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Reigniting the engine of growth

A forward-looking business model for the Mauritian tea industry



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Cover photograph:

@ FAO/Daneswar Poonyth and John Snell: Early morning sun on the tea garden along the Dubrieul Road, Mauritius

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Rome, August 2020.

Acronyms and abbreviations

CTC	Crush, Tear and Curl
COP	Cost of Production
FAO	Food and Agriculture Organization of the United Nations
FAREI	Food Agricultural Research & Extension Institute
GFSI	Global Food Safety Initiative
GMP	Good Manufacturing Practice
GOM	Government of Mauritius
KTDA	Kenya Tea Development Authority
MAIFS	Ministry of Agro-Industry and Food Security
MMA	Mauritius Meat Authority
MRL	Maximum Residue Limit
MTIDA	Mauritius Tea Industry Development Agency
NAPRO	National Agricultural Product Regulatory Office
NPPO	National Plant Protection Office
RTD	Ready to Drink
SFWF	Small Farmer Welfare Fund
SIDS	Small Island Developing State
STG	Small Tea Growers
TB	Tea Board
TDA	Tea Development Authority
TEAFAC	Tea Factories Ltd
VP	Vegetative Propagated

About this report


since the mid-1980s, the Mauritian tea sector has been on a consistent downward trend. In the mid-1990s, faced with declining global tea prices and rising costs of production – the highest being the labour and energy costs, shortage of labour, and ageing tea growers – resulted in about 86 percent of the tea gardens being abandoned, with some replaced with sugar cane and vegetables. Since the mid-1990s, the Government of Mauritius (GoM) has made various attempts to bring the sector back from the brink of collapse. Indeed, the tea processors, small tea growers and consumers have recognized the risks involved in the current downward trend.

Recently, the Government of Mauritius decided to capitalize on the unique island and terroir characteristics, as well as the growing demand for, Mauritian tea. It is within this context that the Ministry of Agro-Industry and Food Security requested FAO, through the Secretariat of Intergovernmental Group on Tea (IGG-Tea), Markets and Trade Division, to support the development of an inclusive business model for a for a thriving and sustainable tea sector in Mauritius.

The objective of this study is to identify the required dynamic transformative actions for a sustainable Mauritian tea industry. More specifically, a thorough review of the sector covering its history, its institutional framework, policy, national strategies, legislations, agronomic practices, the present tea business model and the political and economic motives and their interplay was conducted to identify the drivers that had led the industry to the brink of collapse. This review was followed by an analysis of the current situation taking into account developments in the global tea market and tea producing countries. In sum, this report focuses on a forward-looking business model and proposes strategies for a thriving and sustainable tea sector in a highly competitive global tea market.

Primary and secondary data on institutional structures, agronomic practices and the quality of green tea leaf and made-tea were collected. Both virtual and face-to-face consultations with tea growers, tea manufacturers, former senior employees of the Tea Development Authority and Tea Board, government officials from various agencies and policymakers were conducted. These consultations were followed by desk research and interviews with experts who were involved in the development of the tea industry in the early days. Early morning field visits were conducted, providing insights on tea field maintenance and tea harvesting practices, while factory visits provided an overview of the tea manufacturing process. Finally, the road map proposed for the revival of the tea sector is part of a multi-stakeholder dialogue on: *Relaunching Mauritius tea industry and building on opportunities arising from both the local and global market.*

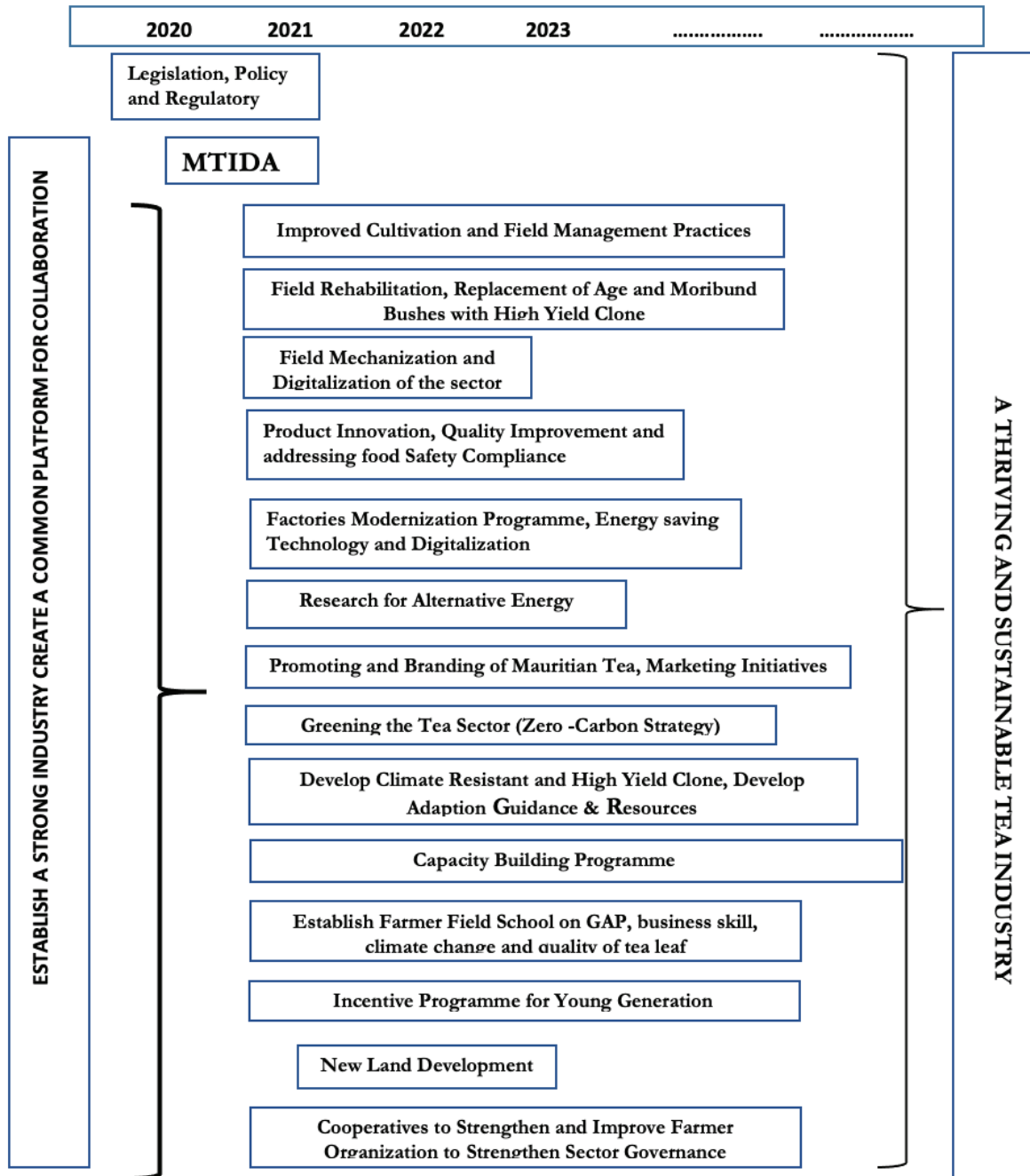
The findings recognize that the tea sector in Mauritius can be transformed into a thriving and sustainable sector. Second, the tea sector has been performing far below its potential capacity. Third, while there are debates on all fronts about what type of transformative actions are needed to revive the tea industry, this report acknowledges that there exists a salient agreement and common understanding among all relevant stakeholders that the tea sector needs a system transformation. Fourth, a public and private partnership with a new governance architecture



for the tea sector, will contribute tremendously to reach a new growth equilibrium. Finally, this report takes note of the Government's high interest in reviving the country's tea sector.

This report is to present strategies for reviving the tea industry in Mauritius and serves as a basis for the way forward for a competitive, sustainable and resilient tea sector.

A road map for a sustainable tea industry



Executive summary

This report finds that the decline in the tea sector in Mauritius is the result of uncoordinated institutional actions, the absence of comprehensive policy and national strategies, weak legislation and regulatory framework. The decline can be attributed to the low level of technology adoption, lack of organizational innovation in the business model, lack of action plans and strategies to navigate the declining global price of tea, rising costs of production, the continued pressure caused by the ageing tea growers and labour shortage. The over-dependency on government programmes and support for the development of the sector in the early days is also one of the causes. The tea development programmes introduced by the Government in the 1980s did not reach their objectives of increasing production efficiency along the tea value chain.

The tea sector is currently facing unprecedented and unpredictable challenges for improving productivity, reducing the high costs of production, addressing the ageing of tea growers, shortage of labour and improving the quality of tea. A programmatic and innovative approach that includes a systems-based policy, legislation, and regulatory framework should be the guiding principle for reviving the sector. The proposed business model aims to make optimal use of innovation and digital solutions.

In sum, the proposed novel dimension could make an important contribution to carving a niche for Mauritian tea in the competitive global tea markets. Three to five year planning and funding cycle would be the norm for bringing back the tea sector from the brink of collapse. Finally, strong government engagement is a pre-requisite for its revival, given the fact that the internal market is satiated, and production is threatened. A holistic approach, from bush to cup, which addresses these challenges, is key to a successful transformation of the tea industry. Based on its findings, this report makes several recommendations for the transformation of the Mauritian tea sector:

Institution, policy, legislative and regulatory framework

Owing to the socio-economic importance of tea, as well as its agronomic and physical characteristics, there is a need to separate the governance of tea from the other commodities under the National Agricultural Product (NAPRO) Act 2013. This report highly recommends the enactment of legislation to set an entity – the Mauritius Tea Industry Development Agency (MTIDA) with focus on all aspect of the tea supply chain under aegis of the Ministry of Agro-Industry and Food Security. The MTIDA will be a one-stop-shop that incentivizes the sustainability of the tea sector through constant innovation. The report strongly argues that a modern and dynamic institution with a new legal and regulatory framework should be the main pillar of the tea revival action plan.

Digital innovation and data-driven tea sector

Digital innovations and technologies should form an integral part of the solutions for an

innovative and inclusive tea business model, increasing productivity, efficiency and sustainability, and for producing quality tea. Digital technologies are creating new opportunities to integrate smallholders in a data driven smallholder tea sector. Access to digital technology can offer significant advantages to revive the tea sector in Mauritius.

Improving productivity and reducing costs of production

Pressures on the quality of made-tea continue to persist. The rising costs of tea production perpetuates the need to improve production efficiency. Investment is needed to enhance productivity at the field level by replacing moribund bushes, old bushes, and tea fields with unknown clones with a high yield and climate resistant clones, and include the use of mechanization, better plant husbandry, and field management. Any new planting or replanting should facilitate mechanization. It is highly recommended to use mechanized/motorized harvesting to reduce the cost of green leaf, thus reducing the costs of tea production. In order to improve quality in line with global market requirements as well as productivity at the factory level, investments are needed to increase the adoption of improved processing technology, energy-saving technology, including ICT, and computerization of key factory production processes, for example, Continuous Fermentation Units. Innovation for the use of renewable energy sources will contribute to reducing costs of production as well. In addition, the quality of green leaf needs to be improved with the aim to reduce the use of energy. The quality of green tea leaf adversely affects the cost of processing; the lower the quality of green leaf the higher the use of energy, thus the higher the costs of production.

Labour shortage, ageing small tea growers (stg) and incentives for youth to join the industry

Mechanization and modern production technology adapted to the Mauritian tea field are required to improve the yield of green leaf, address the labour shortage and ageing labour, and encourage youth to join the tea industry. The arduous and strenuous work involved, together with the decreasing economic returns, have discouraged the youth from joining the sector as tea growers. Mechanization and other modern production technologies can reduce the heavy physical work and motivate the younger generation to join the sector. Furthermore, it will enhance productivity and, therefore, increase the economic returns of tea. A plan of action to facilitate the mechanization of tea production in the country is needed.

Improving quality of made-tea

There is an increasing pressure to improve the quality of Mauritian made-tea. This call for incremental investments to raise the quality of made-tea, which is currently classified as low to mediocre. The quality of the tea is a predicament of the quality of the leaf coming into the factory. Over the past 10 years the quality of the green leaf has dropped. In addition, the weak enforcement of quality green leaf and substandard processing has resulted in the decline of the quality of made-tea. Moreover, there is lack of outreach-training programmes for STG on field maintenance and quality of green leaf. The current price system for green leaf tea provides no

incentive for tea growers to produce quality green leaf. The quality of green leaf is not the only matter of concern for a good standard of made-tea, but quality of green leaf will reduce the overall cost of production. Finally, production techniques need to be altered to maximize the capability of growers to produce internationally recognized and desirable qualities of tea.

Product innovation

Current production is focused on CTC black tea. The Mauritian tea industry has opportunities to diversify by producing specialty tea, green and/or tea extracts. First, this report acknowledges the importance of CTC black tea production for the domestic market. The recommended diversification strategy is to produce specialty tea, green tea and tea extracts in line with global demand. It is suggested that factories become dual production units - CTC/Orthodox or CTC/Green. Production innovation can support the tea export strategy of Mauritius. There are many potential target markets for both green tea and tea extract, the most pre-eminent and logical target market being Europe and North America. For both markets, some pre-requisites such as MRLs, food safety and hygiene certifications are already in place, however other recognized market specific food safety requirements will be needed.

Promoting and branding of the Mauritian Tea


To revive the tea industry in Mauritius, promotion and branding initiatives should be an integral part of any revival programme. Mauritian tea, with its deep-rooted history, heritage, tradition and special functional benefits, has its own brand identity. The island's natural capital could be exploited within the architecture of the brand "Mauritius Island Tea or thé de l'île Maurice", with a focus on creating a regional variety responding to terroir and production techniques. This could help create an extremely valuable product for the Mauritian tea industry. The branding could be a generic national brand, capitalizing on the natural capital of the island and the health benefits of tea.

