly through medial campaigns to enhance public awareness of forest fire prevention in the fire prone Dzongkhags (FFMP, 2005). Chir Pine forests are well adapted to fires (Tewari 1994) and complete omission of this disturbance can lead to fuel accumulation which may be the cause for catastrophic fires (Sangay 2005).

In order to study the complex role of fire in these ecosystems, both socio-economically and ecologically, the Social Forestry Division in collaboration with RC Jakar / CORET and RC Wengkhar, has initiated and developed a research study on the impact of fire in Chir Pine ecosystems. Within the study, prescribed burning will be undertaken in few locations to assess the impacts and recommend whether fire could be used as a management tool and if, under which circumstances.

Additionally there was need to investigate the role and use of lemongrass, being a part of the Chir Pine ecosystem. Therefore this part of the study focuses on the impact of the lemongrass industry on socio-economics in eastern Bhutan. It explores main aspects like resource status and allocation, economic return, institutional problems and mechanisms required to sustain the lemongrass industry.

The study area covered six geogs of Mongar, Lhuntse and Trashigang. The lemongrass industry serves as additional source of cash income on seasonal basis to the distillers and harvesters of four Dzongkhags to support their livelihood security. With technical assistance of the EODP and further stakeholders, the industry produced 89,5 MT of LG oil and generated total sales of Nu 43.5 Million from 1998 to 2004. Further more, lemongrass activities annually create approximately 1000 seasonal jobs.

However the production per active unit has decreased from 140 kg in 1998 to 100 kg in 2004. This trend is mainly to be seen as a result of:

- Lacking bylaws and structures to enable resource allocation based on local decisions
- Lack of coordination among the stakeholders, who provide technical services.

Local knowledge to manage resources on a sustained base could not come to effect, mainly due to one reason: the open access to resources hindered a development of locally decided regulations as for example a demarcation of traditional boundaries. Further the quality and efficiency of activities by focal agencies to support the small scale industry depends on improving standards of coordination and information sharing between the stakeholders. As a consequence the pressure on resources is rising. Looking at the production trend, it is high time to discuss on alternative ways of resource allocation in order to preserve lemongrass activities as an important additional source of income to subsistence farming in the east.

As already proposed in earlier research papers on lemongrass distillation in the eastern Dzongkhags, the study urgently recommends approaches like CB-NRM in order to foster operation rights. Transferring responsibility to local farmers to handle resources within defined management plans would enable a long term plough back system. Secondly, it is necessary to improve coordination and information-sharing among stakeholders, so that supportive processes, be it at the grass root level to preserve the resource base, or at the marketing level, are well directed. Further efforts in the domain of research to upgrade distillation methods should take place. Finally, a scenario like CB-NRM would be the platform to enable organic certification for wild collection areas and consequently serving new markets at higher oil standards.

1. Introduction

Bhutan is an exceptional case in South Asia. With its 65% forest cover, rich biodiversity and plentiful water resources, it can be considered as a resource rich environment (Turkelboom 2001). The Royal Government of Bhutan committed to maintain a minimum of 60% of the country's area under forest cover for all times (RGoB 2005). Besides, 35 % of the nation's land area enjoys environmental protection status of some sort, be it in National Parks, Wildlife Sanctuaries or Biological Corridors linking protected areas (RGoB 2002). In the remaining area under forest cover, economically oriented forest management with special focus on environmentally sound production systems is aimed at for commercial and for local use, both on government and on private/community land (FRDD 2001).

The RNR-Sector has determined to work towards four key sectoral goals during the ninth five year plan:

- Enhancement of household and national food security
- Conservation and management of natural resources
- Enhancement of Rural Income
- Generation of employment opportunities

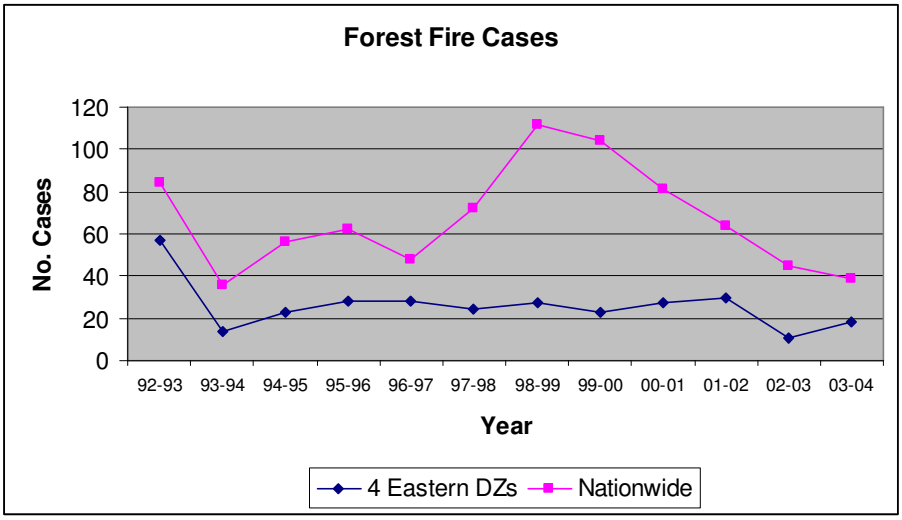
While various stakeholders explore the options of meeting the above goals, constraints are faced with the rapid transition from rural base economy to free market economy, as Bhutan's urban and industrial development exerts pressure on forestry resources. Moreover, the forestry resources are threatened by illegal activities such as land encroachment, illegal logging and the setting of forest fires (FRDD, 2004).

Forest fire in Bhutan has been a regular event, which usually coincides with the dry winter that extends from November to May. Damage depends on the frequency and severity of fire, type of the forest, fuel wood accumulation and local topographic, as well as climatic factors. The current records reveal that most forest fires in Bhutan are caused by people. They mostly originate from burning of debris in orchards and farmers' cultivation fields, careless picnickers or campers, children playing with fires in the dry season and cigarette smokers. In other cases, fires are deliberately set to improve grass growth in the natural pastures, or intended to expand pasture areas.

In the eastern part of Bhutan, the lemongrass industry has started in 1981. Since its inception, the frequency of fire is supposed to have increased; fire is deliberately set in the Chirpine forest ecosystem to improve lemongrass growth for oil extraction. In order to reduce incidences of forest fires, the DoF has done forest fire prevention campaigns vigorously through the media - newspaper, radio, television, public talks, posters, information pamphlets and on-the-ground training of farmers in the fire prone Dzongkhags (FFMP 2005).

Efforts to create awareness about the effects of forest fires have brought down the incidences on national level. Nevertheless, disturbances by fire in the eastern Chir Pine forests occur frequently (cf. *Figure 1*).

Figure 1: Forest Fire Records, Source: SFD



Therefore the Social Forestry Division in collaboration with RC Jakar / CORET, a research partnership between Austria and Bhutan, has initiated and developed a research study on the impact of fire in Chir Pine ecosystems. In addition to questions of Chir Pine regeneration, the utilization of lemongrass, being a part of this ecosystem, is a crucial issue for rural development in the four Dzongkhags. Accordingly this part of the study tries to investigate the impact of lemongrass industry on socio-economics in Eastern Bhutan. It further deals with questions of proper resource allocation under consideration of historical perspectives.

2. Background

2.1 Lemongrass

2.1.1 Species and extracted essential oils

The Lemongrasses belong to the family *Poaceae* (*Gramineae*). The genus has about 55 species, most of which are native to South Asia, Southeast Asia and Australia. Two major types have considerable relevance for commercial use: East Indian lemongrass (*Cymbopogon flexuosus [Nees ex Steudel] JF Watson*) is native to India, Sri Lanka, Burma and Thailand, whereas West Indian lemongrass (*Cymbopogon citratus [DC] Stapf*) is assumed to originate in Malaysia. The plants grow in dense clumps up to 2 meters in diameter and have leaves up to 1 meter long. (Purdue University 1997).

Further *Cymbopogon martini (Roxb.) J.F. Watson var. martini*, which is native to India and cultivated in Java is worth mentioning as it also grows in Bhutan and is extracted for palmarosa oil. Another species with commercial relevance is citronella grass (*Cymbopogon winterianus Jowitt*) which also stems from India, but is today grown throughout the tropics.

The study focuses on lemongrass oil distilled from on East Indian lemongrass, which is relevant in Bhutan. It flourishes in a wide variety of soils, ranging from rich loam to poor laterite. Water logged soils should be avoided as they are unsuitable for its cultivation. It requires warm humid climate with plentiful sunshine. Lemongrass can be propagated either by seeds, vegetative propagation and rooted slips. It has been noticed that both the seedlings and the rooted slips performed equally well. (RCDC 2005).

Lemongrass oil contains citral - its major constituent. The oil quality is judged by its citral content and its solubility in alcohol. It bears reddish-yellow to reddish-brown colour, with strong, lemon odour properties. It is used in the perfume, soap and cosmetics industries and forms the starting material in the manufacture of synthetic Vitamin A. Further the oil serves as an input to pharmaceutical preparations, such as pain balm, disinfectants, and mosquito-repellent creams . (FAO 1996).

2.1.2 Market

The lemongrass essential oils dominated the essential oils market over twenty years but suffered from the harsh competition of synthesized essential oils and the Chinese essential oil made from *Litsea cubeba,* another raw material for citral (Africabiz Online. 2003).

There have been constant commercial disputes over lemongrass essential oil because of the uncertainty created on the market by India which uses a great portion of its production (750 tons /year) for its home consumption and exports the remaining to former USSR under a barter agreement. Nowadays, the Republic of Guatemala is the leading exporter (250 tons). China is on the market for 80 to 100 tons per year. USA and former USSR import each around 70 tons per year; the United Kingdom 65 tons; France and Japan 35 tons each; and Germany around 20 tons.

Selling prices fluctuate from USD 10 to about USD 20 according to the quantity of lemongrass essential oils put on the international market by India (Africabiz Online 2003, UNV 1999).