Extension, technologies and innovation

The demise of public research, innovation and extension services has occurred at a time when STG needs them the most. The Food and Agricultural Research & Extension Institute (FAREI), the main institution that spear head the non sugar crop research, innovation and extension service has not filled the gap. It is recommended that FAREI include tea crop in its research, innovation and extension services programme.

Capacity development

This study revealed a weakness in knowledge and skills, or at least in their application to all aspects of the tea value chain, from producing green leaf to manufacturing tea.



Addressing the emerging challenges of the tea industry entails the adoption of innovative practices to improve productivity and product quality and enhance the sustainability and resilience of smallholder tea producers. STG and tea processors need to acquire new skills and knowledge to respond to the changing production and market environments. In addition, there is a need for field-oriented training programmes, such as “Farmers Field School”, and the manufacturing skills of factory staff need to be consistently upgraded.

Section I: Overview of the tea sector

1.1 Tea a national pride

The tea industry is a source of national pride in Mauritius. This is illustrated by its terroir characteristics, as well the economic and socio-cultural importance of drinking tea in Mauritian society. Mauritius is the first member of the Small Island Developing States (SIDS) to develop a commercial tea industry and its tea industry is among one of the oldest agro-based industries. The natural capital of the island, its volcanic soil, topology, and the terroir characteristics have made the distinguished taste of Mauritian tea unique. These distinguishing characteristics had made Mauritian tea a national pride. In the 1990s, tea grown in Mauritius had a distinctive “vibrancy” because of the young plants and the country’s pristine environmental features. The terroir of Mauritius is unique, first, because it is located above the Tropic of Capricorn and second, mountains are scattered throughout the island where tea grows in areas located 300 meters above sea level.

The cultural diversity of Mauritian society has made drinking tea a deeply rooted tradition. Vanilla tea, which was introduced in 1919, is the most popular tea and is the favourite local vintage tea. The passion for drinking tea has never wavered. A soothing cup of vanilla tea with milk is the welcoming drink most frequently served when visiting a Mauritian home. This culture even exists in government offices. Drinking tea for most Mauritians represents a moment of peace, contentment, and a time for bonding and socializing as well as reconnecting, whether in the early-morning or in the afternoon for a boost. Mauritian vanilla tea offered its distinctive characteristics of quality and flavour and enjoyed a reputation globally until the mid-1990s.

1.2 History of the tea industry in Mauritius

Mauritius has a rich history of tea production that dates back to the French colonization. The tea industry reflects the geo-political history of the country introduced by the French, which was introduced into commercial production by the British and developed into an economic pillar after independence. The French first introduced tea (*Camellia sinensis*) in the 1760s. Seventy years later tea was grown for commercial purposes. By the end of the 19th century, 190 hectares were occupied by tea crops, which increased to 850 hectares in 1945.

In 1955, the Government launched the “Smallholding Scheme” and “Project Planters’ scheme. Faced with high unemployment in 1970-1971, with the help of a loan from the World Bank in 1970-1971, the government initiated the tea intensification programme known as the Mauritius Tea Development Authority Project (TDA). During the 15 years that followed Mauritius became a significant player in the global tea market and the tea industry became one of the pillars of the Mauritian economy, in addition to an important source of foreign exchange. Moreover, the tea industry was a source of employment and livelihood for many Mauritians. The days of glory of the tea sector lasted until the mid-1990s.

Since the mid-1980s, tea production has been on a downward trend. The sector was hit severely by the uncertainties created by its declining global price, rising production cost, poor field management, the age of tea bushes, low quality of made-tea, ageing labour, high overhead costs, inappropriate agricultural practices, low labour productivity, climate change, and dilapidated infrastructures. The downward trend was further exacerbated by the uncoordinated actions and strategies of the TDA, Tea Factories Ltd (TEAFAC), and Tea Board (TB) in addition to the lack of innovation in production technologies to improve productivity and the quality of made-tea.

Various attempts to revamp the tea sector did not generate feasible results, instead, small tea growers (STG) abandoned the sector. Against the backdrop of the declining global tea prices, the rising cost of production, the highest being labour costs, and high overhead costs, some 86 percent of tea gardens were abandoned, while others were replaced with sugar cane and vegetables. These events led to the closure of the government-owned factories and only 3 private tea factories survived; Bois Cheri Tea Estate, Corson Tea Estate Co. Ltd, and La Chartreuse Tea Manufacturing Co. Ltd. Three years ago, Mauristea Investment Ltd, otherwise known as Kuanfu Tea, joined the group.

In the early 1990s, with the support of the Government of India, Mauritius embarked on a programme, the Public Tea Sector Rehabilitation Plan, to improve productivity and tea quality, reduce production costs, and increase production efficiency within a period of three years. Some progress was achieved and the production efficiency and quality level improved. However, these advantages were short-lived. By the mid-1990s, the programme lost its momentum and all progress were wiped out, leading the sector to a near collapse.

1.3 Acreage

Acreage under tea production has also declined. From the 3 907 hectares registered as active tea growing in 1981, however tea acreage declined to 656 hectares in 2018, which is the equivalent of an 83 percent reduction. Currently, tea crops are clustered around the tea factories; Nouvelle France, which accounts for the highest acreage, followed by Bois Cheri, Grand Bois and La Flora.

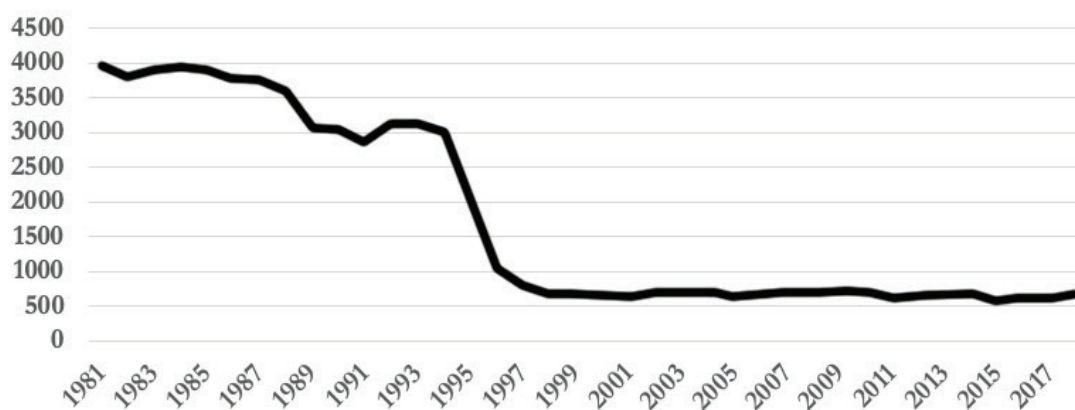
Table 1. Distribution of active tea land area (hectares)

Region	2013-14	2014-15	2015-16
Curepipe	11	11	11
Forest Side	6	6	5
Nouvelle France	234	234	234
Union Park	4	4	4
La Flora	63	43	42
Grand Bois	82	82	80
Bois Cheri	272	270	246
TOTAL	672	650	622

Source: NAPRO Annual Report.

Beginning of 1988, smallholders who were recruited as tea-trainees by the TDA started to abandon the tea fields. Tea estate owners and metayers followed with a similar declining trend; however, tea fields occupied by free planters did not. As of 1995, some 2 500 hectares of both the active and abandoned tea fields were converted to sugarcane. With 10 000 tonnes in the EU-Sugar quota, sugar production was perceived to be more remunerative. The country saw a sharp decline in the active tea growing area in 1996 when 1 108 hectares were registered as active tea fields; thereafter the areas occupied by tea fields stabilized to between 660 and 680 hectares.

Figure 1. Area harvested (hectares)

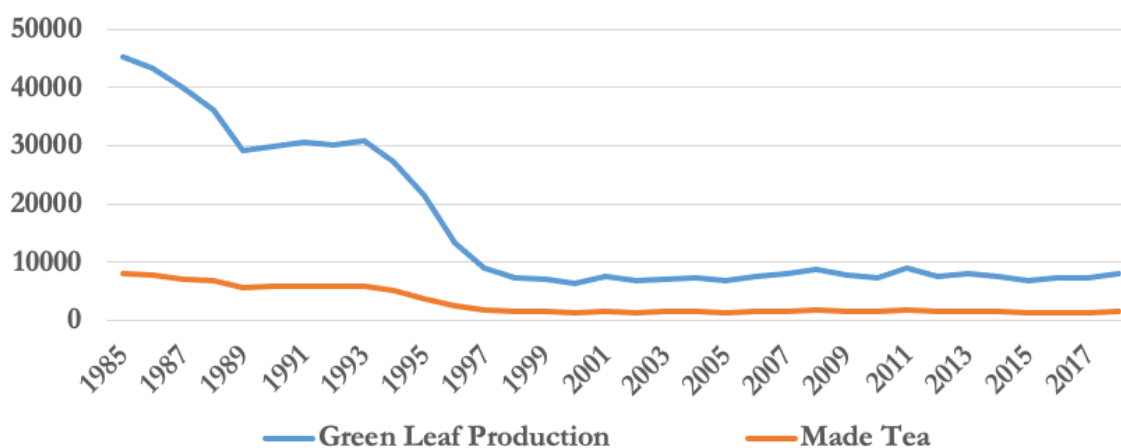


Source: StatMauritius

1.4 Production

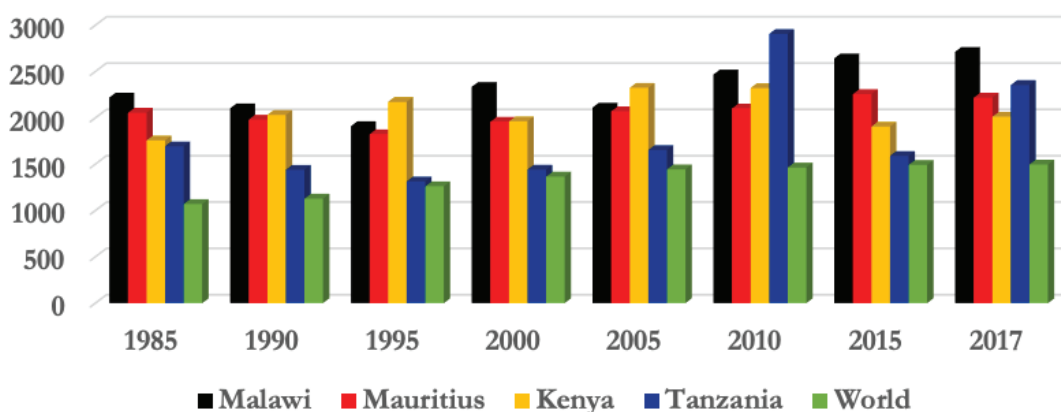
Following the downward trend of tea acreage, made-tea recorded a severe decline in tea production. Green tea leaf production declined from 45 291 tonnes in 1985 to 7 309 tonnes in 2017, that is an 84 percent reduction. Made-tea followed a similar trend with a decline from 8 115 tonnes in 1985 to 2 497 tonnes in 1996 and subsequently 1 379 tonnes in 2017.

Figure 2. Green leaf and made-tea (tonnes)



Source: StatMauritius.

Figure 3. Made-tea yield (kg/hectares)



Source: FAOSTAT.

The table in Appendix III reveals some interesting observations. Between 1985 and 2018 green production by smallholders experienced a 94 percent decrease, while tea estates and metayers saw a 75 percent and 54 percent decline respectively, however, free smallholders green leaf production increased by 66 percent. The smallholders' tea garden was developed by TDA under

the tea intensification project at a no cost investment and without liabilities for small tea growers (STG). Hence, this made it easier for them to exist and incentives were provided to facilitate the transition from the tea production venture into sugar production. Although the small tea holders were grouped into cooperatives, they still were not able to innovate and reverse the decline, while the free planters maintained their average level of acreage despite the decline in prices. Seemingly for the free planters it was more expensive to exit because most of them had made a personal investment. Ironically, the TDA was given the task to replace 6 000 acres of tea by sugar cane as a diversification strategy. Moreover, the metayers exited at no cost, since their tea field had been leased from the tea estate. Under the “Project Planters’ scheme some estates were provided with various types of support and some of them were returned their fields. The adopted business model and institutions did not yield innovative methods to address the downward trend of land area under tea. The yield of made-tea ranges from 1 900 kg per hectares to 2 700 kg per hectare. Green leaf yields and made-tea are well above the world average, but below that of Malawi and Kenya.

The volume of made-tea is influenced by the outturn rate. Between 1985 and 1997, the computed outturn was in the range of 17.8 to 20.6 percent (Figure 4) which is far below the major tea producing country standard of 22 to 24 percent. The outturn rate is the ratio of the amount of dry matter to the fresh weight of green leaf. Accordingly, the more moisture a leaf contains, whether internally or externally (as surface moisture), the less the dry matter, in other words, the lower the outturn. The outturn depends on the moisture content in the green leaf standard and the quality of leaf. A one percent decrease in the outturn (loss of qualitative control) will increase the cost of production (COP) by 5.5 percent.

Table 2. Impact of outturn and absolute leaf price on made-tea cost of production (MUR per kg)

Year	Outturn	Avg. Price of Green leaf	Cost of green leaf per kg of made-tea
2015	19.2	14.81	77
2016	18.5	15.42	83
2017	18.9	16.56	88
2018	18.2	18.34	100
2019	16.7	19.23	119

Source: Authors computation.

Between 2015 and 2018 the combined impact of the increase in the national average green leaf price (23 percent) and decrease in the outturn increased the cost of production of made-tea by 30 percent. The outturn needs to increase through a better-quality management of green leaf that will benefit all stakeholders, STG, processors, and consumers.

Figure 4. Outturn (ratio of made-tea to green leaf percent)



Source: Computed based on Production Data from StatMauritius.

Green leaf prices account for a major share of the cost of production of the made-tea, with processing production costs running at about 25 percent of the COP of made-tea, equal to approximately 150 MUR/Kg (4.05 USD/Kg) for bulk tea. This is in line with the sale price of orthodox (leaf grade) tea of attainable, comparative, origins such as Kericho in Kenya.

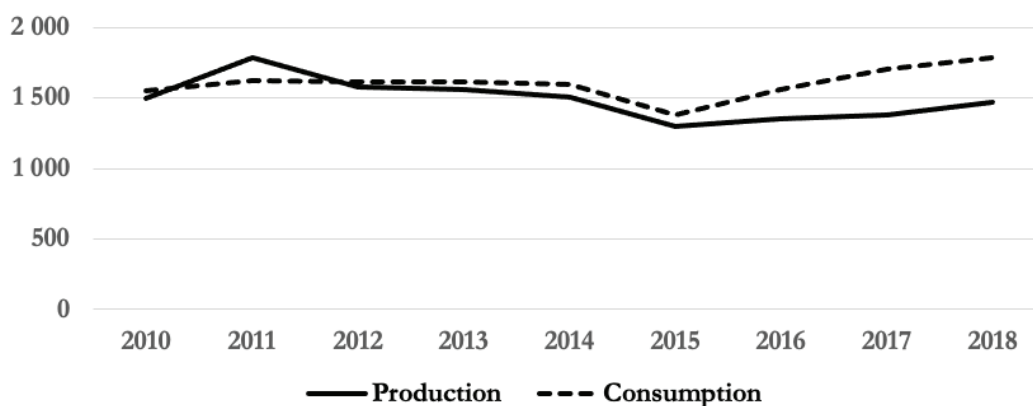
1.5 Consumption and trade¹

The current production is insufficient to meet the increasing domestic demand for made-tea. While production has fallen, local consumption of tea has grown steadily by more than 15 percent, from 1 550 tonnes in 2010 to 1 784 tonnes in 2018. Domestic tea production accounted for 96 percent of domestic consumption in 2010 and declined to 76 percent in 2018. Tea import have increased from 31 tonnes in 2010 to 467 tonnes in 2018. Kenya is the main source of imports accounting for 60 percent in 2013 and 93 percent in 2018. Black tea import increased from 108.25 tonnes in 2015 to 446.7 tonnes in 2018.

To protect the domestic tea sector, Mauritius restricted the import regime for black tea, allowing only 2.5 percent of the domestic consumption for blending purposes. However, as of 2015 the limit of 2.5 percent was relinquished due to the increase in domestic consumption. Trade data indicates approximately 8 percent and 25 percent of the domestic consumption were imported in 2015 and 2018, respectively. A small quantity of high quality tea for the hotel industry is also imported. Mauritius imports green tea as well, which experienced an increase from 12 tonnes in 2010 to 19.1 tonnes in 2018. Mauritians have increasingly become consumers of imported tea products, such as green tea and oolong. About 30 tonnes of tea are exported annually, mainly to the Réunion Island, Seychelles, France, and China. The domestic demand for tea has been rising steadily, from 1 550 tonnes in 2010 to 1 784 tonnes as of today.

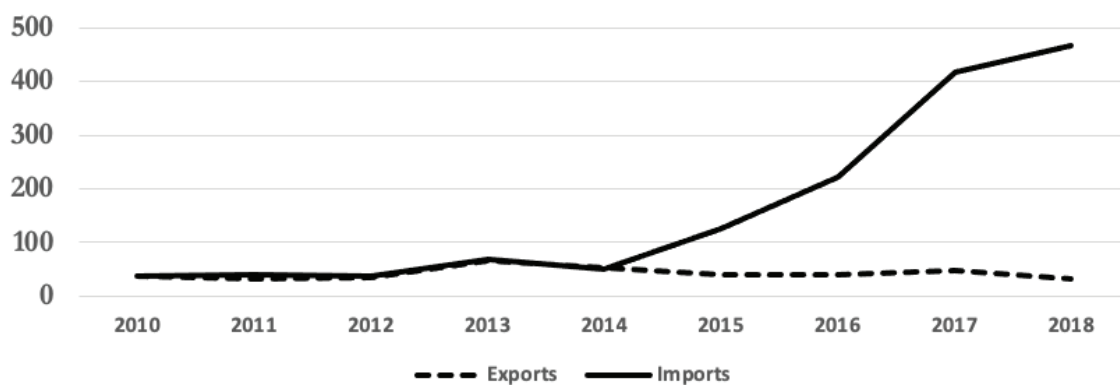
¹ Tea products are classified under the HS heading 0902, which includes the following subheadings: green tea in small packages (HS code 090210), green tea in bulk (HS code 090220), black tea in small packages (HS code 090230) and black tea in bulk (HS code 090240).

Figure 5. Tea production and consumption (tonnes)



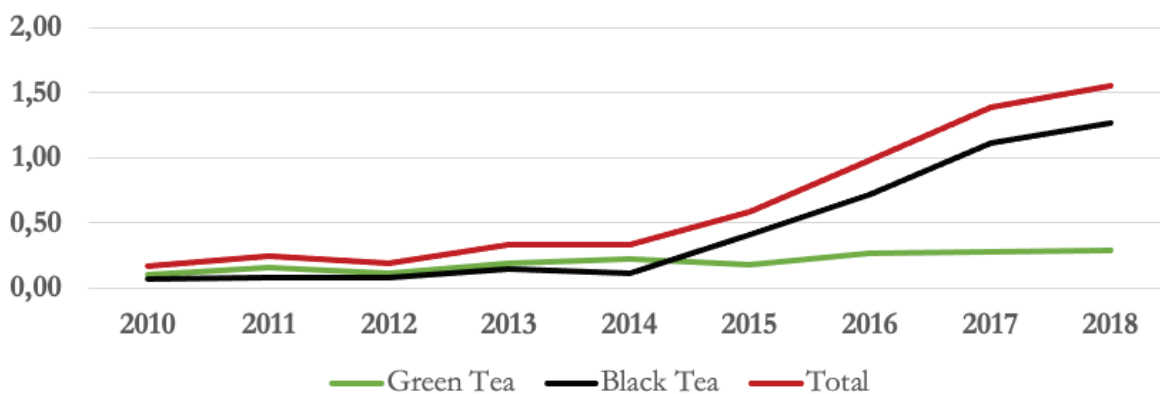
Source: StatMauritius and IGG/Tea.

Figure 6. Import and export volumes in tonnes



Source: Comtrade.

Figure 7. Import values (million USD)



Source: Comtrade.

Table 3. Import volumes in tonnes

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Black Tea	23.8	23.1	26.9	46.2	26.9	108.3	221.5	348.6	446.6
Green Tea	12.9	17.6	12.5	23.2	23.5	17.8	23.3	23.0	19.6
TOTAL	36.7	40.7	39.4	69.4	50.5	126.1	244.8	371.6	466.1

Source: Comtrade HS: 090210, 090220, 090230, and 090240.

Other tea-related products that are imported are powder iced tea, Roobios, herbal infusions and flavoured tea, tea extract and ready-to-drink (RTD). Some of these products are considered as medicinal drinks hence are not subject to neither import permit requirements for imports nor custom clearance fees. No detailed data for the different types of tea (powder or instant) are available and therefore no conclusions could be drawn. Data shows that there has been a steady increase in imports from 36.7 tonnes in 2010 to 466.1 tonnes, even though domestic production has increased. Black tea is most imported tea for blending purposes. This unprecedented increase in imports² represents over 30 percent of the domestic consumption.

1.6 Factories and processing technologies

Currently, there are 4 privately own tea factories; the three-surviving factoring from TDA days, Bois Cheri Tea Estate, Corson Tea Estate Co. Ltd, La Chartreuse Tea Manufacturing Co. Ltd, and most recent Mauristea Ltd, also known as Kuanfu Tea housed in the former Dubrieul tea factory. Except for Mauristea Ltd, all three factories use the Crush, Tear, and Curl (CTC) method of manufacturing tea. Mauristea Ltd uses both CTC and orthodox methods. CTC is a method of processing black tea in which tea leaves are passed through a series of cylindrical rollers with serrated blades that crush, tear, and curl the tea into small, even-shaped pellets. CTC uses a maceration device to macerates the leaf in order to maximize cell membrane rupturing and oxidation, resulting in cups of good coppery colour and body but reduced flavour and astringency. To make CTC tea, fresh, whole leaves are fed into the CTC tea machines that crush, tear, and curl them and process them over a period of just two hours. The result is an even output of small brown pellets. CTC tea has a homogeneous taste, but a lower quality as compared to tea produced through orthodox processing. Tea made by the CTC method has more infusion-giving surfaces and brews stronger, thicker, brighter and brisk tea, which ensures a maximum cuppage per unit weight. The CTC method yields more in terms of cuppage than the conventional orthodox manufacture. The CTC black tea are sorted into broken leaves, fannings, and dusts. CTC has gained popularity because of the simplicity of manufacturing, its ability to handle coarser leaf as well as to produce a stronger brew of tea.

² The imported black tea has an average price of 2.84 USD/kg, more than 1USD/kg below the current Mauritius COP. This will have significant risk for domestic production.

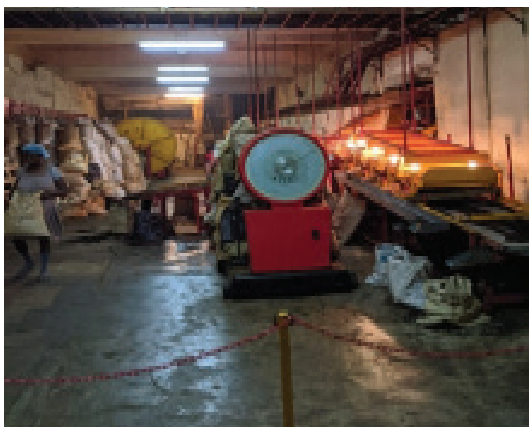
The orthodox method for producing tea involves the withering of the tea leaf in cool dry air. The leaves are then subjected to a series of rolls through rolling machines followed by oxidation. Next, the leaves are dried using a furnace to arrest the oxidation process and to dehydrate them, after which they are transformed into black tea leaves, allowing for easy storage. Orthodox processing requires that every batch of plucked leaves be treated to a precise amount of withering, rolling, and oxidation to extract the best flavour from the leaves. Great care is taken in rolling and handling the leaves because they are delicate and susceptible to adulteration and damage. Orthodox tea, whether black, green, white or oolong, are known for the complexity of their flavour and refined texture. Orthodox tea are highly appreciated. The orthodox method involves manual hand rolling or a roller for rupturing the tea leaves. Kuanfu Tea mostly uses the orthodox method.

Except for Mauristea Ltd, all the three traditional factories have outdated machinery that need replacing. All four of the factory buildings require heavy maintenance for factory safety. None of the traditional factories are producing optimal quality tea. Currently, the factories do not adhere to the Global Food Safety Initiative (GFSI) or other international standards, which are pre-requisites for export markets in a value-added form as well as in bulk form. The tea factories need renovation, innovation, and modern machines to produce quality tea and reduce the cost of production. All four factories must adopt a zero-carbon strategy for processing tea.

Mauristea Ltd represents a window to the potential future for Mauritius tea. This company is a producer of speciality tea; green, oolong, fermented and black tea, and uses new modern machinery with updated technologies. However, the factory also has issues with respect to GMP and food safe certifications. Although they are not producing optimized specialty tea but with their deeper understanding of their target market has positive impact.

All the tea factories have hygiene issues such as dust control, unsealed floors, lack of shatterproof lighting, inconsistent use of protective clothing and no handwashing stations. Maintenance of proper hygienic conditions at the factories before and after processing tea is needed. The processing and manufacturing facilities must comply with international standards to guarantee a safe product. To improve the quality of made-tea infrastructure and machines require upgrading. A factory standard is needed to guide the infrastructural standard.

Figure 8. Storage room inside a mainstream CTC factory



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Article 2 of the NAPRO Act 2013 states that “control and regulate the preparation, processing, packing and manufacturing of regulated products” is one of the functions, however, there are no strategies or guides to ensure that this function will deliver the expected outcome. The NAPRO Act 2013 do not make provisions for hygiene standards for tea factories. Discussions with NAPRO officers and factory owners revealed that this function has never been implemented.

Processing is characterized by the concentration of black CTC, as most factories have only a single production line, thereby limiting product diversification. There are limited incentives to produce other types of tea. In addition, the processing is characterized by the high cost of energy and heavy reliance on non-renewable energy. The tea processing needs innovation to reduce the cost of production, mainly the energy cost. Tea factories in other producing countries are using renewable energy such as solar energy. Mini-tea factories are easily mineable and use renewable energy such as solar or wind; for example, the small solar power mini-tea factories with a capacity between 200kg to 500 kg of made-tea require 35 kWh of power.

1.7 Green leaf and quality of made-tea

Mauritian tea is classified as low to medium quality. The sensory test of tea samples provided by Bois Cheri and Chartreuse (deemed representative of the Mauritian CTC black tea) firmly classifies current quality between Malawi, a low-quality tea and medium Kenyan tea. The result of the sensory test is reported in Appendix 1. Over the past 15 to 20 years the quality of made-tea has dropped. The lack of control during processing, lack of ambient temperature and humidity, lack of speed control, and lack of bed depth have led to a mediocre quality of made-tea. It is critical the capacity of the factory worker to control the process be enhanced.

The quality of green leaf is a predicament of made-tea. In fact, the degradation of the green leaf has seen the quality of made-tea drop to the more basic Malawi levels. The quality of green leaf is not only a matter of concern for the quality of made-tea only. Indeed, it has a major influence on the cost of processing as well. The lower quality of green tea leaf, the higher the use of energy, thus increasing the cost of production. The quality of green leaf depends on the type of cultivar, environmental (temperature, rainfall, and the amount of sunlight) and agronomic conditions, age and density of tea bushes, soil type, plant husbandry, field management include fertilization and most importantly the harvesting methods and post-harvest handling. There is no outreach training programme for STG on field maintenance and the quality of green leaf. Leaf collection points do not have any control over the quality of green leaf. The degradation of plant husbandry, unsuitable fertilizers and harvesting methods have contributed to the degradation of the quality of the green tea leaf. Green leaf, harvested by various methods is mixed at the collection point, hence during the processing stage a mixture of different quality of green leaf are process at same time on same production line. STG often lack the necessary incentives to produce green leaf. After field visits and meetings with the tea growers, it became apparent that they were familiar with the best practices for tea farming, including tea harvesting. Nevertheless, there are no incentives to support them for field practical applications.