2.2 Substitues: *Litsea cubeba*

2.2.1 Plant and Oil

Litsea cubeba oil is distilled from the small, pepper like fruits of the tree *Litsea cubeba*. It grows in Eastern Asia, former Indochina and is cultivated to a minor extent in Formosa and Japan. Oil of *Litsea cubeba* is a pale yellow, mobile oil of intensely lemon like, fresh and sweet odour, with a soft and sweet fruity, uniform dry-out. *Litsea cubeba* has a definite advantage over lemongrass oil. The citral contents of the two oils are almost equal. However, lemongrass oil has a superior odour tenacity due to its heavy sesquiterpene part, with a tone of sweet and moderately pleasant notes. Furthermore, the oil of *Litsea cubeba* has also a pleasant taste, and a rectified oil could be used in flavour work as a modifier for lemon and lime flavours and as a general freshener in fruit flavours. For use in perfumes, *Litsea cubeba* oil could replace lemongrass oil to a certain degree, but the Chinese oil would probably find better use in artificial verbena type bases, colognes, household sprays and air fresheners. (FAO 1995).

2.2.2 Market

Although cheap synthetic citral (ex turpentine or petroleum hydrocarbons) is readily available, and has displaced much of the citral from lemongrass previously used for derivative manufacture, there has remained a significant market for natural citral, which low-priced *Litsea cubeba* oil has been able to meet. Countries with the capacity to fractionate essential oils are the major importers of *Litsea cubeba* oil, i.e. the United States, countries of Western Europe and Japan. Trade in some years is estimated at up to 500 metric tonnes. (FAO 1995).

Chinese production of oil is impossible to quantify accurately. Recent Chinese source placed it much higher, at 1500 tonnes pa. If Chinese domestic consumption of *Litsea cubeba* oil grows as expected, then quantities available for export are likely to decrease and opportunities will occur for new producers. Small quantities of *Litsea cubeba* oil are produced in Java, Indonesia, but from the leaves rather than the fruits and it is not rich enough in citral to be suitable for export (FAO 1995).

The price of *Litsea cubeba* oil has been erratic as a result of competing economic forces in the People's Republic of China. Pricing of first quality oil continues to advance with latest quotes having been received at USD 16.00 per kilo CIF (UHE 2005).

3. Review of the development of the LG industry

3.1 Distillation Units and Production

Lemongrass oil production from the wild area was started in 1981 by the Bhutan Aromatic and Phyto-Chemicals Section (BAPC) of Tashi Commercial Corporation. The company operated a big distillation unit at its office in Kurizampa and supplied a large number of smaller distillation units to the farmers of Mongar, Trashigang and Lhuntse Dzongkhags. The oil was processed by steam distillation, using low-cost, cottage-type distillery made from second-hand petrol drums. The company also bought lemongrass collected from the wild and delivered to road sides and conducted demonstration on harvesting and distillation of lemongrass plants on various occasions.

In the late 80s His Majesty commanded to further expand the scope of distillation plants. In 1990 the FAO-supported project "Production of Essential Oils by Small Holders in Remote Areas" was operationalized and two essential oil distilleries were established, known as ITA industrial type units at Pakhadrang (Mongar District) and Lungtenzampa (Trashigang District) with a total capacity of 2.5 tons of lemongrass per eight-hour working day. The project also helped in establishing germplasm and multiplication nurseries at Gyelpoizhing (Mongar District) and Chhali (Mongar District), using plant materials from India and Europe. Trials on mentha, citronella, vetiver, palmarosa grass and Basilicum were conducted. (FAO, 1996).

In the process of strengthening the LG industry, it was found that the units developed by FAO were very huge and had operating problems. Therefore the MoA intervened in 1991 by modifying and developing a stainless-steel type portable plant, which improved the distilling efficiency and quality of the oil. By 1993, the Essential Oils Development Project (EODP) of the Ministry of Trade and Industry (MTI) took part in the process of developing the cottage type distillation units and began support the marketing aspect.

As an outcome of this development process, 18 semi-portable FAO-type stainless units were put into operation in 1995. Three years later a milestone in further improvement efforts was the distribution of 118 stainless steel cottage type distillation units, which met the needs of distillers in terms of portability, efficiency and durability. Since 1999, 154 units of this type have been owned by the distillers in the 4 Dzongkhags.

In 2003, Tashi Industries Corporation quitted lemongrass business temporarily, therefore 270 active mild steel units known as Tashi type were not operated any longer.

3.2 Marketing

The marketing of lemongrass oil was initially done by Tashi Commercial Cooperation, which exported to various places in India. The expansion to European markets began from 1990. The Primavera company was the first and only customer of the EODP for several years. Primavera is a German company specialising in the import and distribution of aromatherapy products.

As the production of lemongrass oil increased to 17.5 MT in 1998, Primavera, insisting on exclusive supply, was not able to purchase the whole output and quit the business with Bhutan, therefore the MTI had to find new customers. After the Primavera experience, the Bhutan Export Promotion Centre at the MTI ordered a review of potential markets for lemongrass oil in the United Kingdom, Germany, France and the Netherlands, done by CTA Economic & Export Analysts Ltd.

The report by CTA stated that "Primavera was under the impression that it had a contractual agreement with the Government of Bhutan to be the sole distributor of Bhutanese lemongrass oil. It used to purchase the entire crop as well as giving considerable technical assistance to promote the development of Bhutan as a source of LG oil."

Primavera informed CTA "that the Bhutanese have been extraordinary difficult to deal with as supplies. Orders are late in arriving, are short-weighted, do not correspond to the technical specifications, are not of a consistent quality and are often wholly unsuitable for their purpose. It is, however, often very difficult to communicate such complaints to the Bhutanese, messages being either not received or, of they are received, ignored. To this extent, the experience of Primavera reflects that of other companies supplied from Bhutan, which are noted in the body of the report."

A more serious complaint was that "Bhutanese lemongrass oil has been offered for sale through other outlets. This has been done not only by commercial organisations such as the Tashi Group, but even by the Bhutanese Government sales agency." (CTA 1999).

The review of CTA gave recommendations on pre-marketing preparation (minimum technical requirements in production) and marketing strategies. In the follow up action to the report, the MTI has established a quality processing unit at Mongar and started exploring new markets, primarily in Western Europe. Several consignments were delivered to end-users in France, Germany and UK. Most of these end-users rejected parts of the consignments due to lacking quality standards. Although quality control was established at the production side, the deficiencies were mainly caused by the deterioration during the long two months transport via Calcutta, Singapore, Sri Lanka to its end destination in Europe, and inappropriate oil containers, which did not preserve the oil well.

The EODP also tried to cover Japanese markets, but until now without success. Further more, the Indian market is not attractive because of low prices offered. Since 2003, John Kelly, a broker in the UK, is the only importer of Bhutanese lemongrass oil. According to the EODP, John Kellys provides high quality barrels for transportation from Calcutta harbour to Europe. Moreover, the UK firm also accepts consignments with citral content below 75%, as they are able to mix those barrels with consignments of higher quality to reach the minimum specifications for retail user.
The main reason for Tashi Industries' leaving the market was growing competition on Indian markets, exerting pressure on prices for high quality oil (8-9 USD for 78-80% citral content).

Table 1: Chronology of Lemongrass Industry

1981	• beginning of LG distillation by BAPC section of Tashi Commercial Corporation • 270 mild steel units distributed until 2003
1990	• FAO project: 2 ITA industrial type units in Mongar and Trashigang
1991	• MOA intervened in modification process of units
1993	• EODP (MTI) supports development of drums and marketing of oil in Europe
1995	• 18 semi-portable FAO units distributed
1998-99	• 118 + 36 cottage type units distributed • Primavera leaves business as production climbs up • CTA reports states serious problems in technical requirements and export • EODP enhances quality control and new marketing strategies
1999 - 03	• different costumers in Western Europe buy Bhutanese LG oil
2003	• Broker John Kelly, UK as only costumer • Tashi Commercial stopped LG business

4. Lemongrass Resources in Bhutan

Lemongrass (as of now referring to Cymbopogon flexuosus) spreads in the eastern part of Bhutan in association with the Chir Pine forest ecosystem. It is estimated that 50,000 hectares of the Chir Pine forest is covered with (RNR-RC 1998). The growth and biomass production are more important where the crown density of pines is low. The economic life of lemongrass is about 8 to 10 years. According to research data by Renewable Natural Resource Research Centre (RNR-RC Wengkhar), the oil yield from 1ha of lemongrass area in the wild is up to 9 kg. The low production of biomass and the amount of oil output is due to moisture stress and poor soil nutrient content.

RNR-RC Wengkhar has undertaken research studies both to domesticate the indigenous grasses for oil, and to control soil erosion. It has also developed technologies to improve management of the grass in its wild habitat. It was reported that in low altitude (<1000 m) given good management conditions, grass remains green through out the year and facilitate five cuts, yielding 105 kg of oil per hectare per year in rain fed conditions (Legha, PK, 1996).

5. Objectives of the study

The objective of the study is to explore opportunities and constraints of lemongrass harvesting and distillation in relation to ecological sustainability, including economic return and its distribution, status of access to resources and local arrangement for sustainable harvest:

A) Local Population

- Investigate the social background of the local population involved in lemongrass business

B) Development context

- Which development progress in production and marketing of lemongrass has been realized?

C) Status of lemongrass industry

- Socio-economic aspects:
    - What are the socio-economic benefits of lemongrass industry compared to expenditures.
- Resource Allocation and Management:
    - Which rules and arrangements have regulated the management of common property resources like lemongrass in former times, which ones are prevailing now? What are successful ways of managing the use of common property resources?
- Ecological aspects:
    - Which factors could endanger a sustainable utilization of lemongrass?

6. Study Area and Methodology

Lemongrass spreads in the Chir Pine forest ecosystem in the Dzongkhag of Mongar, Lhuntse, Trashigang and Trashiyangtse. Based on the area and the operating units, six geogs were selected for the study. Random samples of active distillers, inactive distillers and collectors were selected for semi-structured interviews.

Six Rapid Rural Appraisal sessions were conducted involving active and non active distillers, local administration and research staff to assess the general consensuses on problems, trends and future management of lemongrass business to enhance a sustainable industry. During the group sessions, RRA tools such as resource mapping, wealth ranking, seasonal calendars were used to promote an overview on socio-economic as well as environmental impacts of lemongrass industry.

Field visits to distillation units were conducted to get an overview of the harvesting and distillation area and to see practical problems in lemongrass distillation. In addition to the research at the collection and distillation sites, semi-structured interviews with the different stakeholders helped to understand ongoing processes in this small scale industry.

An overview of the geogs and interviewees sampled is given in *Table 2*, details on interviewed persons are shown in Annex 1.

Table 2: Study geogs for the socio-economic survey on lemongrass.

Dzongkhag	**Geog**	**# of distillers**	**active distillers interviewed**		**inactive distillers interviewed**	**RRA Sessions & Meetings**
			individual	PRA		
Mongar	Drametse	41	12	27	3	42
	Chaskar	11	5	4		19
	Thangrong	8	4	4		9
Lhuntse	Tshengkhar	15	10	16		45
Trashigang	Bartsham	1	1	0	8	10
	Uzorong	13	11	10		12
Sum		**89**	**43**	**61**	**11**	**137**

7. Results & Discussion

All analysis are restricted to distillation units running under the Essential Oils Development Project. Concerning all aspects of analysing the industry's development and especially in regard to resource use, Tashi Industries' leaving has to be considered. The methods of data deriving for EODP units, as well as additional data on former Tashi units is provided in the Annex.

7.1 Social Background of the Lemongrass Distillers

7.1.1 Family Structure and Size

All owners of distillation drums were males with an average age of 40 years within a range from 23 years to 64 years. The average family size of farmers operating a distillation unit distributed through EODP was 8.5 persons (cf. Table 3). More than 2 persons of a distiller's household were students and 3.5 were household workers. The number of government servants per household was less than 1.

Table 3: Family structure of active distillers

Family Structure				
# HH Members	# Gov. Serv.	# Employee	# Students	# HH worker
8.48	0.73	0.10	2.15	3.50

The average size of a distiller's household was compared to the average size of households in the study geogs. *Table 4* shows that apart from Drametse, distillers' households were larger than an average household in the concerning geog.

Table 4: Average Size of Households: Overall vs. Distillers

Comparison: Average Size of Households (Person / HH)						
	Drametse	**Chaskar**	**Thangrong**	**Uzorong**	**Tsengkhar**	**All**
average HH (Source: 9th FYP)	8.9	7.7	8.0	7.3	7.5	**7.9**
Distiller HH (40 Samples)	7.3	9.3	8.5	8.1	9.2	**8.5**

7.1.2 Landholding

Households involved in lemongrass distillation owned an average land holding of 5.83 acres (cf. *Table 5*). Five different types of land holding were identified: Dryland (mostly maize or potatoes), Wet Land (mostly paddy), Tsheri (for shifting cultivation), Pangshing (fallow grass and tree areas) and Sokshing (area for leaf litter collection).

Table 5: Land holding of active distillers

Land Holding in Acres					
Dry	Wet	Tsheri	Pangsing	Sokshing	**Sum**
3.63	0.39	0.48	0.40	0.92	**5.83**

Moreover, the landed property of distillers was compared to the one of the overall population (cf. *Table 6*). In Drametse and Chaskar, distillers had slightly smaller landholding than the average population, whereas in the remaining geogs the households involved in LG distillation owned more private land. It is interesting to note that in Uzorong distillers had almost three times higher landholding compared to the average population.

Table 6: Land holding: Distillers vs Overall Population

Comparison: Average Landholding of Households (acres / HH)						
	Drametse	**Chaskar**	**Thangrong**	**Uzorong**	**Tsengkhar**	**All**
average HH (Source: 9th FYP)	2.6	4.4	2.2	4.3	3.6	3.5
Distiller HH (40 Samples)	2.3	4.2	2.5	12.4	4.1	5.8

7.1.3 Livestock

Finally, the livestock data of sampled distillers was compared to the average population in each geog. In all categories, cattle, horse, pig and poultry the distillers owned more livestock per household than the average population (cf. *Table 7*).

Table 7: Livestock holding: Population vs. Distillers

Comparison: Average Livestock Holding (Animals / HH)					
	Cattle	**Horse**	**Pig**	**Poultry**	**All**
average HH (Source: 9th FYP)	4.9	0.5	1.0	3.3	9.7
Distiller HH (40 Samples)	6.4	1.5	1.2	3.8	13.0

The study results concerning social background of lemongrass distillers leave discussable conclusions: distillers seem to have larger families, higher landholding and more livestock than the average population. As it is pointed out in the following chapters on economic return, lemongrass distillation enables considerable additional cash income for the rural population.

However it might be the case that farmers of lower social and economic status take less advantage of lemongrass activities than the richer part of rural society, as it needs a minimum of financial requirements to enter the industry. Therefore it would be worth discussing to what extent the industry promotes the local elite.

7.1.4 Seasonal Calendar: Income of Distillers by Sources

An assessment was done to find out different sources of income of the distillers' households. *Table 8* lists different sources of income, the type of income these sources generate and age groups providing work assignment to different sources. In detail columns of *Table 8* deal with following features:

- *Work assignment* (1 = low assignment, 2 = medium assignment, 3 = high assignment) to different sources of income (farm, off-farm and others) by gender according to the Bhutanese calendar months (1 to 12, where 1 is the month of losar)
- *Type of Income*: shares of subsistence and cash income
- *Age*: Division of labour, age groups (from … to) contributing to sources of income
- *Share of Work Assignment*: Work assignment to one sector in relation to the work input to all sectors.
- *Share of Income Generated*: Interviewed distillers in 2 PRA sessions tried to assess how much income (cash and subsistence) is generated by different sources:

The main labour force of a household was assigned to farm activities (sum of agriculture, livestock and timber: 78,4%) where the majority of the farm income is used for subsistence.

During the RRA sessions lemongrass collection and distillation was assessed to contribute 30% to the overall household income, where as work assignment to LG activities was only 12% over a year.

Table 8: Seasonal Calendar: Income sources of distillers.

Income by Sources																		
			Work Assignment (1 = low, 3 = high) according the Bhutanese calendar												**Type of Income**		**Age**	**Shares**	
	Activity	**Sex**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Subs.**	**Cash**		**Work Assignment**	**Income generated**
Farm	**Agriculture**	m f	1 3	2 3	2 3	3 3	3 3	3 3	1 3	2 3	3 3	1 3			59%	41%	14 - 58	34.9%	40.0%
	Livestock	m f	1 1	3 2	2 2	2 2	2 2	2 2	2 3	3 3	2 2	2 2	1 1	1 2	55%	45%	9-14 & 55-65	33.5%	20.0%
	Timber	m f	2 1	3 2	2					1	2	1 1	1 1		100%	0%	18 - 50	10.0%	10.0%
Off-Farm	**LG**	m f						3 3	3 3	3 3					0%	100%	15 - 55	12.3%	30.0%
	Contract	m f													0%	100%	20 - 30	0.0%	0.0%
	Weaving	m f	1										2	2	100%	0%	19 - 45	3.7%	1.0%
	Daily wages	m f						1	1	1	1	1	2 1	2 1	0%	100%	18 - 43	4.8%	8.0%
Others	**Pack pony, etc.**	m f											1	1	0%	100%	9 - 12	0.7%	1.0%

7.2 Distillation Units Distributed

Efforts in improving distillation equipment led to the distribution of 118 cottage-type units in 1998, at a price of Nu. 26,953. One year later, in 1999 additional 36 units were distributed at a price of Nu 22,498. Besides the cottage-type units, since 1995 18 so called FAO-type units have been under operation, sold at a price of Nu 51,930 per unit. At present, 172 distillation units are recorded by the EODP (cf. *Table 9*). The FAO-types were provided by the project on credit basis. The cottage type units were purchased by term loan with 13% interest rate. Most of the distillers paid off the loan within 2 years. The cottage stainless steel drums have a life time of 10 years.

Table 9: Distribution of Distillation Units under EODP

Year	Type of Unit	# of Units	Net Price (Nu)
1995	FAO	18	51,930
1998	COTTAGE	118	27,953
1999	COTTAGE	36	22,498
Total		172	5,043,122

7.3 Gross return of production

7.3.1 Gross Return per kg

Figure 2 shows the relative cost shares to produce one kg of lemongrass oil. Absolute numbers are provided in *Table 10*. The sales price for the 2004 season (Nu 503.94 / kg) comprises following cost items:

- *Fuel Wood* cost comprise the royalty for collecting dead, dry or diseased trees (DDDs) or the payment of contractors.
- *Labour cost* paid to collectors of lemongrass, and in some cases to collectors of fuel wood, if this work is not done by the distiller's household
- *Distillation unit* cost comprise depreciation and repayment of loan or hiring rate, maintenance and other costs
- *EODP & STCB* expense is the amount kept by the EODP mainly for transportation and insurance costs. Details of EODP expense are shown in *Table 11*.
- *Net income* for a distillers' household after deducting all expense.