In Mauritius most tea gardens have heterogeneous tea bushes of unknown parentage, therefore the quality of made-tea fluctuates. In addition, the quality of made-tea has been adversely

affected the quality green leaf standards at the harvesting and collection, and the substandard processing method.

The current pricing of green leaf tea provides limited motivation for the STG to produce quality green leaf, as there is no price differential for the quality of green leaf in any factory area with the exception of Mauristea Ltd. ICT can be used to monitor quality at the collection point and even at the processing stage. Currently, only Mauristea Ltd has strict monitoring for the quality of green leaf and pays a premium price for quality green leaf. Mauristea Ltd produces a small volume of high quality tea using the orthodox method for a specific market. The quality of tea produced by Mauristea Ltd is influenced by the two factors: (1) higher prices for quality green leaf, (2) skilled and experienced experts from China managing the manufacturing processing. All their tea produced are sold in their personal brand retail stores and a small volume is exported to China. The ripe black tea made by Mauristea Ltd sells for approximately USD 340 per kg.

The low quality of made-tea is a real challenge for the Mauritian tea sector. Processing techniques need to be altered to maximize capabilities to produce internationally recognized/desired qualities of made-tea.

1.8 Storage and packaging

Tea aroma is one the most important characteristics determining the quality of black tea and it is highly correlated with the price of tea. Packing material plays an import role in tea quality. A review of the current packing for retail led to some noticeable observations. Some packed tea for retail is wrapped in polyethylene. The quality of the packing materials is as important as the quality of the tea. Poor packing and storage will have a negative impact on the quality and value of processed tea. Packaging for retail should consider minimizing oxidative degradation through tamper-proof guidelines and recyclability of the total package. A package of tea acquired from the supermarket is displayed in Figure 9. The tea is packed in a plastic zip lock plastic.

Figure 9. A local tea package



© FAO.

Tea is a hygroscopic material that absorbs moisture during cooling and sorting. The amount of moisture uptake depends on the temperature and humidity to which it is exposed to. Moisture

higher than 5 to 6 percent will impair the quality of the tea and increase the incidence of mold and release a bad odor. Tea stored in aluminium foil pouches or bags retain their quality better than jute or paper bags lined with polyethylene. In fact, tea bought in duty free shops at the airport are not sealed or tamper proof. Tea acquired however from Mauristea has all of the required seals on their packaging, which are also tamper proof. In sum, factories need to revisit their storage facilities, packing equipment and packaging.

1.9. Food safety and tea standards

According to NAPRO, tea factories are HACCP certified for food safety. Compliance with HACCP certification demonstrates good manufacturing practices (GMP), hygiene, food safety, and quality systems. A visit to the two factories, Bois Cheri and Mauristea Ltd revealed a myriad of food safety issues at the factory level including: dust control, unsealed floors, shatterproof lighting, limited use of protective clothing, lack of handwashing stations to mention only a few.

A code of practice for the tea industry as well as standards for made-tea need to be established, such as in the case of MAURIGAP, for fresh fruit and vegetables. This can be a model on Kenya's Tea Industry - Code of Practice (2015). The tea industry must provide guidance to all stakeholders in the tea value chain on how to conduct all activities to ensure:

- food safety and quality;
- human safety and welfare; and
- environmental protection and sustainability.

Maximum Residue Limits (MRL) incidents for tea are relatively low. As in the case of many other food safety issues, incidents of residue are increasing; for this reason, MRL should be defined in order to promote Mauritian tea as a safe food product. Hence, a well-defined MRL will ensure that the food safety standards of made-tea are met. There are no internationally standardized regulations on tea, but there are guidelines such as CODEX, regional regulations (European Union), as well as national regulations have been established. Therefore, it is recommended to follow the EU MRL for tea, established under the CODEX guidelines and EU regulations. The default values of MRL set by the EU in 2008 are much lower than those found in the CODEX guidelines. The EU has increased the number of regulated pesticides for tea over the years, and the number permitted currently stands at 454 pesticides.

Food safety and food control have become key issues for the tea industry. In order to guarantee food safety, tea must be traceable throughout the supply chain and the risks of contamination must be limited. The implementation of a quality management system could be an important tool for controlling food safety hazards. NAPRO claims that the Mauritian tea is “pesticide free”; although this may be true in part, it is not based on any scientific evidence. In Mauritius, NPPO requires that imported tea meet certain phytosanitary requirements and the MRL is used as a measure to ensure food safety. The importer submits certification supplied by the exporter to NPPO, however, NPPO does not conduct any physical tests on imported tea, which is detrimental to its interests.

Recently, anthraquinone has emerged as an MRL issue. In many cases, anthraquinone has never

been used as a pesticide on tea plants. Tea can become contaminated during drying or packaging, or by smoke caused by the tea drying process. Hence, in such a situation the claim “pesticide free” overlooks such issues. Mauritius does not currently have contaminant regulations in place, specifically for tea, which is highly recommended. Leaky dryers and heat exchange pipes are a major cause for concern with respect to anthraquinone. Moreover, another issue is the pyrrolizidine alkaloids that are produced by certain weeds. These weeds need to be identified and eradicated before harvesting, particularly for mechanizing or sear harvesting.

1.10 Cost of production of made-tea and price of tea

The tea industry in Mauritius has been operating under a backdrop of rising costs of production. The cost of green leaf in addition to the cost of processing makes up the cost of production of made-tea. The cost of green leaf includes cost of tea cultivation, cost of plucking, as well as the margin at the growers’ level. The cost of processing includes labour cost at factory, energy and fuel cost, fixed and overhead costs. In the absence of detailed production cost data in this case, the analysis is based on the findings of other studies and expert knowledge. A fair break down of the production costs of made-tea would be 75 percent representing the cost of green leaf, and 25 percent that accounts for cost of processing, including factory labour costs.

Green leaf price

Regulations 44 to 49 of the Tea Industry Control Regulations, 1980, commissioned TB to determine the price of green tea leaf. Before the demise of TB, the price discovery had been based on a well-structured formula. This formula had a price mechanism that guaranteed a minimum price for green leaf delivered by STG. The analytics of the formula were transparent. Moreover, the fixing of the price was subject to the approval of the board, which included a representative of the smallholders as its member. After the demise of the TB in 2013, NAPRO took over the responsibility for determining the price but last year discarded the logical approach of TB. Both STG and tea processors, claimed that the current price determination had been left in the hands of those with very limited knowledge of the tea industry.

Tea cultivation is a labour-intensive operation and indeed tea plucking is very strenuous. Based on the production costs supplied by the STG to NAPRO in October 2019, the computed cost of production per kilo of green tea leaf no matter the quality was MUR 10.29, and the average prices received was MUR 18.34. Labour cost accounts for more than 50 percent of the average price of green leaf. According to a report submitted to NAPRO by the smallholders in October 2019 during the green leaf price negotiation, it costs about MUR 8 to pluck one kilo.

Table 4. Green leaf price rupees (per kg)³

Crop	Bois Cheri		Corson		La Chartreuse	
	Price	% Change	Price	% Change	Price	% Change
2009-2010			13.1		13.1	
2010-2011	13.43	2.6	13.4	2.29	13.42	2.45
2011-2012	13.6	1.27	13.65	1.87	13.59	1.23
2012-2013	13.83	1.69	14.13	3.52	13.82	1.72
2013-2014	14.36	3.83	14.77	4.49	14.47	4.71
2014-2015	14.9	3.76	15.05	1.92	14.77	2.09
2015-2016	15.67	5.17	15.9	5.66	15.54	5.19
2016-2017	17.3	10.4	17.31	8.86	16.47	5.98
2017-2018	19.23	11.16	18.69	8	18.47	12.14

Source: NAPRO.

For the STG sector, tea plucking is done with shears or is hand-picked, which is arduous and labour-intensive. The cost reduction strategy for green leaf should focus on the cost of the plucking – labour costs. Cost reduction measures for plucking would significantly reduce the cost of production. Mechanical harvesting of tea is one of the effective alternatives that can reduce costs. To a limited extent, tea estates are using are using mechanical harvesting.

Processing cost of made-tea

The cost of tea processing includes labour and energy. The cost of energy makes up 20 percent of the cost while the cost of labour makes up 5 percent. Tea processing involves the removal of water (moisture). The processing of tea requires a great deal of energy, especially for activities such as withering, crushing, tearing, curling, drying, grading, and packaging. In many tea producing countries thermal energy is used for drying and accounts for a major share of the energy cost, which can be up to 70 percent of the energy cost, while electricity, 30 percent of the energy cost. The factory visited used oil/gas as thermal energy. For the sustainability of the sector, cost reduction strategies should focus on energy efficiency and energy cost as well. The old and outdated machinery of the factories consume a higher level of energy and electricity. The quality of the leaves also affects the energy consumption.

The factories use fossil fuels and electricity. Reducing electricity and fossil fuel use as well as switching to renewable or low carbon energy sources offer several economic and environmental benefits. There are many benefits that warrant investing in climate change mitigation activities. The benefits include reduced production costs through the increased efficiency of equipment and processes, increased product quality, improved maintenance and operating costs, and improved working environment, decreased liability and improved public image.

³ Note: These prices were submitted as a memorandum to NAPRO by the tea processors for green leaf pricing for 2018-2019.

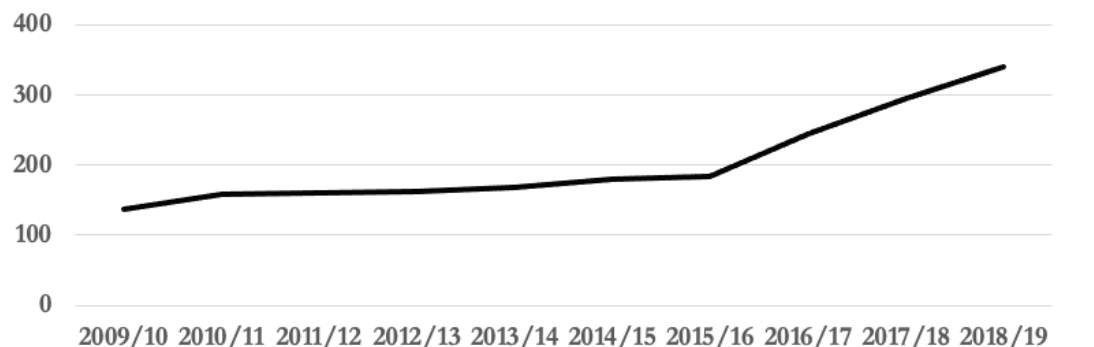
In Mauritius, the options include solar and wind energy and bioenergy briquettes made from bagasse from sugarcane for boilers. The briquettes are easy to transport and produce more energy per unit than wood. Transforming the bagasse into bioenergy could not only reduce the industry's environmental impact but would also bring economic benefits to both the tea and sugar sector. Many tea producing countries have experienced "mini-factories". These mini factories are suitable as well as practical for using renewable energy, such as solar. For example, the small solar power mini-tea factories with a capacity of 500 to 1000 kg of made-tea per day require about 30 kWh of power. These "mini-factories" are powered by solar or wind energy and to power the boilers, security in energy supply can be achieved through investing in sugar cane bagasse briquettes or pellets. These sources of energy can be considered as carbon neutral and would produce no greenhouse gas emissions, if managed in a sustainable manner. Pursuing a low carbon tea processing strategy can be used as a promotional label.

Price of tea

Unlike the price of green leaf, the retail price of tea is decided by tea processors. The power in the tea sector is unequal, and with a concentration of three processors the retail price ultimately suffers. Prior to the demise of the TB, the average retail price was MUR 140/kg and increased to MUR 160/kg in 2015, a 14.3 percent increase in six years. However, from 2015 to 2018 the average retail price more than doubled, the average retail price was MUR 340/kg, a 112.5 percent increase, while the consumer price index for tea increased by 29 percent during the same period (Figure 11). There is no economic rationale to explain the steep increase in the retail price of made-tea post-2015. Base on the sensory scores of tea sample provided by Bois Cheri and La Chartreuse and available sensory score of tea from other sources and prevailing international tea prices, Mauritian tea is valued at USD 2.32/kg for Bois Cheri and USD 2.72 for La Chartreuse (see Table 1.3 in Appendix I for detail results).

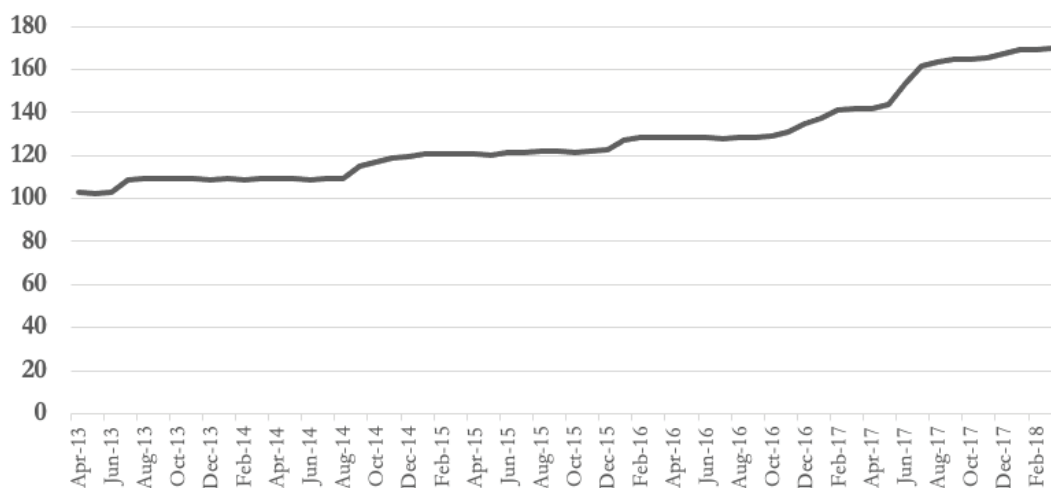
The retail price of tea in Mauritius is extremely high relative to international markets, and this is one of the many reasons why there has been a lack of interest in optimizing quality and efficiency. It is suggested that the Competition Commission to conduct a study to investigate whether there is an abuse of dominance or price fixing.

Figure 10. Retail price of made-tea (rupees per kg)



Source: NAPRO.

Figure 11. Consumer price index for tea (2007=100)



Source: StatMauritius.

Figure 12. FAO composite price monthly average (USD cent/kg)



Source: FAO.

1.11 Tea industry structure, institution and governance

The Ministry of Agro-Industry and Food Security (MAIFS) has sole responsibility for policy, regulatory, and decision making for the agricultural sector including the tea subsector. Figure 12 shows the organizational structure of the tea industry in Mauritius.

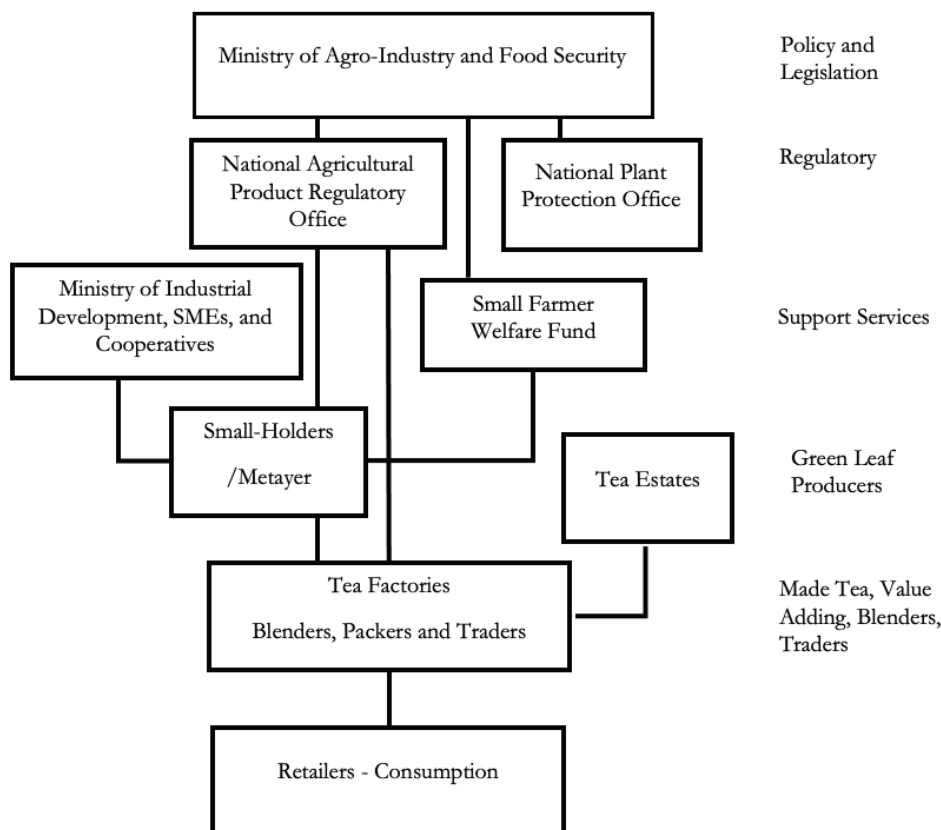
In 2013, the National Agricultural Products Regulatory Office (NAPRO) was created as a unit within the MAIFS to implement the NAPRO Act of 2013. Other institutions involved in the sector are the National Plant Protection Office (NPPO), the Cooperative Division of the Ministry of Industrial Development, Small Medium Enterprise and Cooperatives, and the Small Farmer Welfare Fund (SFWF). NPPO oversees the phytosanitary requirements and ensures that no plant diseases are introduced into the island. The Cooperative Division provides managerial support to the tea cooperative and has contributed significantly to the financial transactions of the STG. Tea Cooperatives effect payments to the STG. Payments to growers are made on a monthly basis by the cooperatives that receive payments directly from the factories for the green leaf delivered. Moreover, cooperatives provide credit to STG while the Small Farmers Welfare Fund promotes the economic and social welfare for small planters, including the STG.

Tea is grown using two systems; smallholders and estates. Smallholders are the drivers of the tea industry through the production of green leaf. There are four factories, three of which have existed since the early days of tea development except for La Chartreuse, which had a change of ownership and location. These three factories produce CTC black tea. The tea factories also handle blending and packaging. The fourth factory, Mauristea Ltd, which started operation about three years ago and produces specialty tea. Except for Mauristea Ltd, the traditional tea factories own tea estate also. The predominance of these tea factories creates a challenge vis-à-vis the governance of the sector.

The tea industry is organized in such a way that diverse players occupy different roles that complement each other. The sector is structured around NAPRO, whose responsibilities cover three unrelated commodities; however, it has not fulfilled the tasks laid in the NAPRO Act 2013 for tea. Market power is centralized with the three traditional factories.

It has been strongly argued by STG and tea processors that NAPRO is the weakness link in the tea value chain. The merging of staffs from different and unrelated commodity bodies further exacerbates the technical weakness of NAPRO. This has become even more evident due to the frequent changes in leadership at NAPRO, as well as the lack of institutional capacity and skilled staff for tea. Moreover, another weakness of the structure is the total lack of research and extension to support the development of the tea sector. Since the collapse of the TB and TDA, the research system has become obsolete, which is a clear signal that broad-based reforms are needed to revive the tea sector. Data collection and analysis which used to be a core activity for the TB is non-existing in current structure of NAPRO.

Figure 13. Current governance structure of the tea industry



Source: Authors.

1.12 Legislations governing the sector

The governance structure is a key determinant of the extent to which participation in the tea industry translates into a broader development of the sector, especially when STG accounts for the major share of the green leaves production. Governance plays a crucial role in providing a framework for managing organizational structures in order to achieve the intended goals, vision, and mission.

De facto, the NAPRO Act 2013 is an administrative agreement that provides a regulatory architecture but not an institutional structure for the tea, tobacco and meat. As stated in its annual report, NAPRO took over the regulatory functions of (i) the Mauritius Meat Authority (MMA), (ii) the Tea Board (TB), and (iii) the Tobacco Board. All these three parastatal bodies were defunct or bankrupt. NAPRO emerged as a result of the merger of TB, Tobacco Board and MMA. The office operates as a unit within the MAIFS and ensures the conformity of all regulated products imported, exported and produced in the country; this includes tea, meat, and tobacco. As for tea, NAPRO has the following responsibilities:

- controls and regulates the import, export, production and sale of tea;
- controls and regulates the preparation, processing, packing and manufacturing of tea;
- determines the prices at which tea leaves may be sold to a producer of tea products; and

- registers STG delivers manufacturing license, licensing of imports and provides import clearance.

The registration functions of STG establishes a contract which links STG to tea factories for the supply of green tea leaf.

A review of the NAPRO Act revealed major discrepancies. Most importantly, the current structure of NAPRO, as stipulated by the NAPRO Act, does not have the necessary development strategy for tea. Furthermore, it does not make provisions for capacity building for the development of the tea sector. The NAPRO Act is more specifically a monitoring mechanism for tea import, registration, and distribution of the STG to existing factories and issuing operating license to factories. The mandate of NAPRO does not include any provisions to encourage or support the STG to develop their tea farming skills. NAPRO determines the price of tea leaf but it does not have the power neither to control nor coordinate activities related to tea processing and retail sale. The current structure and functions of NAPRO are not able to facilitate the coordination and interaction among the different stakeholders. Effective interaction and coordination require:

- committed and capable leadership;
- appropriate incentives;
- an enabling environment, in which important stakeholders can coordinate their activities;
- stable support programs; and
- efforts to strengthen the capabilities for innovation and collective action.

The framework for the revival tea subsector needs to be inclusive and should have balanced representation, both factories and STG. In addition, an effective governance structure supported by a coherent policy and plan for a coordinated development action plan for the tea sector is essential. Within an already weak institutional environment, there are no provisions for effective legal or policy frameworks under which all sector stakeholders may work, or for which they may be held accountable. Currently, the tea sector is not operating under such conditions.

In order to support development of the tea sector, legal and policy instruments are required to promote the STG. The current governance structure needs restructuring so that it can translate the intended objective of the government to increase tea production, making the industry sustainable, efficient, and cost effective. Working hand-in-hand for a buoyant tea sector requires investment for dedicated institution for tea sector with an inclusive business model, within public-private partnership and with a focus on STG. The business model should be inclusive. During consultations with STG and tea processors, the creation of such an institution was strongly endorsed, and it was felt that the tea sector had been neglected by the MAIFS. Adding to the challenges is the lack of tea sector managerial skill.

While the debate continues how to revive the tea subsector, all the stakeholders agree that the institutions and legislations will have a major supportive role in the reform of the sector. At the

institutional level, the key constraints are the lack of skilled personnel with knowledge of the tea industry, strategies, regulations, and policy conducive to the growth of an inclusive business model for sustainable development of the tea sector.

It seems there is a lack of trust by STG in NAPRO. Keeping in mind the experience with the TB, this report recommends the creation of a **Mauritius Tea Industry Development Agency (MTIDA)**. MTIDA's mission will be "to support effective technical and managerial services to the tea sector for efficient production, processing, and marketing of high quality tea and investing in innovation to benefit the STG and other stakeholders". Innovation is noted to be a necessary ingredient for the sustained success of tea sector, and MTIDA will ensure such innovations.

The MTIDA should not duplicate activities or function of other institutions, for example, Food and Agricultural Research and Extension Institute (FAREI), Department of Agriculture, Small Farmers Welfare Fund and Cooperative Division of Ministry of Industrial Development, SMEs and Cooperatives. Though FAREI's mandate is to "support and oversee development in non sugar crop sector and ensures that needs of the non sugar are addressed through research and adoption of new technologies", however contrary to the mandate FAREI does not have any function or activities related to tea sector. It is highly recommended that FAREI includes tea crop in its mandate and provide the necessary support for the development of sustainable and environmentally friendly tea sector.

MTIDA will be the regulatory body and provide enable policy framework to support the development of sustainable tea sector. In fact, MTIDA will provide the public goods to support the development of innovative and inclusive business model for the tea sector. However, before setting the institutional architecture of business model of MTIDA, it highly recommended to conduct a governance and political economy analysis including the financial feasibility for such setup. As MTIDA will be providing public goods, the current financing mechanism which funds NAPRO can used to fund the new setup and should be of no additional cost to the government.

1.13 The processors and their economic reality

Discussions with tea processors⁴ revealed interesting insight. Table 5 summarizes the cause and effect of the current state of affairs as perceived by the tea processors, as well as the actions taken by them to address the challenge.

Table 5. Selected cause, effect and processors reactions

Cause	Effect	Independent action
No control on leaf quality	Poorer quality production	Protect against inconsistencies by focusing on own leaf. Private deals and exclusions being made for green leaf outside government control
No systemic control on leaf price	Price of green leaf now unsustainable	Mechanize own fields to reduce labor cost and increase yield of tea leaf
Demise of Tea Board	Loss of holistic approach to the industry and loss of Public/Private partner-ship (trust)	Diversifying to protect own business, including away from tea.

The uptake of this is that, if the status quo is maintained, two things will happen:

- the price for green leaf will become so unattractive that small tea growers will leave the sector; and
- the price for green tea will increase in order to satisfy the small tea growers, forcing the tea processors to diversify away from tea.

Both scenarios will yield the same result: a rapid demise for the sector.

1.14 Policy and policy shortcoming

Tea strategy has not achieved its objectives as demonstrated by the multiple unsuccessful initiatives, beginning with its initial development in the 1960s and subsequently its attempt to reform the sector in the mid-1990s. As of today, there is no “Tea Policy” per se. Tea has become a low priority due to the absence of a specific policy despite the existence of various tea-related acts, the most recent being the NAPRO Act 2013. The tea development strategies in the early 1970s were designed to address the high level of unemployment. A cursory review of literature shows that the tea strategy after independence was aimed at integrating STG into the mainstream of tea production. The selection of high yielding cultivar by the TDA and improved planting and cultivation methods have had a dramatic effect on yields. The Tea Experimental Station at Wooton had a major policy role in providing technology and know-how but became an unprogressive experimental research center with no major policy drive for the modernization and mechanization of smallholding. During the reform in the early 1990s

⁴ Note: during the scoping mission the team held discussions with two processors.

that dealt with policy and strategies for modernization, the focus was on tea factories but not on labour-saving technologies for green leaf production.

The decline in tea production in the mid-1990s and the lack of any real improvements, thereafter, can in part be attributed to the lack of coordination among institutions that govern the sector in addition to poor public and private partnerships. This argument is based on the analysis of the institutional reforms governing the sector in the 1990s when three institutions were operating in an uncoordinated way. Overall, there was an increase in inefficiency and an overhead cost of production. Even at that time there was no defined policy regarding the governance of tea. Despite government programmes and support, the tea subsector did not managed to increase production efficiency or reduce the cost of production.

In the early days of the TDA, the tea subsector did not have a comprehensive strategic vision or plan, which resulted in piecemeal and uncoordinated action for the sustainable development of tea. This led to disinvestment by the public and private sector, which resulted in a deterioration of the tea infrastructure and the abandonment by the STG of their tea fields. Instead of restructuring the institutions and creating efficient and effective institutions, the authorities closed all the institutions, which contributed to discouraging the development of the STG sector.

Mauritius in many ways has a guaranteed price system for green leaf due the TB's effective and analytical pricing mechanism. The minimum guarantee green leaf price was negotiated at the national level between the apex of the TB, STG associations and the tea factories. However, more recently the function of the price discovery mechanism has not been based on transparent analytics; instead, the price of green leaf is now determined by NAPRO in consultation with the ministry.