Figure 2: Production Cost of 1 kg lemongrass oil

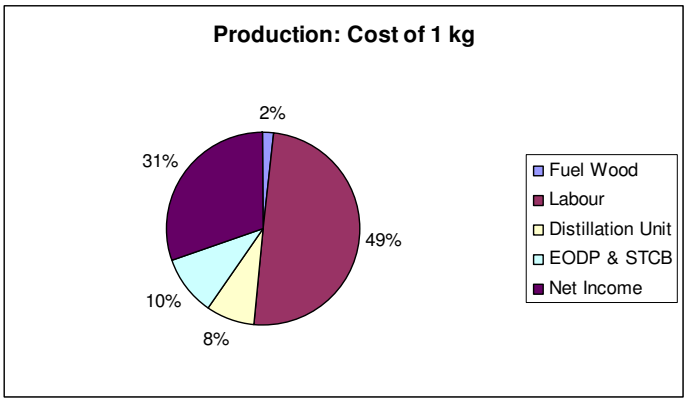


Table 10: Production and export costs per kg

Particulars of expense incurred	Cost Nu/kg
Fuel Wood	10.06
Labour	248.92
Distillation Unit	40.74
EODP & STCB	50.33
Net Income	153.90
Price 2004	503.95

Particulars of EODP & STCP expense paid by the EODP are presented in *Figure 3* (relative numbers) and *Table 11* (absolute numbers):

- Royalty of 5 Nu per kg of oil paid to the Department of Forests
- Transport costs consist of transit insurance (Mongar – Phuntsholing) and truck charges.
- STCB: Expense and commission paid to the State Trading Corporation of Bhutan
- Charges for financial services (bank and TT charges)

Figure 3: EODP & STCB Cost of 1 kg lemongrass oil

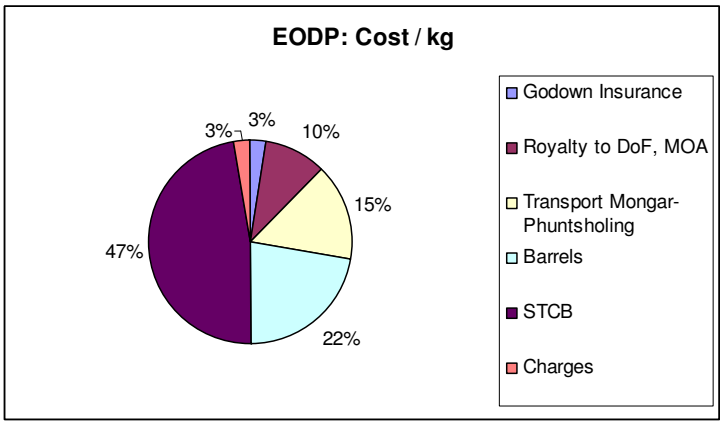


Table 11: EODP & STCP Costs

Particulars of expense	Cost Nu/kg
Go down Insurance	1.31
Royalty to DoF, MOA	5.00
Transport Mongar-Phuntsholing	7.72
Barrels	11.00
STCB	24.00
Charges	1.30
Sum EODP+STCB	50.33

7.3.2 Total Gross Return

Distillation units under EODP were generating sales of around Nu 5 million at with a production of 9.9 MT in 2004. The average return of the last seven years was Nu 6.22 million with an average production of 12.78 MT (cf. *Figure 4*, Table 12).

Looking at the trend in Figure 3, there was an initial hype of over 17 MT production in 1998 and 1999, when the mild steel cottage units were distributed. Pressure to pay back loans for purchased distillation caused high production. Since then, declining distillation units and a declining output per active unit, as discussed in chapter 7.5 and 7.6, brought down the production, which now ranges at 10 MT.

Figure 4: Production Timeline 1998 – 2004

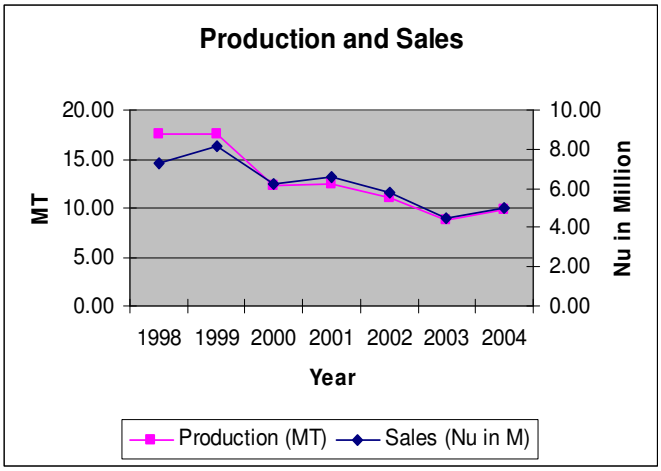


Table 12: Production and Total Gross Return

Year	Production (MT)	Sales (Nu in M)
1998	17.48	7.25
1999	17.63	8.14
2000	12.24	6.26
2001	12.42	6.56
2002	10.98	5.81
2003	8.82	4.51
2004	9.90	4.99
Total	**89.47**	**43.52**
Average	**12.78**	**6.22**

7.4 Beneficiaries of Sales

7.4.1 Distillers

On the average one distillation unit has an net income Nu 14,052 net income per year (cf. *Figure 5*, *Table 13*).

Figure 5: Distillers' Net Income per Unit

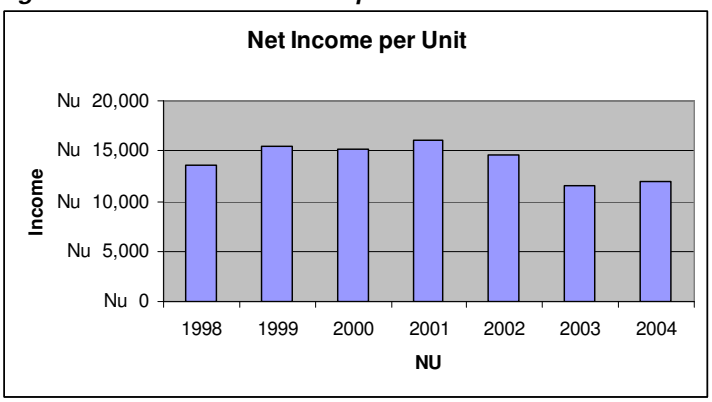


Table 13: Net Income of Distillers

Year	Net Income
1998	Nu 13,506
1999	Nu 15,532
2000	Nu 15,169
2001	Nu 16,034
2002	Nu 14,662
2003	Nu 11,466
2004	Nu 11,997
average	***Nu 14,052***

Opportunity costs for distillers were assessed for 2004 (see Annex): The units were operated by 2 family members. Sharing a net income of Nu 154 / kg oil, one family member of the unit household earns Nu 178 per day.

7.4.2 Harvesters

51% of harvesting work is done by female collectors. On the average 5 collectors per unit accumulate lemongrass to operate one unit. The mean daily wage of a lemongrass collector was Nu 115 in 2004 season.

Figure 6 shows the net income of a harvester per unit per season, derived from the cost analysis for 1 kg of oil. In 2004 the mean seasonal income of a lemongrass collector was Nu 3,881, equal to 33,7 working days per season at an daily wage of Nu 115.

Figure 6: Net Income of Harvesters per Unit per Season

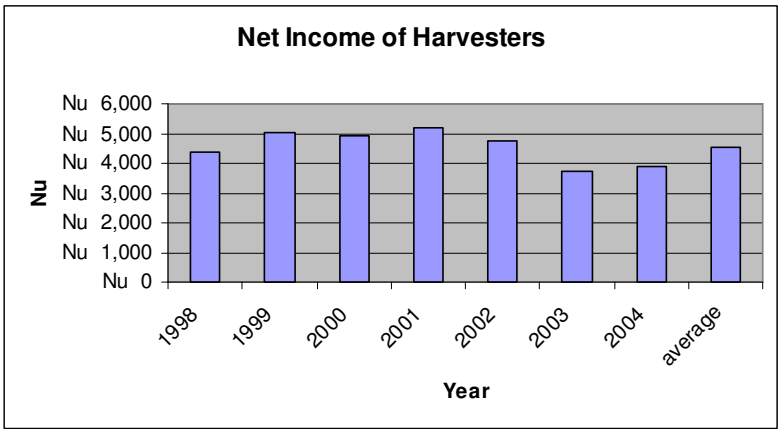


Table 14: Harvesters: Net Income per Unit

Year	*Net Income*
1998	Nu 4,369
1999	Nu 5,025
2000	Nu 4,907
2001	Nu 5,187
2002	Nu 4,743
2003	Nu 3,709
2004	Nu 3,881
average	Nu 4,546

7.4.3 Government Revenue

Derived from the cost analysis for 1 kg oil, lemongrass industry generates a direct government income in form of fees, charges and royalty of Nu 193,000 per year (cf. *Figure 7*, *Table 15*).

- Fuel Wood: Nu 10.20 per kg includes a cost fee charged for fuel wood collection in the nearby forests and goes to the Department of Forests. Very few distillers on the road site are supplied by Forest Management Units and do not collect fuel wood.
- LG Royalty: The Department of Forests charges Nu. 5.00 per kg oil for collecting the lemongrass (fee for extracting a non wood forest product).

Figure 7: Government Revenue

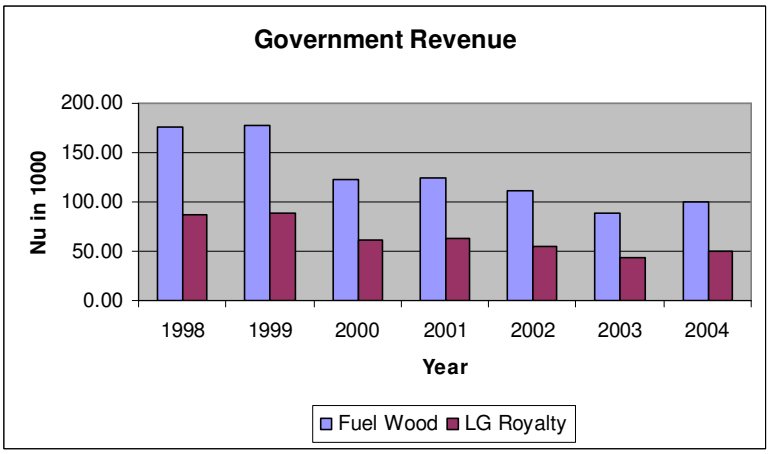


Table 15: Government Revenue, Nu in 1000

Year	Fuel Wood	LG Royalty	Sum
1998	175.95	87.42	263.37
1999	177.38	88.13	265.51
2000	123.18	61.20	184.38
2001	124.99	62.10	187.09
2002	110.50	54.90	165.40
2003	88.76	44.10	132.86
2004	99.63	49.50	149.13
Total	900.40	447.35	1,347.75
Average	128.63	63.91	192.54

7.4.4 Employment

Taking in consideration that one unit creates employment for 5 collectors and 2 persons of the owning household, all in all 7 jobs are created per unit per day. Employment generated by lemongrass industry is shown in *Figure 8* / *Table 16*. On the average, the industry enables 943 jobs each year.