The increasing of import from 2.5 percent of the production to 25 percent volume needs to be reviewed, if not kept in check will certainly lead to the gradual demise of the STG. The import of bulk tea by the three tea factories has created cause for great concern for several reasons. Even the fees charged by NAPRO for different importers are highly discriminatory and furthermore, to allow cheap imports will lead to the demise of the STG.

In 2017, the government allocated 600 arpents of new land for the expansion of tea production. Three years later about 40 to 50 arpents has been planted. Nonetheless, the government's policy has not achieved its intended objective. The uptake of newly planted tea gardens by STG has been slow due to the high risks and field maintenance cost. The long gestation period (three to four years) of tea significantly deters farmers, particularly in the absence of alternative sources of income. Assistance schemes to support these smallholders could encourage them to acquire these new-planted fields.

This situation implies that the subsector operates without a clear strategic development focus, resulting in piecemeal and uncoordinated reform initiatives. There is no tea policy to serve as a guide for the sustainable development of the sub-sector. This is compounded by the lack of

strategies and regulations to support the STG from the short to medium term. A comprehensive tea industry policy is needed for a sustainable and inclusive tea sector. This is not the case at present, as there is no policy for tea to reverse the market failures and provide development space for a sustainable tea industry. The few policies that do exist are piecemeal and only partially address the symptoms, or to please a few at the cost of STG and its consumers.

1.15 Physical and agronomic status of tea gardens

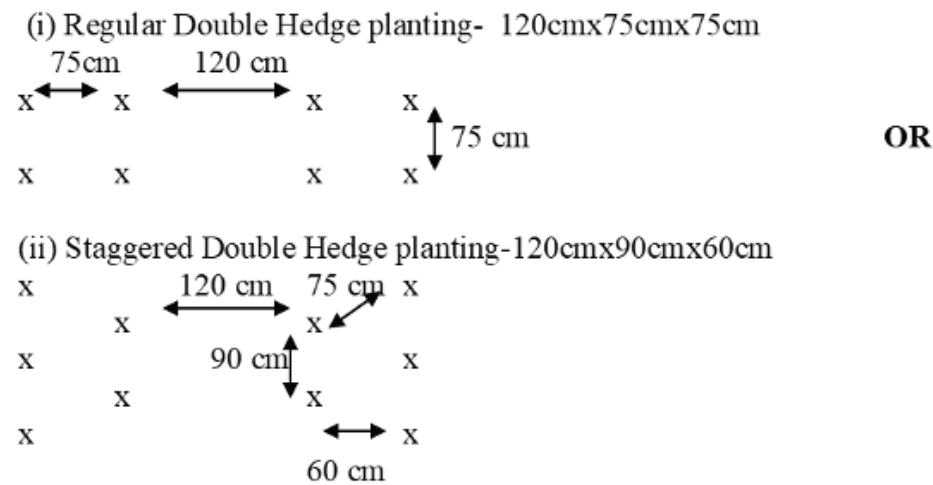
Tea is grown under two systems: STG on plots less than 0.5 hectares and estates on plots averaging 40 hectares. In the 1960s and 1970s the fields were planted with a mixture of seedling and vegetative propagated (VP) tea, developed by the Tea Research Institute at that time. Under the TDA programme, tea seeds were imported from Tanzania and a tea seed garden was created. The importation of plant stocks from other countries was not permitted, therefore all varieties stem from the propagation work done on the island. This may have been relevant in the 1980's and could still be, however it is unlikely that the current plant stock is optimal given the lack of plant nursery work over the last 30 years. It is evident from field visits, this has led to:

- **variable bush densities:** due to plant death and lack of in-filling;
- **variable planting patterns:** difficult for individual reference points and no defined lane planting in many cases;
- **variable bush maintenance:** no defined cycle of pruning, weed maintenance and nutrient application;
- **unknown plant identification:** no records accessible for older plants;
- **status of tea bushes:** ageing and moribund bushes; and
- **leaf standard:** poor plucking controls and therefore poor leaf standards.

However, with the demise of the Tea Research and Experimental Station and Tea Board, records on the type of cultivar that was planted and where it was planted have been lost or buried. Without this specific knowledge it is difficult to design a perfect field management strategy, as growth rates and qualities of green leaf vary.

Records show that during the early days of TDA, bushes were planted in a 4 ft x 2 ft density, in other words, 13 448 bushes per hectare following the Assam model. According to NAPRO, the density is between 11 000 to 12 000 bushes per hectare. A higher density pattern is known to deliver better yields with bushes in areas where moisture is plentiful, such as in Mauritius, otherwise competition for water can lead to bush loss. NAPRO has reported the planting patterns (Figure 14) which differ from what was gleaned during the field trip. There is apparently more than one design being used and this makes uniformity difficult for harvesting or mechanization.

Figure 14. Planting pattern/densities as per NAPRO



Source: NAPRO.

Soil structure is fundamentally altered by standing water and compaction, which reduces the ability of nutrients and dressings to feed root systems. During field visits it was highly evident that drainage works carried out as part of the TDA tea expansion project does not exist and where they did exist were blocked by tea growers and other agencies for reasons unknown. It is imperative for healthy bush growth and for the quality of the leaf that the soils be well leached, and water cleared from the root systems. Investments to open the drainage and dig new drainage systems in areas where needed is prerequisite.

There is a lack of a soil maintenance initiatives within the STG, perhaps because the land has been leased. A great deal of work needs to be done on soil analysis and in fact, according to the Tea Board and NAPRO records, the last soil analysis was last carried out in 2008. Samplings of soil need to be executed before any further applications can be made; furthermore, an evaluation of the capacity for conducting soil analysis is needed. Currently, not even The Food and Agricultural Research & Extension Institute conducts soil analysis.

After 40 years productivity of the tea bushes either stagnate or decline. Studies have shown that in ageing bushes yield decline faster. This is further exacerbated by almost continuous harvesting, which consumes the nutrients in the ground; moreover, these nutrients do not receive the adequate or balanced replenishment. Most of the tea gardens in Mauritius are more than 40 years old and some of the moribund tea bushes have created numerous gaps, thus damaging the soil underneath, which is of poor quality. These fields require infilling in order to increase their density and productivity and in the worst cases, uprooting and replacing poor performing fields or moribund bushes with high yield, clones may be necessary.

Figure 15. Moribund tea and gaps in fields close to Dubreuil



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Pruning and skiffing

The sustainability of tea gardens depends on pruning and skiffing. Pruning and skiffing of tea are the most important operations in tea production. Tea bushes are pruned at an interval of three to four years and in between the bushes are skiffed or sometimes left untouched. Pruning and skiffing help plants to maintain and improve plant health. Furthermore, pruning and skiffing increase the overall bush canopy and pluck ratio as well as yield and quality of the green leaf. Both manual and mechanical pruning and skiffing are employed. During field visits it was discovered that bushes exhibited damages, disease, or contained too much wood in the frame due to unorganized pruning. This situation impacts the health and productivity of the bush, which needs to concentrate on the growth of new shoots rather than on dry matter. There is a need for an outreach programme that can ensure the correct rehabilitation (where necessary) and regular standardized bush husbandry.

Harvesting

The geographical location of the island allows for a seven-month window for green leaf plucking — October to May — the months of December and January being the peak months. The quality of made-tea is nevertheless affected by the quality of the green tea leaf, which depends on many factors including a harvesting interval and the method of harvesting. Harvesting removes the photosynthetically active green tissues. The three common methods of harvesting are: hand plucking, shear, and mechanized harvesting. Mechanized harvesting is being used by state owners on a small scale. It is necessary to minimize the physical damage to tea shoots during the harvest and while transporting. Shoots can also be damaged when too many leaves are retained in the hands of the pluckers or in the shear-collection box.

STG mostly use shear harvesting and manual plucking. Shears harvesting was introduced due to the ageing and shortage of workforce. There is no price differentiation between shear plucked

and hand plucked green leaf. This precedence was set because all the green leaf is accepted at collection centres with no pre-determined quality or policing of the incoming leaf. The same issues exist with the tea estates and all the green leaf are mixed at processing. Mixing green leaf increases the ratio of green leaf to made-tea and causes a drop-in efficiency, a rise in costs and a decrease in the quality of made-tea. Clearly, the methods of harvesting affect the quality of the leaf.

Most STG have the expertise in plucking the best quality shoots of the tea, however, they have no authority or control over the quality of the shoots that are delivered to the factory. A “needs-must” style of harvesting green leaf, driven by the need to keep up with the vigorous growth of the bush rather than quality, is a common practice.

Although tea estates have adopted mechanical tea harvesting operations to mitigate the rising production costs and labour shortage, handpicking and hand shears harvesting is still predominant amongst STG and tea estates, as most fields have not been lane planted. The frequency of harvesting is critical, and a good quality of leaf can be maintained by manipulating the frequency and standard of harvesting. For Mauritius to succeed in increasing the quality of made-tea to a competitive standard, the harvesting and collection of the green leaf must be controlled.

Table 6. Manufacturing capabilities for leaf from different harvesting methods (origin Kenya)

Harvesting method	CTC	Orthodox leaf	Green	Quality	Relative Kgs/person/day
Hand	✓	✓	✓	✓	50
Shear	✓		✓		80
Handheld mechanical	✓		✓		900
Tractor style mechanical	✓	✓	✓	✓	6000

Source: Various publications of Kenya Tea Development Authority.

Hand plucking is arduous and strenuous work and for this reason the younger generation is not interested. To encourage the younger generation to enter the tea sector, mechanization should be encouraged. In many other tea producing countries mechanization is being introduced at a steady rate to address the issue of the ageing labour and labour shortage. Table 5 illustrates the current state of capabilities based on this phenomenon in Kenya, which has comparable origins.

Given the ageing of farmers and shortage of workforce, the lack of incentive for the next generation to enter the tea industry, and the current cost of green leaf, it is strongly advised to use mechanized harvesting. The type of mechanization depends on the field topology and bushes structure. However, the harvesting machine should meet the topology criteria and must be adaptable to the Mauritian terrain. When processing fine tea for example, there will still be a need for handpicking; therefore, a capacity building programme should be integrated into the

revival programme. It should be noted that orthodox and green tea are both viable alternatives, and with mechanical harvesting they may offer Mauritius production options such as green tea and RTD tea.

Other tea producing countries have been continuously working on improving yields, developing climate mitigation strategy, addressing the needs of different harvesting techniques and increasing quality, as dictated by the marketplace. Innovation in other tea producing countries has been able to develop clones that mature in 2 years rather than 4 to 5 years, as is the case in Mauritius. In addition, varieties have been developed by other tea producing countries that require less spacing and produce a higher yield of between 5 to 6 kg of green leaf per bush in a year.

To improve productivity and increase the quality of the green leaf there are a number of basic issues that need to be resolved. First, it should be recognized that Mauritius has an ideal climate for tea cultivation. During the field visits it was observed that there is a lack of conformity to any standard, be it in field management, harvesting method, or collection. To increase the productivity of tea sector, recommendations are as follows:

- map of existing tea fields and clones/seeds;
- assess the viability of existing Mauritian clones are best suited for future planting;
- explore of existing internationally available high yield clones with good standing in terms of climate, pest and disease resistance and low inputs;
- develop high yield clones with previously mention standards;
- old tea bushes should be uprooted and replanted with high yield tea bushes and previously mentioned standards and organized planting structure to facilitated field mechanization; and
- support to tea growers through soil testing and analytical testing leaf and fertilizer analysis, tea quality, pest and disease identification crops, agrochemicals evaluations and botany elements.

1.16 Product Innovation

Mauritius produces mostly CTC black tea and a limited quantity of specialty tea. Bois Cheri produces small quantities of white and other specialty tea. All three traditional factories produce a range of specialty tea with black CTC tea as the base product, in addition to flavoured tea (other than the omni-present vanilla) and herbal tisanes. RTD, a bottled tea beverage, is also being produced. The issue with these laudable initiatives is that they are carried out in isolation, with no central agency to support activities that could create a fundamental identity for the Mauritius Tea Industry. None of these initiatives have ventured into processing green tea and tea extracts, which are gaining popularity among the millennials and generation Z.

Figure 16. Mauristea orthodox roller and brick tea.



© FAO.

Various options exist for Mauritius and all of them are focused on resolving the biggest issue, which is the value of green leaf. This report does not want to suggest that the current process of CTC black tea should cease; indeed, it stresses that CTC black tea would be suitable for the domestic market, however not for a long period of time. In fact, Mauritian black tea is not a competitive product for exports and growth. There are many potential target export markets for both specialty and green tea. The most pre-eminent markets to target would be Europe, more specifically the United Kingdom and France (due to the historical ties and tourism) and North America where this would be a considered a “New World” and exotic product.

The drive for diversification is evident, as consumers increasingly demand natural flavours in diversified blends. There is also a growing interest in higher quality specialty tea with distinctive flavours. At the same time, green tea, green tea lattes, green iced tea, and sparkling green tea as well as herbal and fruit tea are gaining popularity, as proven by the volume of imports of these products and the increasing demand in different markets. There appears to be a gradual shift towards greater differentiation and higher value-added products, which can bring substantial price premiums.

Specialty Tea: The low yield/ha and high labour costs (for hand plucking) make the primary input green leaf cost prohibitive for processing specialty tea such as White, Green and Oolong. Recommended strategic direction for the tea industry, coupled with Mauritius’ enviable history, topography, regionality, natural capital, and unique leaf stock, is to focus on specialty tea.

Green Tea: The high labour cost, labour shortage, and ageing tea farmers call for a strategy for the mechanization of harvesting green tea leaf, which forms the basis for manufacturing green tea. Mauritius produces some green tea that result in smooth liquors, one of the most important traits for widespread customer satisfaction. Moreover, if it is proven free of chemical residues and pathogenic microbes, then it would be an attractive product for a market that is looking for new and exotic origins.