Considering the average number of operating days per season, the 943 created jobs correspond to 38,731 working days per year.

Figure 8: Jobs Created

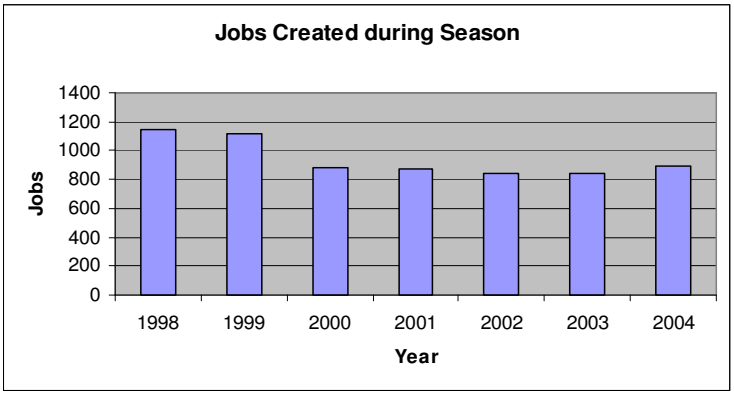


Table 16: Jobs Created

Year	Jobs
1998	1148
1999	1120
2000	882
2001	875
2002	847
2003	840
2004	889
average	943

7.5 Production Trend Lines

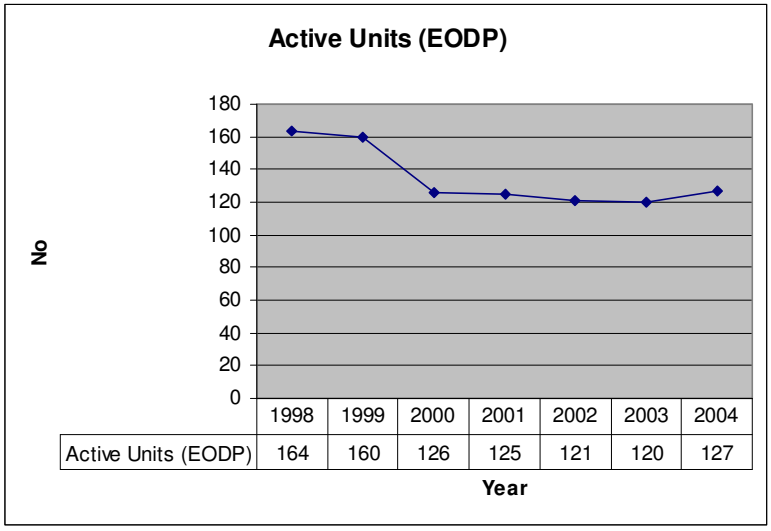
7.5.1 Number of active distillation units

In the past years the number of active units was moving around 120. Small fluctuations are caused by distillers who do not work permanently, stopping business for one year in order to go for contracts and then restarting distillation again. Looking at long term trends the number of active units has gone down by 26% from 172 in 1999 to 127 in 2004 (*Figure 9*, numbers for years 2000 – 2003 were assessed).

The following points could be reasons for this trend:

- Alternative employment: Lemongrass distillation is regarded as laborious job, while development activities of the government enabled a diversification in employment opportunities. Therefore a part of former distillers has shifted to other off-farm activities, mainly contract work in construction business, daily wage employment in the road construction sectors and others. Furthermore, some farmers might have used lemongrass distillation as a platform to shift to other types of business.
- Depletion of the input resources lemongrass, fuel wood and water in certain areas.
- Religious stigma: regarding Buddhist perceptions lemongrass distillation is considered as sinful activity, since it kills lots of insects and other micro organisms.

Figure 9: Active Units



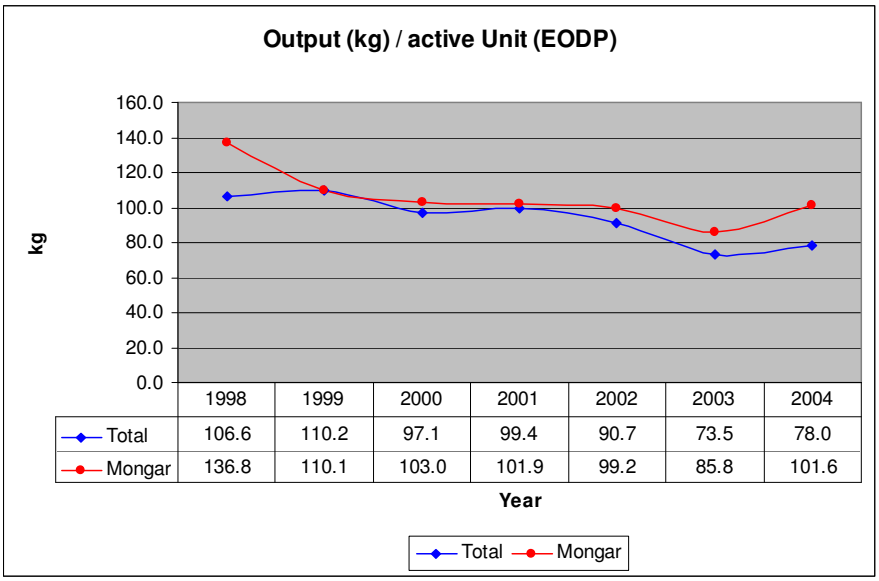
7.5.2 Oil Production per active Unit

The oil production per unit has decreased in the years from 1998 to 2004. In total, the average oil production per unit has gone down from 107 kg in 1998 to 78 kg in 2004, a decrease of 27% (*Figure 10*). Causes for this trend can be seen in:

- a decrease in oil yield
- a decrease in operating days due to shortage of resources (lemongrass, fuel wood and water) or religious perception, which drives farmers to stop distillation on auspicious days

- late issuance of permit to collect fuel wood in certain areas

Figure 10: Output per Unit



7.6 Problems

7.6.1 Decline of Resources

An assessment has been done to find out the intensity of environmental input decline, based on the information provided by the distillers during the individual interviews and the PRA sessions. The geog wise intensity of decline in resources is given in *Table 17*.

Table 17: Resource Decline in different geogs

Geog	Resource Decline		
	LG	**Fuel Wood**	**Water**
Tshengkhar	Medium	High	High
Drametse	High	High	High
Chaskar	High	High	High
Thangrong	Low	Medium	High
Uzorong	Medium	Medium	High
Barthsam	Medium	Medium	High

7.6.1.1 Lemongrass

Lemongrass, a perennial grass endures repeated harvesting and its life span in the wild is about 8-10 years. Previous studies (RNR-RC East, 98; Lama, B. 2004) showed that the LG resources in the distillation areas are declining as a result of over harvesting and improper harvesting.

At present, the method of harvesting differs from one place to another, with a minimum cut of two to three times per season depending on the altitude of the location. The harvesting season in general starts from June and ends at November or December. The distillers express their concern that three and more cuts per season and improper methods of harvesting have adverse effects on the quantity of

biomass production for the next year. A limit of 2 cuts per season has to be set and the harvesting technique should follow the cutting method by keeping 20 cm stalk above the ground level.

Further more, repeated cutting has enabled other weedy species to compete and establish in the lemongrass area. Common weeds found in the LG area are *Parthenium sp., Lantana camera,* and *Stipa sp*. The farmers state that those engulfing weedy species were not there in the first years of distillation (cf. RNR-RC 2002). They see three main reasons for impending weeds:

- Over harvesting of LG because of lacking management plan to define an optimum lemongrass harvesting intensity
- Dispersals of seeds by grazing livestock
- Frequent fire which enhances the growth of weeds

7.6.1.2 Fuel Wood

The fuel wood supply is met from collecting lops and tops and other dead, dying or diseased trees. It is collected after paying royalty to the Department of Forests. In most cases, the farmers in the LG area use Chir Pine trees, sometimes broad leave trees to heat the drums. Additionally, trees are lopped to supplement the fuel wood. Most distillers express that fuel wood has become scarce, therefore some have already left the industry. Other distillers have delayed distillation works due to late issuance of permit by the Department of Forests. The local forestry authority states two reasons for not issuing the permit:

- Deliberately setting fire in the lemongrass growing area.
- Lack of cooperation in the suppression of fires.

The setting of fires in the Chir Pine ecosystem has a long history. Although the lemongrass industry appears as a further source of man-caused forest fires, no scientific evidence was provided until now. In interviews with farmers, five main reasons for forest fires were mentioned:

- to establish grazing resources in bottleneck periods
- to scare wild animals in order to protect crops
- to induce lemongrass growth
- accidental fires cause by human movements: torches, campers …
- natural fires

The DoF has created a system to avail firewood from the FMU fire wood contractor for distillers along the road sides. Distillers at the road side criticized the system in regard to 3 aspects:

- The fire wood from the contractors is too expensive (up to Nu 5000 per TL).
- It is less efficient due to containing decomposed wood.
- The system itself is unfair because of inducing higher cost compared to the cost of fuel wood permit paid by distillers in the forests.

The fire wood shortage has been already addressed in previous studies (cf. RNR-RC East 1998, 2002). The studies recommended the plantation of multipurpose fast growing trees. However, it has to

be noticed that an alteration of the species composition could endanger the functionality of the Chir Pine ecosystem. The DoF strongly recommended to foster indigenous species.

Some of the distillers are willing to plant suitable tree species, at least 10 seedlings per season as a mean of meeting fuel wood in long run. The notion of planting has been induced as a result of stakeholder meetings. However, frequent fires would pose threats to the seedlings in the fire wood plantations.

The Chir Pine forest ecosystem provides a variety of services starting from construction timbers down to the fuel wood, resin and cattle bedding. Therefore an analysis was carried out to assess the fuel consumption of the lemongrass industry. The analysis came to similar results than the 1998 study by RNR-RC East: A consumption of 16.5 truck loads of fuel wood per metric tonne of oil.