Tea for Extraction: As in the case of green tea, tea for extraction can be mechanically harvested and produced according to the requirements of the partner extractor.

Section II: Climate change and weather

tea crop is highly sensitive to climate and indeed, climate is a critical factor that determines both the quality and quantity of tea. Temperature plays a major role in the growth, yield and quality of tea. Tea requires cool to warm temperatures with at least 5 hours of sunlight per day and relies on a well-distributed pattern of rainfall and precipitation. During the growing season a relative humidity of 70 to 90 percent is the ideal condition, while dry periods are also important for harvesting tea. Climate change, triggered by global warming, has increased the frequency of extreme weather conditions. A rise in temperatures influences the rainfall patterns and distribution, and changes in other meteorological parameters that influence soil and plant health have further complicated tea production.

Tea bushes require adequate and well-distributed rainfall for their survival. Heavy and erratic rainfall can increase soil erosion and deplete soil fertility, which therefore affects the productivity of tea gardens and the quality of tea. Reduced sunlight due to fewer sunshine hours will also have a negative impact on the yields and quality of the leaf, in addition to subjecting tea bushes to diseases. The probability of pest infestation increases with the rise in temperature and as an after effect, productivity will experience a decrease.

Climate change affects tea production and at the same time weather conditions are the driving force for optimal growth of tea shoots and bushes. Tea growth depends heavily on stable weather conditions and on natural precipitation. In Mauritius, tea is a rain-fed crop. Compared to other crops, tea crops do not depend on irrigation.

Climate change has a significant impact on yield and the quality of leaves. Increased temperature variability and changes in rainfall patterns have the greatest impact on tea yields, the quality of the green leaf and made-tea, and the overall sustainability of the tea sector. Temperature variability has the greatest impact on tea yield. A warm wet season, is ideal for the quality and quantity of green leaf production. Furthermore, another impact of climate change is the occurrence of severe weather conditions such as cyclones and heavy rainfall, which significantly impact the green leaves. In the case of Mauritius, the increasing frequency of cyclones mainly during the peak harvesting season is a major concern, as high winds have an impact on the leaf quality and cyclonic weather delays the harvesting of green leaf and consequently negatively affects the quality.

The impact of climate change can be reduced by developing and introducing field management strategies and tea cultivars. This makes it essential to develop national climate change policies for tea and specific adaptation measures. Seedlings and VP tea cultivars must be developed while taking into consideration the local conditions, geophysical environment, cultivation practices, and the socio-economic factors. This would include the selection of stress-resistant tea varieties,

the reduction of climate disaster losses through intensive field management measures, and the establishment of an early warning system.

At the field level, climate change mitigation activities have many co-benefits. Also, many farm level mitigation activities help farmers to adapt to climate change. Activities that increase vegetation and tree cover such as planting shade trees to protect tea bushes, cover crops to protect soils, and hedges to act as windbreaks and reduce soil erosion are all forms of climate change mitigation.

Mauritius has developed clones mixed with old seedling tea. The challenge has been to determine what was planted and where, since this information was apparently lost or buried with the closure of the Tea Research and Experimental Station. Without this knowledge it becomes difficult to design a perfect field management strategy, as growth rates and qualities vary. There is an urgent need to develop climate resistant clones. It can take up to 20-25 years to develop a clone and integrate it into commercialization. While this activity should be an ongoing part of the support for the industry, in the interim, Mauritius should research other regions with similar climates which have developed clones that are in production today. This will jump-start the industry. Moreover, extension services and capacity building are fundamental to implementing climate change policies and applying climate change mitigation and adaptation measures.

Section III: Promoting and branding of Mauritian tea

Promotion is an important element for rejuvenating the tea sector. The basic thrust of a promotion policy is to expand the overall market demand and foster tea loyalty, while simultaneously dealing with competition from beverages and tea from other sources. To revive the tea industry promotion initiatives and brands should be an integral part of the revival programme, since the incremental value that the promotion and brands generate will contribute significantly to the development of a sustainable tea sector. The promotion and branding activities should be based on a shared identity and interests with a focus on the natural capital of the island. The promotion and branding programmes should start with an “in-country” focus, which will develop itself into its promotion in the export market with a focus on the tourist sector.

MAIFS should encourage the tea industry to develop a generic promotion and brand programme aimed at strengthening the consumption of domestically produced tea and to counteract the increasing intake of carbonated sugary soft drinks and the consumption of imported tea. All major tea producing countries such as Rwanda, Kenya and Sri Lanka have adopted a generic national promotion policy and brand for their tea. In the case of India, branding is region specific: Darjeeling, Nilgiri and Assam. Tea produced in these three regions is protected under the Geographical Indication.

Experiences from Kenya, Sri Lanka and many other tea producing countries have shown that using health-related messages for promotion and branding purposes has contributed to the growth of the domestic market. Government of Kenya encouraged packers to undertake brand promotion activities based on the health qualities of tea. In Sri Lanka, the promotion programme included seminars for medical professionals in association with clinical societies. These promotional and branding initiatives included the nutritional and health aspects of tea. Sri Lanka uses a promotional generic slogan “Health in a Cup”. Promotional and branding initiatives in the case of Mauritius should be based on the flavours and terroir, the quality attributes of the natural capital of tea growing areas, and health benefits.

To strengthen the national image of Mauritian tea a single logo should be developed, for example, Sri Lanka - Lion logo), Rwanda -A Natural Reawakening, Kenya -KETEPA, The Pride of Kenya and Kericho. Every tea processor or blender in Mauritius can have its own trade label but should include a national single logo representing the Mauritian brand, which should reflect the natural capital of Mauritian tea. Since Mauritius is an island nation, the report suggests capitalizing on its uniqueness as an “Island Tea” or “thé de l’île”, to differentiate Mauritian tea from other tea on the market.

Mauritian tea, with its deep-rooted history, heritage, tradition and special functional benefits has its own brand identity. The health benefits of Mauritian tea give it a unique advantage and can contribute to the development of a stand alone national brand. The consumers mainly made up of the millennial’s generation X, and Y are placing more value on healthy lifestyles, safer and innovative products, convenience, and the social image of a product. A brand identity will ensure that Mauritian tea continues to be sought after as a trusted and high quality product with

functional benefits backed by strict regulations and standards. Moreover, it will encourage and facilitate the conservation of its valuable natural heritage. The brand identity will be the driving force for innovative and responsible ways to process and produce tea. It is recommended that MAIFS develop a consumer education programme regarding the health attributes of Mauritian tea; furthermore, the government could declare Mauritian tea as a “National Drink” that adds value to a healthy lifestyle.

The branding and promotion of Mauritian tea as a pesticide free product is high on the agenda of the Government of Mauritius (Budget Speech-2019, para 79). NAPRO claims that tea produced in Mauritius is pesticide free, based on the argument that there is “no pest or disease of economic importance that attack the plant.” However, there have been claims by tea growers that ‘bacteria’ affects tea bushes in many cases. Regular MRLs testing could provide better analytics to support the pesticide free policy. The branding and promotion of Mauritius tea as chemical free instead of pesticide free, will add to the uniqueness of Mauritian tea, as many countries are producing pesticide free tea.

Many new market requirements, including carbon foot print standards, have started to emerge. These new market requirements can offer opportunities to promote the Mauritian tea brand, once the tea sector adopts a carbon neutral production strategy. The carbon neutral tea can promote eco-tourism as well. Mauritian tea with its deep-rooted history, heritage and tradition and special functional benefits is uniquely positioned to support the development of a national brand for its tea.

The demographic, millennial, and generation X and Y are seeking unique tea with a unique story and relevant attributes such as carbon neutral, chemical free, decent work conditions, and “green products”, all of which the Mauritian tea can offer. The island’s natural beauty, location, and romanticized imagery should all be harnessed within the architecture of the brand “Island Tea”. Creating “terroir” and production techniques that optimize differentiated profiles can help add value to Mauritian tea. The tourist sector can further contribute to giving the national brand “Mauritius Island tea or “thé de l’île Maurice” brand a higher status. Moreover, dates for when the tea was first produced could be included to add a touch of heritage to its promotion and brand. The term ‘single origin’ is as essential as it sounds — it means that the tea leaf comes from one place only and usually from a certain region and country.

Promotion alone will have little chance of success. Promotion is one of the several concerted actions to take in a coordinated strategy. Promotion can only have a chance at succeeding if it is backed by the regular supply of a good quality product at an affordable price. Generic promotion and branding must follow brand standards ensuring that it cannot be altered, thus benefiting the processors’ special brand of tea.

A strategy is easy to develop whereas developing a brand is a lengthy process. It is recommended that an in depth study, including consultations with all stakeholders and consumers, be undertaken. Branding experts should lead the branding exercises. Promoting and branding is the responsibility of all stakeholders and public-private partnerships are required based on principles of good governance. As currently there is no institutional structure to support

tea branding, there is a need to set a tea standard and also to improve packaging. A capacity development scheme and programme for the development of brand excellence need to be setup.

However, there are some serious issues in Mauritius that should be addressed. The statements made about health benefits on tea packages are sometimes exaggerated or cannot be supported and, together with the awkward marketing, can undermine the industry.

Section IV: Capacity gaps

The study revealed that knowledge in all aspects of tea should be improved, from the bush to the cup. This review is based on the existing capacity⁵ and future capacity needs for a potentially vibrant and sustainable tea sector, as a result of the opportunities provided by the market development of tea.

Gaps exist in the capacity of NAPRO to effectively deliver on its mandate as regards to policies, regulations and leadership for the tea sector. However, the NAPRO act, the legal framework on which the NAPRO mandate is anchored, makes no provisions for capacity development. The assessment found that the staffs were not adequately qualified, for example, at the senior management level had experience in various disciplines but not in the tea sector, except for one staff member. NAPRO does not have enough staff, more specifically tea specialists, market researchers, and policy experts, who can effectively carry out the required activities to support the development and production of quality tea. Moreover, staff training programmes does not exist.

The use of information and technology in the production of green leaves and processing tea was found to have low capacity; furthermore, gaps exist in the development of knowledge management systems and moreover, NAPRO does not have an interactive website for the tea sector. The capacity to manage its relationship with core constituents or to address climate change, plant husbandry, field management and field mechanization is lacking or non-existent. There is a fundamental need for the capacity development programme to enhance the skills of NAPRO, STG and factory employees.

Tea cultivation is a highly scientific and technical enterprise. Although some STG have more than two to three decades of experience, many STG have shown a significant lack of expertise in plant husbandry, efficient field management, and harvesting. Furthermore, STG do not appear to have a firm understanding of policies and their impact, and moreover their technical knowledge and business skills are limited. Tea cultivation requires a strong understanding of the science, technology, and cultural practices involved in the entire process.

The adoption of innovative practices for improving productivity, quality and sustainability of the tea industry are fundamental to addressing the emerging challenges. STG and tea processors need to acquire the skills and knowledge that will enable them to respond to the changing production and market environments. There is a need for field-oriented training programmes such as the Farmers Field School, in order to improve the limited manufacturing skills of factory staff.

⁵ Capacity: the “ability of people, organizations, and society as a whole to manage their affairs successfully; and capacity development as the process by which people, organizations, and society as a whole unleash, strengthen, create, adapt, and maintain capacity over time” and Capacity Assessment: a situation analysis of existing capacity where an assessment determines capacity “gaps” by comparing desired capacities against existing capacity and formulate strategies to address them (African Capacity Building Foundation (ACBF) 2011: 31)

Section V: SWOT analysis of mauritian tea industry

Before embarking on a plan of action it is important to have a balanced view of the industry. The SWOT analysis gives a general overview of the strengths, weaknesses, opportunities for the Mauritian tea sector as well as the threats (Table VII). The SWOT analysis illustrates that, while there still exists a major impediment to the tea industry, if the right strategies are exploited tea sector have a great potential. However, it must be noted that the international tea production community is relentlessly pursuing the same goal and from an advantageous starting point, given their production efficiency and access to markets.

Table 7. SWOT analysis of Mauritian tea industry

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> • Long history with the tea industry; • Health and Wellness benefits; • Strong domestic tea-drinking culture; • Government willing to engage; • Existing strong production base; • Favourable natural conditions (good climate and soils) that enable tea production all year round; and • Potential to increase the volume of production. 	<ul style="list-style-type: none"> • Ageing tea bushes; • Ageing tea growers and no action plan to attract younger generation; • Difficulties with the introduction of mechanization of field operations; • Unorganized nature of the production system; • Uncoordinated actions between institutions; • Loss of field expertise and field management leading to poor quality ratings of made-tea; • Lack of processing facilities technology, tea manufacturing facilities and manufacturing process becoming obsolete; • No emphasis on R & D both at field level and product development due to gaps in policy; • Poor focus on biodiversity and sustainable cropping; • Poor and low-yield cultivars; • Low production volume; • Lack of quality monitoring mechanism for both green leaf and made-tea; • Unknown tea bush identification, no record available for older tea gardens; and • No quality standard for made-tea.

Reigniting the engine of growth: a forward-looking business model for the mauritian tea industry

OPPORTUNITIES	THREATS
<ul style="list-style-type: none">• Leverage natural capital and island cache to create strong brand equity – terrior;• Leverage on tourist demographics to develop marketing strategy;• Diversification of product range to extract better value from tea leave and new product – green tea, powder tea, tea extract, instant tea;• Social enterprise for women-owned vertically integrated tea production model;• Development of high value brands;• Development of new areas with optimum natural conditions for tea plantation;• Existence of high value specialty markets and ability to invest in mini factories for specialty tea; and• Possibility for carbon neutral tea production.	<ul style="list-style-type: none">• No mitigation plan for climate change threats;• Rising cost of production making it commercially unviable;• Tea processing unit/made-tea do not satisfy requirements in terms of quality, standards and food safety;• Lack of a collective approach toward GAP and GMP;• Fragmented policy and government support;• Climate change compromises the capacity for sustainable tea production;• Competition from other beverages such as carbonated drinks;• Unchecked imports of tea blending may compromise quality;• Lack of Policy, legislation and regulatory framework; and• Competition from other COMESA tea producing countries.