Table 18 lists the fire wood consumption in truck loads and assessments in m^3 and standing trees for the years from 1998 to 2004. The average fuel wood consumption by EODP units was 211 truck loads per year.

Table 18: Fuel Wood Consumption (EODP Units)

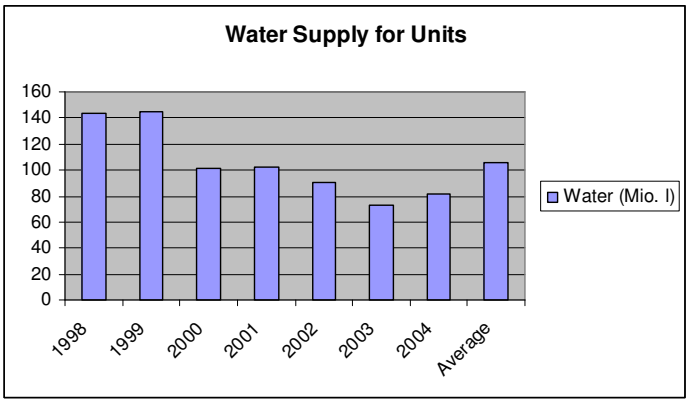
Year	Truck Loads	m^3	No of Trees
1998	288	2307.9	1,154
1999	291	2326.6	1,163
2000	202	1615.7	808
2001	205	1639.4	820
2002	181	1449.4	725
2003	146	1164.2	582
2004	163	1306.8	653
Total	1,476	11810.0	5,905
Average	*211*	*1687.1*	*844*

Note: based on data by FRDD, one truck load was assessed to correspond to 8 m^3 or 4 standing trees

7.6.1.3 Water

The distillation plants need a constant flow of water to cool the condenser. They are placed near water streams or at points the water supply is met by pipelines. Some distillers have to face a fluctuating flow of water, others rely on seasonal water and therefore are forced to invest in water pipes to drain water from faraway sources. *Figure 11* shows the amount of water used from 1998 till 2004, and indicates an average use of water which is more than 100 million litres per year.

Figure 11: Water Supply for Distillation Units



Note: assessment based on IHDP 1996, Report of the First Input, Annex

7.6.2 Labour Competition

Labour shortage is mainly caused by two reasons: Firstly, a part of the distillers do not have funds to pay labourers in advance. Secondly, the shortage is a result of differences in labour wages for LG collectors. Distillers in certain areas have fixed the prices based on collected quantity, while others pay daily wages based on the National Work Force wage. Collector wages are varying from Nu. 60 to Nu. 150 per day. In some areas of low wages payment includes three meals. Distillers state that the erratic flow of wages poses a threat to the resource base, since it encourages collectors to harvest lemongrass without following the admissible cut. Furthermore, different wages encourage collectors to shift frequently in search of higher wages.

7.6.3 Access Rights and Resource Allocation

Until 2002, the resource allocation was based on individual interests favoured by an open access situation. Due to the Forest Nature Conservation Act (cf. Chapter II), the LG resource as other NWFPs, is legally owned by the state. The Act allows commercial use of forest products with a permit system. Any individual farmer interested in lemongrass business could submit the application via the Gup and Extension to the Dzongkhag authority (without influence of the EODP) for approval of the plants. The plants were distributed by the Dzongkhag Agriculture Sector after rectifying the location of sites to be set up. The farmers had to specify the location where to set up the plant. Factors as water and fuel wood supply, accessibility and lemongrass quantities influenced the decision making process of choosing a distillation site.

Due to the nature of the allocation system, there is great variation in area holding. The average harvest area of a distiller was 196 acres, but there is high variance: Some distillers hold more than 1000 acres while others have to be satisfied with 15 acres, a situation leading to conflicts in certain areas: for instance, the distillers of Chaskar do not have much LG area in their jurisdiction and have been relying on areas of Drametse. This access was objected by the Drametse authority, the matter reached to court for settlement, but was not addressed as the forest Act allowed any person to collect lemongrass all over the country. This led to more confusion among users and responsible persons of the local authority.

In interviews, farmers, but also RC – Wengkhar, were emphasizing on the importance of respecting traditional boundaries. Locally defined access rights could be a long term solution to avoid freerider cases, and to enhance rural autonomy as well as enable long term sustained resource use with plough back. However, recent efforts to demarcate the harvesting area for each distiller failed as there was no legal base to support local regulation on forest products.

A historical perspective offers an account of the decentralised nature of polity of the Bhutanese government in pre-modern times. Beyond the communities, the members of a geog had certain rights and obligations defined within the context of a geog in cultural and economic spheres. The members of neighbouring geogs could not get rights to valuable common property resources found within the territory of a geog. Access to resources beyond ones geog could be obtained either with sanction from higher powers or authorities, or with customary rights (Ura 2004).

In contradistinction to a feudal system, historically land use decisions especially regarding forests have been made by the people themselves without major state intervention as is being today. The past generations of villagers have bequeathed a pristine environment to their children and it would be well worth the effort to learn from them (Wangchuck).

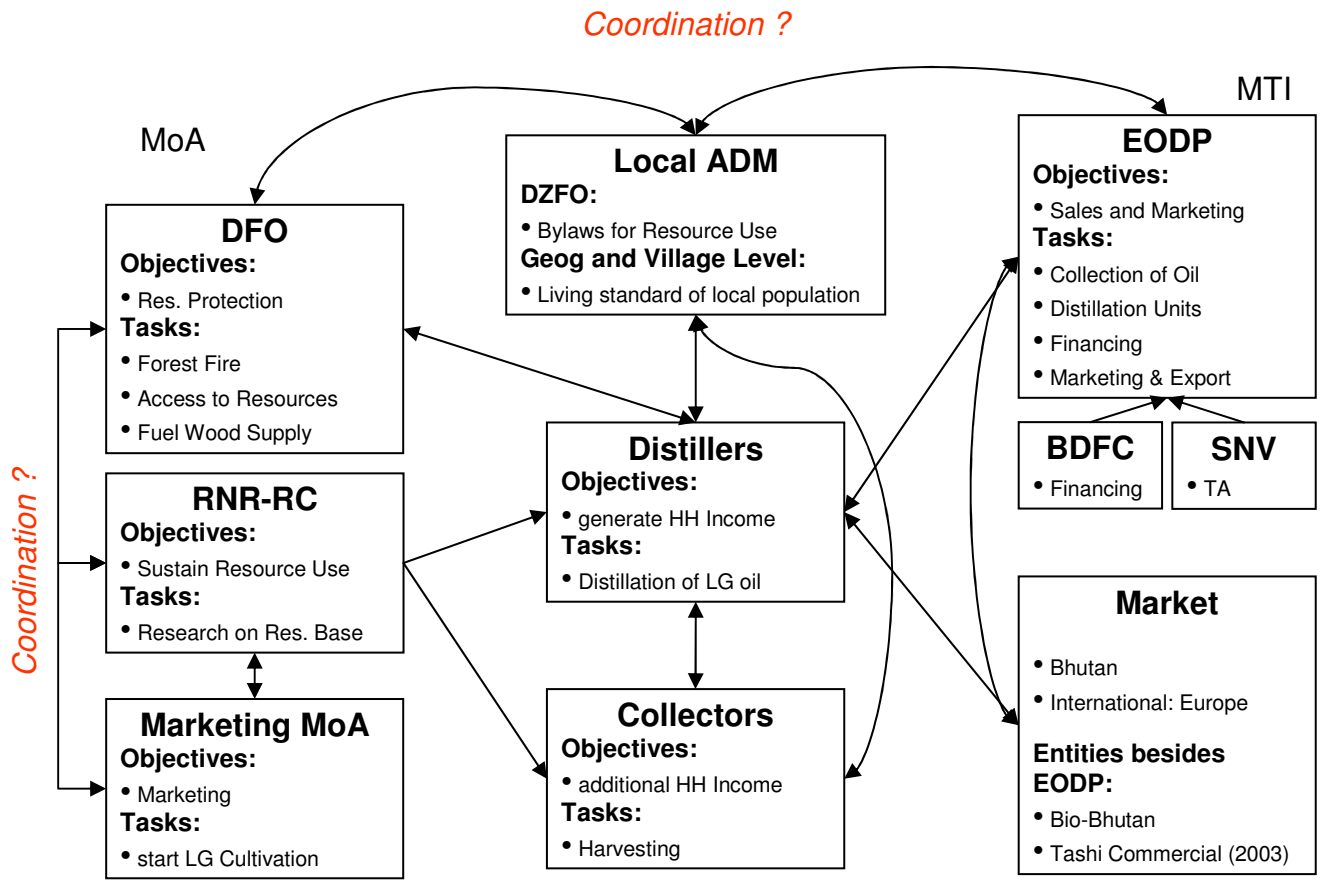
The GTY Chathrim 2002 was a step towards local autonomy. The use of resources has been restricted by the local authority since the geog boundary is under its jurisdiction.

7.6.3.1 Lack of Coordination amongst Stakeholders

Due to the nature of mandates and the functions of different involved stakeholders, the coordination of processes to support the small scale industry has serious flaws. This has led to a situation where distillers, harvesters and the local authority of certain areas (e.g. in Drametse) are fed up with approaches by stakeholders to conduct meetings and interviews to understand the constraints of LG industry and to find solutions. A review of the 9th FYP revealed that no program oriented to LG industry was supposed, although it was stated in previous reports that the industry contributes to rural development as a source of cash income for the local population in the 4 eastern Dzongkhags.

To meet local expectations, there is a need of adapting and synchronizing the agenda of main decision-makers like EODP and RNR-RC, otherwise supportive measures cannot lead to satisfying results. An organisational diagram (*Figure 12*) illustrates the scenario, including all stakeholders and their main functions.

Figure 12: Organisational Diagram: Present Scenario



8. Conclusion

At its inception by Tashi Industries in the early eighties, lemongrass distillation started as a low risk enterprise with low initial capital investment and fast cash return to labour. Favoured by an open access to resources, the lemongrass industry boomed in its initial stage. However due to inferior technology and lacking resource management, the oil quality could not meet international standards, thus being reduced to low prices.

From the beginning of the 90ties onwards, the government and the UN-assisted projects established higher distillation technology, introducing more efficient equipment to raise the oil quality and reduce pressure on resources. Until now, the cottage and FAO type distillation plants produced 111 MT of LG oil and generated sales of Nu 54 millions, enhancing rural income and providing approximately 1000 seasonal jobs a year.

Although the retirement of low level distillation by "Tashi-type" plants released the pressure on resources, the industry is still not running on a sustained basis. The decreasing output per unit is a result of:

- Lacking bylaws and structures to enable resource allocation based on local decisions
- Lack of coordination among stakeholders, who provide technical services

Local knowledge to manage resources on a sustained base could not come to effect, mainly due to one reason: The open access to resources hindered a development of locally decided regulations, as for example a demarcation of traditional boundaries. Further more, the quality and efficiency of activities by focal agencies to support the small scale industry depends on improving standards of coordination and information sharing between stakeholders.

As a consequence the pressure on resources is rising. Looking at the production trend, it is high time to discuss on alternative ways of resource allocation in order to preserve lemongrass activities as an important additional source of income to subsistent agriculture in the east.

9. Recommendations

9.1 Coordination among Stakeholders

There is a high need to improve coordination and cooperation among stakeholders in LG industry. Ongoing efforts by focal agencies like EDOP, RNR-RC East or the Territorial Forest Division will lead to long term objectives if involved entities are interlinked to deliver comprehensive solutions through cooperative means.

Activities on higher levels of the production chain, as for example EODPs efforts to establish a Distillers Association have to be synchronized with processes on grass-root level to sustain the resource base. The study recommends a workshop involving all stakeholders to discuss on roles, functions and responsibilities in order to improve coordination of technical backstopping.

9.2 Framework to define resource access and management

The Chir Pine ecosystem in the eastern Dzongkhags provides a variety of services, apart from lemongrass activities. In order to make sure that the resource base outside FMUs is used in a sustainable way, it is necessary to discuss resource allocation.

The formation of committees at geog level with technical backstopping of focal agencies like DFO, EODP and RNR-RC could be a platform to define access rights and management plans. Transferring regulatory powers to local representative institutions like GYTs would promote the environment and knowledge for communities to practice small rule and policy making for their own localities laws.

Options for securing operating rights to foster a long term plough back system could be:

- CB-NRM (Community Based Natural Resource Management)
- Forestry lease to groups or individual distillers & Management Plan (if a legal basis is set)
- Management plans within the framework of Community Forestry / Social Forestry

The options present different degrees of user group cooperation. Creating awareness about the long term advantages of concepts like CB-NRM among the users of lemongrass was already promoted during the study and has to continue. All these solutions of course demand a legal framework, that should be set up by responsible decisions-makers.

The above approaches are frameworks to develop a management plan for the commercial use of LG as well as for the use other NWFPs on local level with technical assistance by involved agencies. The implementation of a sound management plan requires assessment of concerned resources: lemongrass, fuel wood and water. Further more, a mapping of distributed distillation units, as it was already hinted to in previous papers by RNR-RC East areas, is urgent.

Regarding the fuel wood issue, possible scenarios for a long term supply have to be further explored. Imaginable options would be a rotational system of logging Chir Pines after assessing needed quantities.

9.3 Organic Certification

The implementation of proper resource allocation and management practices in combination with operational structures like a distillers association should lead to the organic certification of wild harvested lemongrass. Organic certification would be the starting point to open up new markets.

Organic Certification would enable a notable achievement in selling prices. The European retail market's price for organically produced and imported lemongrass oil is USD 20 per litre, whereas the prices for conventional oil is about USD 14.7 (both excl. transport costs, source: German trader, prices 2005). Selling prices for end users are USD 4.8 for a 5 ml bottle of organic oil.

Required conditions for organic certification are listed in the Annex.

9.4 Research

The study team recommends further research and development activities by responsibly agencies in areas of:

- Improvement of distillation technology to increase oil quality and distillation efficiency. Intermediate solutions to save energy with existing equipment like methods to insulate the stainless steel drums should be explored.
- Local studies on fuel wood supply
- Bio-mass and oil yield of lemongrass as there is a variation in oil contents and in grass recovery in different lemongrass areas.
- Feasibility of secondary processing of lemongrass oil. Value addition through local small scale industries as a further option to enhance rural income.
- Feasibility of cultivation of lemongrass on farm trial to enhance diversification of farm activities. According to the Marketing Section of MoA there would already be interested customers in Europe to support cultivation activities.

10. References

Africabiz Online. 2003. Introduction to the Essential Oils' Industry and Trade. <http://businessafrica.net/africabiz/arcvol1/is47front.php#data>

CTA. 1999. Bhutanese Lemongrass Oil. An Assessment of the European Market. CTA Economic & Export Analysts LDT, UK.

FAO 2002. Non wood forest products in 15 countries of tropical Asia – An Overview. Bangkok, FAO Regional Office for Asia and the Pacific. <http://www.fao.org/DOCREP/005/AB598E/AB598E08.htm#5681>.

FAO. 1995. Flavours and fragrances of plant origin. Chapter 7, Litsea Cubeba Oil. <http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/V5350E/V5350e00.htm>

FAO. 1995. Non-wood forest products of Bhutan. In Beyond timber: social, economic, and cultural dimensions of non wood forest products in Asia and the Pacific. RAP Publication 1995/13. Bangkok, FAO Regional Office for Asia and the Pacific. <http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/X5336e/x5336e0c.htm>

FAO. 1996. Non wood forest products of Bhutan. RAP Publication: 1996/6. Bangkok, FAO Regional Office for Asia and the Pacific. <http://www.fao.org/docrep/X5335e/x5335e05.htm>

IHDP. 1996. Report of the First Input of the Solvent Extraction And Aromatic Chemistry Specialist. Integrated Horticulture Development Program. MoA, Thimphu.

IHDP. 1996. Report of the Second Input of the Solvent Extraction And Aromatic Chemistry Specialist. MoA, Thimphu

Lama, B. 2004. Discussion paper on Essential Oils industry in Bhutan. EODP Mongar. Unpubl.

MoHA. 2002. Dzongkhag Yargay Tshogchhung. Royal Government of Bhutan, Ministry of Home Affairs, Chatrim.

MoHA. 2002. Geog Yargay Tshogchhung. Royal Government of Bhutan, Ministry of Home Affairs, Chatrim.

Namgyel, P. and Tshitila 2003. Rare, Endangered, Over-exploitation and Extinction of Plant Species. Putting Cordyceps – a high value medicinal plant – to Test. Council of Research and Extension and Bhutan Trust Fund for Environmental Conservation. Thimphu, Bhutan.

P.K. Legha, 1998. Present Status and Future Strategy for Sustainability of Lemongrass Production in Eastern Bhutan. RNR-RC Khangma, MoA.

Purdue University. 1997. Guide to Medicinal and Aromatic Plants – Lemongrass. Purdue University, West Lafayette. <http://www.hort.purdue.edu/newcrop/med-aro/factsheets/LEMONGRASS.html>

RCDC. 2005. Regional Centre For Development Cooperation. Orissa, India. <http://www.banajata.org/d/a1_12.htm>

RGoB. 1995. Forest and Nature Conservation Act of Bhutan. Royal Government of Bhutan, Thimphu, Bhutan.

RGoB. 2005. The Constitution of the Kingdom of Bhutan. Draft of the Tsa Thrim Chhenmo as on18th August 2005.

RNR-RC East. 1998. Impact of Lemongrass Distillation on Socio-Economy and Environment in the Eastern Bhutan. RNR Research Centre-East, Khangma, Trashigang, Bhutan.

RNR-RC East. 2002. Conservation and Sustainable Use of Lemongrass in the Eastern Bhutan. Dhanapati Dungyel, RNR-RC, Khangma, Trashigang, Bhutan <www.wwfbhutan.org.bt/medicinal%20plants.doc>

Turkelboom, F., Gurung T.R. and Dukpa D. 2001. Role and Use of Common Property Resources (CPRs) in Bhutan Himalayas: Between Tradition and Globalisation. presented at The Inaugural Pacific Regional Meeting for CPRs, Brisbane, Australia <http://dlc.dlib.indiana.edu/archive/00000663/00/turkelboom.pdf>

UHE. 2005. Market Newsletter: Flavor and Fragrance Ingredients. George Uhe Company, New Jersey, USA. <http://www.unv.org/Infobase/articles/1999/99_06_01BTN_vol.htm>

UNV. 1999. Bhutan Newsletter: Thuensum, Issue 1. Dr. Prem Kumar Legha. Unitad Nations Volunteers. June 1999. <http://www.unv.org/Infobase/articles/1999/99_06_01BTN_vol.htm>

Ura, K. 1993. Land Tenancy and Food Security. Royal Government of Bhutan, Thimphu, Bhutan.

Ura, K. 2004. Peasantry and Bureaucracy in Decentralization in Bhutan. Discussion Paper. Centre for Bhutan Studies, Thimphu, Bhutan.

Ura, K. and Kinga S. 2004. Butan – Sustainable Development Through Good Governance. A case study from Reducing Poverty, Sustaining Growth; Scaling Up Poverty Reduction: A Global Learning Process and Conference Shanghai 2004. The Centre for Bhutan Studies, Thimphu, Bhutan

Wangchuk, Tashi. Change in the Land Use System in Bhutan: Ecology, History, Culture and Power. Nature Conservation Section. DoF, MoA.

WBG. 2005. Conserving Bhutan's Natural Heritage through a Trust Fund. The World Bank Group. <http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/SOUTHASIAEXT/BHUTANEXTN/0,,contentMDK:20208772~pagePK:141137~piPK:217854~theSitePK:306149,00.html>

11. Annex

11.1 Deriving Data

Table shows how the costs to produce one kg of oil were derived:

Table 19: Deriving Costs Components

	Cost shares (per kg)	Source	Data 2004	Note
	Gross Return	EODP	503.95	price fetched by EODP on market
-	EODP Costs	EODP	50.33	transport, STCB, …
=	Distillers' gross income		453.62	price paid to Distiller per kg
-	Fire wood cost	samples in field	10.06	royalty paid to DoF or costs per truckload
-	Labour cost	see next table	248.92	
-	Cost of material	samples, EODP (life time)	40.74	depreciation of distillation unit = purchase price / life time or hiring rate for unit maintenance costs miscellaneous (e.g. costs for water pipes)
=	Distillers" net income		153.90	

From the data gained in field interviews, the major cost components for producing one kg of lemongrass oil were calculated. As distillers provided imprecise data on expense for labourers, the labour costs were assessed as follows:

Table 20: Assessing Labour Costs

	Variable	Source	Data 2004
	average oil yield (%)	reports by RNR-RCs	0.33%
*	lg quantity per distillation batch (kg)	specification of drum	140.00
*	average batches per day	derived from field data	5.00
=	**average output per unit per day**		**2.31**
	harvesters' average daily wage	samples in field	115.00
*	no. of harvesters per unit per day	derived from field data	5.00
/	average output per day		2.31
=	**labour cost per kg**		**248.92**

11.2 Units under Tashi Industries

Table 21: Sales under Tashi Industries, 1992 - 2004

Sales under Tashi Industries						
Year	**No. Units**	**Production (MT)**	**Sales (MT)**	**Paid to Distiller (Nu per kg)**	**Output (kg) / Unit**	**Distillers Proceeds (Nu in M)**
1992	80	9.00	2.10	91.00	112.50	0.82
1993	82	6.50	5.40	91.00	79.27	0.59
1994	78	6.90	12.90	135.00	88.46	0.93
1995	74	14.10	14.30	135.00	190.54	1.90
1996	81	19.80	15.40	155.00	244.44	3.07
1997	76	14.30	17.60	175.00	188.16	2.50
1998	78	13.20	16.50	235.00	169.23	3.10
1999	74	17.90	1.40	240.00	241.89	4.30
2000	72	11.60	27.10	240.00	161.11	2.78
2001	75	9.83	10.69	260.00	131.07	2.56
2002	76	11.70	3.60	280.00	153.95	3.28
2003	75	8.30	2.50	300.00	110.67	2.49
2004		0.49	1.08	300.00		0.15
Total		**143.62**	**130.57**			**28.47**
Average	*76.75*	*11.05*	*10.04*	*202.85*	*155.94*	*2.19*

Table 22: Units under Tashi Industries, 1992 - 2004

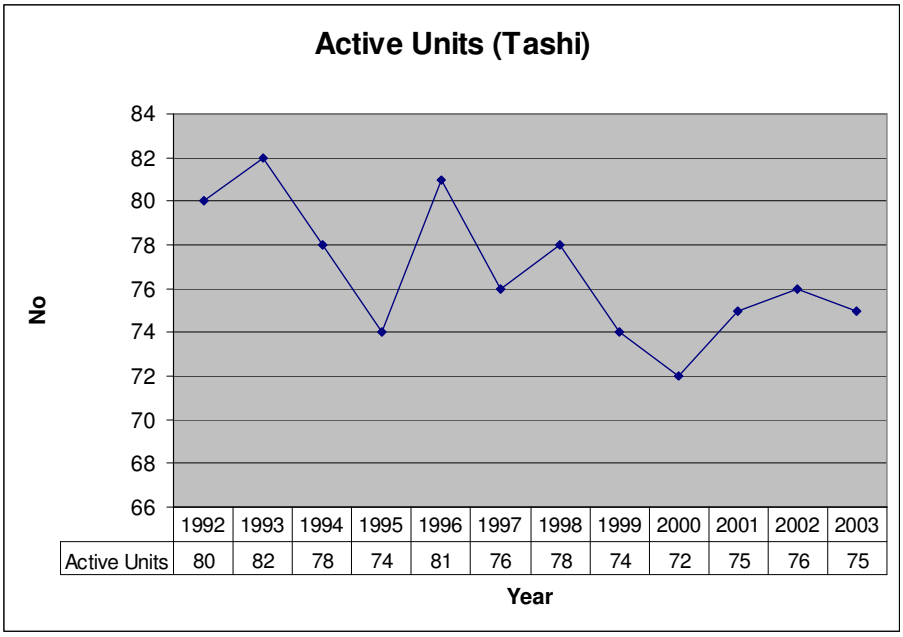
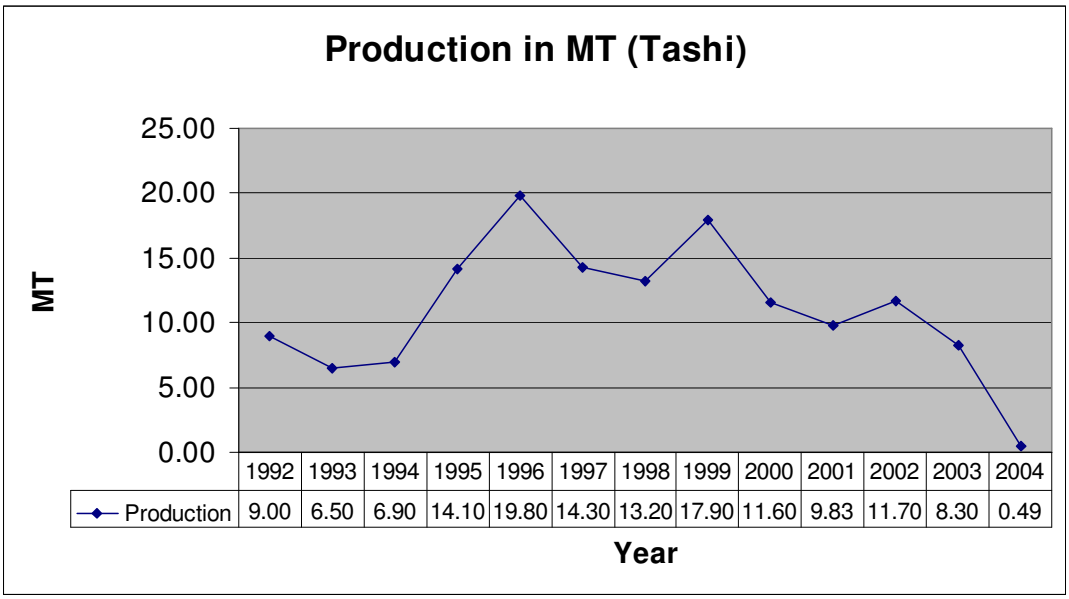


Table 23: Production under Tashi Industries, 1992 - 2004

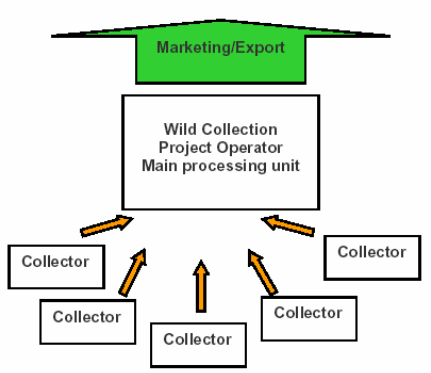


11.3 Conditions for Organic Certification

The conditions for organic wild collection are intended to give guidance for the implementation of general requirements for organic wild collection as set in the Regulation (EEC) 2029/91. The following overview defines main requirements to comply with both the European organic regulation and also the USDA National Organic program.

To achieve the necessary transparency all wild collection activities need to be organised in a well structured project. A simple suitable model would look like:

Figure 13: Model for Organic Certification



Critical Points

- Sustainability: The plant population must not decrease because of the collection. Additionally, the collection activities must not damage the habitat or endanger other plant species or wildlife in general.
- Quantities: The estimation of how much of the plant material may be taken out of one area must be based on a resource assessment. Preferably this is done year by year by a botanist, in cooperation with the collectors.
- Training: The project is responsible for ensuring that the collectors are trained in sustainability topics. The collectors need to understand how much of the plant can be collected so that the population does not decrease. The method of collecting must have the least possible impact on the plant, plant population and ecosystem in general. Each collector must know exactly how to collect the plant.

Table 24: Conditions for Organic Certification

Issue	**Conditions**
Critical Points	
Sustainability	Harvested quantities based on resource assessment
	Training of collectors: harvesting quantity & method
Risk of Contamination	Contamination through human settlements, agriculture, industry, roads …
Traceability / Transparency	Trace back each batch of goods
Quality issues	No subject to organic certification, recommendation: meet market requirements
Internal Collection Rules	
Collection	
Collection area	Well-defined borders, no non-allowed inputs, free of contamination
	Maps of collection areas
	Define sites which are not suitable for collection
	confirmation: area was 3 years free of not allowed input
Collected Plants	Must be grown naturally, Collection must sustain the ecosystem
	Suitable plant for wild collection
	Confirmation of sustainable use
	Resource assessment
	Information about collected plant: botanical name …
Collectors	Approved collectors list
	Training
	Contracts with collectors
Processing	
Hygiene/Risk of Contamination	The risk of contamination has to be minimised
Organic and conventional quality	Collectors are not allowed to handle same good in conventional and organic quality
Transport to Purchase Station	risk of contamination should be minimized
Purchase, Processing and Sales	
Purchase Procedure	the buyer (here: EODP or Association) has to check quality and relevant data to trace back the product flow
	check collectors list
	check compliance with internal collection rules
	Labelling
	keep purchase register
	receipt for collectors / distillers
	each year: consolidated quantities to purchase centre
	documentation of all purchase procedures
Storage and Handling	during handling of organic products quality and compliance to documentary requirements must be ensured
	identification of the product on all steps
	strict separation organic – non organic
	no prohibited methods (irradiation of containers…)
	transport documentation
	stock records documentation
	warehouse must be label organic
	keep sanitary records
Processing	main processing units (distillation units) are always subject to full external inspection by certification body
	check incoming goods
	declare ingredients and processing aids
	separation and identification of organic & non-organic products
	present processing steps in flow charts