Section VI. Barriers that may prevent the revival of the tea subsector

The barriers listed below are for 'cautious awareness' during the implementation of the revival programme and to provide guidance for inbuilt mitigation action in the revival plan.

Barrier 1: Smallholder concerns are not fully integrated in the tea ecosystem

The current existing governance of the tea industry will hinder the revival of the tea subsector. As a result, investments and support systems are focusing on the promotion of an ecosystem of quantity rather than quality products or products with dynamic market demands. This barrier is particularly challenging due to the limited human, financial and institutional capacity and politics.

Other challenges for an efficient tea subsector sector are the limited knowledge of the smallholders' needs and the limited buy-in from the stakeholders' sectors, as well as the public and private sector. Furthermore, limited resources hinder the integration of smallholders in the tea ecosystem. As a result, many attempts to transform the sector did not deliver the intended outcome. Removing this barrier would require building the capacity of tea growers and decision-makers at all levels to mainstream STG in the tea value chain.

Barrier 2: Lack of support from institutions and political risk

Institutional frameworks need to encourage better coordination of the tea value chain. For example, stakeholders require greater access to information regarding the best international and national principles and practices. The tea subsector revival programme should ensure that public institutions deliver promptly the much needed support to the tea sector, especially the STG.

It should be noted that institutions previously supporting the development of the tea sector were not designed to increase its efficiency, instead, they were designed to satisfy the political elites at that time. This report stresses the importance of modern and dynamic institutions with a new legal framework and political neutrality as the main pillar of their development plan. In the past, most of the reformed agencies had gone bankrupt and were not very effective in supporting the sector. Keeping this in mind, the current programme should ensure that such an event be avoided.

Political economic forces had a major influence on the near collapse of the tea sector in Mauritius. For the revival programme to be successful, policymakers must bear in mind the extent to which existing elites will be affected by the redistribution and democratization associated with the revival of such a programme. These issues should be factored into the revival programme and a mitigation mechanism must be inbuilt into the action plan.

Barrier 3: Weak public – private partnership

A major barrier that can be overcome through this project concerns the insufficient amount of technical support available or accessible to the STG from government extension officers. The revival programme will establish a participatory process. In the absence of institutional leadership (technical and coordination) for the tea sector, it had become difficult for the government to set common goals or to introduce more extensive and far-reaching reforms for the tea sector. The strong participation of government, the private sector and the STG will provide the momentum.

Section VII: Recommendations and strategic interventions

The Mauritian tea sector has been the object of neglect by both the public and private sectors. This has led to a severe disinvestment by the public and private sector and subsequently the abandonment of many STG. Since 2010, the tea subsector has completely ignored the following six “I”:

- **inputs:** degradation in the quality of green tea leaf leading to mediocre/low quality of made-tea;
- **incentives:** no incentive for STG to produce quality green leaf or for the youth generation to join the tea sector;
- **infrastructures:** below standard infrastructure at the factory and field level;
- **institutions:** inadequate, weak institutional legislative and regulatory framework including the absence of a policy and poor coordination among institutions to support interventions and guide the tea subsector;
- **innovations:** tea subsector never innovated in terms of product diversification, ICT, processing technologies, field management and harvesting; and
- **investments:** huge disinvestment by the public and private sector, many STG exited the tea from subsector by abandoning their tea gardens.

The findings of the analysis confirm that the major challenges facing the tea industry in the remit of this study, are:

- weak institutions, legislation, and regulations, absence of tea policies and uncoordinated actions;
- poor agronomy practices and bush maintenance, unknown cultivars, ageing and moribund bushes, variable bush densities, no extension services, low quality of green leaf;
- no climate change adaptation plan and strategy, low government engagement;
- high cost of green leaf production, shortage of labour, ageing tea growers, low productivity;
- dominant product is black CTC, quantity rules and not quality, absence of tea standard, no product innovation, old infrastructure, hygiene and food safety concerns, high cost of processing, highly dependent on electricity and fossil fuel;
- inadequate human and institutional capacity, low adaptation of technology; and
- strong culture of tea, branding based on the island natural capital.

Based on the above analysis, the reports recommend a holistic approach for a successful transformation of the tea sector, which should include bush to cup. This would encompass a range of interventions and programmes to address the systemic challenges facing the tea industry and subsequently transform the tea sector. Against the backdrop of the opportunities provided by both local and global markets, this report argues that the interventions and programmes approach embedded in social science, economics, agronomy, governance and political economy, including an effective engagement of the government, should be the guiding principles for transforming the tea sector. These new strategies need to be implemented simultaneously within the existing industry structure and, as success takes hold, tea gardens and processing capacity can be expanded.

A. Enhanced enabling institutional, policy, legislation and regulatory framework

Owing to the national importance of tea, its unique agronomic and socioeconomic characteristics, the governance structure, legislation, and regulatory framework should be separated from other commodities as listed in NAPRO. Admittedly, there are major institutional constraints concerning the development of the tea sector, in fact, it has been recommended to remove tea from NAPRO and create a tea entity with main focus on tea. This entity to provide the much needed public goods to incentivize the development of the tea sector and will be the lead agency to implement the remaining programmes and interventions. Furthermore, lessons from the 1990s point to the need for a comprehensive tea policy, tea legislation, a regulatory framework and effective institution to coordinate the tea sector. It is highly advisable to enact legislation to encourage the tea industry and tea culture to establish and implement a master plan in order to advance the tea industry.

A.1. Proposed institutional setup: Mauritius tea industry development agency

Based on experience, it is recommended to remove tea from NAPRO Act 2013 and enact a new legislation which will facilitate the creation of the Mauritius Tea Industry Development Agency (MTIDA), with a focus on public goods needed for new innovative business model for a sustainable and environmental friendly tea sector under aegis the Ministry of Agro-industry and Food Security.

MTIDA will provide a framework as well as an enabling environment for the intensification and sustainable development of the tea sector, with a focus on research, extension and product innovations, provision of rules and regulations, surveillance and enforcement, policy, and planning functions. MTIDA will be the regulatory body and high performing entity that will facilitate growth and development in the tea sector. Furthermore, it will regulate the quality control of inputs and made-tea and promote, regulate, and support the sustainable management of the tea sector; it will issue licenses to factories. MTIDA will be to modify, cancel or suspend a license issued to a tea manufacturer should the terms and conditions of the license be violated. Such an institutional setup will ensure coordination and interaction among the stakeholders. MTIDA will formulate an appropriate policy framework and contribute to the action plan to support the development of an internationally competitive, innovative focused tea subsector. While the debate persists on how to revive the tea subsector, there is one area where all the stakeholders agree: institutions and legislations have a major supportive role in the reform of the sector. At the institutional level, the key constraints are the lack of skilled personnel knowledgeable of tea, strategies, regulations and policy conducive to the growth of an inclusive business model for sustainable development in the tea sector.

A.2. Legislation, regulatory and policy framework

The study findings indicate that there are gaps in the legal and regulatory frameworks. This implies that the tea sector has been operating without a clear strategic focus, which is further compounded by the absence of a tea policy. The closure of TB and the transition to NAPRO resulted in the loss of a focus on tea sector development. It is highly recommended to separate tea from the NAPRO Act. As previously mentioned, a comprehensive (stand alone) tea policy, legislation and regulatory framework should be established to clearly define and coordinate the role of all stakeholders. A legislation and regulatory framework will guide tea policy matters through the MAIFS. It is recommended to explore avenues for effective engagement of the government for a tea policy, legislation, and regulatory framework, which will regulate the tea sector including research, processing, marketing, and promoting tea.

A.3. Extension, technologies and innovation

FAREI which is responsible to provide technologies and innovation, effective extension services for non sugar crop. FAREI has not provided such support to the tea sector and to promote the STG as they have the biggest potential to unlock sustainable growth in the tea sector. Such an institution will develop a capacity development programme to strengthen and improve the knowledge and skills of STG in field management and manage the quality of green leaf and processing skills of factory workers. It will ensure the highest standards of food safety and consumer protection. FAREI must expand its crop coverage in its mandate. FAREI should promote research, extension, product development and investigate agronomic problems associated with tea including the productivity (yield), quality and suitability of land in relation to tea planting; and matters ancillary thereto. Furthermore, FAREI will also be responsible for future-proofing the industry against climate change and other events likely to change the physical health of the industry through the development of a high yielding clone. FAREI will establish an innovation laboratory in collaboration with a special emphasis on value addition.

B. Tea field productivity

Improved tea field productivity is influenced by appropriate plant husbandry and field management, the age of bushes, moribund tea bushes and the type of tea clone being grown. There is a need is to evaluate the agronomic status of the current tea gardens as well as the abandoned fields. Replacing the ageing tea bushes and moribund bushes with high yielding clones could bring about improvements in the yield of green leaf. Similarly, a new area that has been earmarked should be planted with optimal clones to facilitate mechanical harvesting. The current fertilization process as well as the fertility to be reviewed, periodically.

Tea farming involves a high level of fix capital investment and the STG does not have access to financial resources. Hence, replanting the old tea gardens with improved clones is stymied by the high costs of inputs, long gestation period of tea and lack of alternative income sources for STG during the gestation period. This necessitates state intervention and institutional arrangements to support and encourage STG to replace the old tea gardens and moribund tea bushes with high yielding clones. There are many successful land developments, the most cited being the Malaysia Federal Land Development Authority for palm oil. It is suggested to explore

and learn from these land development practices and adapt them to the Mauritian tea sector. Also, as mentioned earlier in some cases drainage have been blocked. An appropriate drainage system should be installed. Good agronomic practices need to be followed by the STG. At the field level, investments to promote innovation in the farming system so as to ensure that the field meets the requirements for mechanization. Farmer field schools can contribute to the capacity building of STG to improve field productivity.

C. Factory and rising processing cost

The old and outdated machinery of the factories need to be replaced. Factories need to meet the food safety standards. Modernization programmes and improved technologies including energy-saving machinery for processing and digitalization of key factory production processes are essential.

Reducing electricity and fossil fuel use and switching to renewable or low carbon energy sources has many benefits. Factories should adopt innovations for reducing energy costs by shifting to new technologies. An important source of energy for boilers is bioenergy briquettes made from bagasse produced from sugarcane. Briquettes produce more energy per unit than wood. Transforming bagasse into bioenergy would not only reduce the industry's environmental impact but it would also have economic benefits for both the tea and sugar sector. Other options include solar and wind energy. The cost reduction strategy using renewable energy can contribute to the zero-carbon strategy.

Rising costs of processing perpetuate the need to increase production efficiency. The quality of green leaf also influences the cost of production and ultimately determines the quality of the tea produced. Capacity building is needed to improve the quality of the green leaf.

Many tea producing countries have experimented with “mini-factories”, which are easily mineable and reduce the cost of processing through the use of renewable energy. For example, the small solar or wind power mini-tea factories with a capacity between 500 to 1000 kg of made-tea require about 30 kwh of power. These mini factories can facilitate product diversification.

D. Product innovation

Black CTC tea is dominant product as all three traditional factories operate only black CTC tea production lines. It appears that factories do not have any incentive to produce other types of tea, since they have a secured domestic market for black tea through various trade measures. A small volume of specialty tea experiments is taking place; mostly centered around black CTC (the flavoured tea currently produced is black tea based). In order to increase product diversity in specialty tea would require introducing new production lines. STG also may also diversify by planting material to include other botanicals such as lemongrass, chamomile, and peppermint, etc. This will not only diversify the portfolio of Mauritian tea but will also transform income streams for STG.

The industry can explore the possibility or facilitate the setting up of mini-tea orthodox factories

for high-end quality tea and develop other tea-based products besides made-tea. New strategies aimed at adding value and reducing production costs are also needed, especially to meet changing tastes and to attract young consumers who currently depend heavily on carbonated sugary drinks.

E. Improving quality of green leaf and made-tea

The low to mediocre quality of made-tea is a challenging issue for Mauritian tea production and requires a transformational and holistic change in order to survive. The decline in the quality of made-tea is due to the weak enforcement of standards, and substandard processing.

Improving the quality of made-tea begins in the field. If Mauritius is to increase the quality of made-tea to a competitive standard, the quality control should start with field management, harvesting and collection of the leaf; this includes appropriate plant husbandry, field management, and harvesting methods. STG often lack the necessary skills to produce quality green tea in an effective way, mainly because of the traditional methods used for field management, without taking into account new technologies and innovation. Quality enforcement of green leaf collection needs strengthening. An outreach-training programme for STG on field maintenance and on how to produce a high quality of green leaf should be put into place.

The lack of control during processing, lack of ambient temperature and humidity, lack of speed control, and lack of bed depth have led to a mediocre quality of made-tea. It is critical to enhance the capacity of the factory workers to be able to control the process.

To maintain uniformity across all of the factories, made-tea from each factory will be subject to sensory tests on a regular basis. Investments are needed to raise the general quality of made-tea. To improve the quality of made-tea, modern factory infrastructures including process technology would be required. The conditions of the tea machinery are to be checked periodically by MTIDA. A standard should be set and maintained in all factories to produce quality tea. To maintain the quality level of tea, an official quality indicator should be designed as a guide for the examination or inspection.

The current price mechanism for green leaf tea does not adequately motivate STG to produce quality green leaf. The price mechanism needs to be reviewed to account for the quality and price differentials for green leaf quality as in the case of Mauristea Ltd. There is no standard for the grading of made-tea. Prices should serve as a guide for the grading of made-tea, which will help to improve the quality of green leaf and made-tea. The tea manufacturers serve as a cartel, which in a sense has stymied the quality of made-tea. In sum the decline in the quality of made-tea is due to the weak enforcement of standards and lack of incentives.

F. Promoting and branding of the Mauritian tea

Mauritian tea with its deep-rooted history, heritage, tradition and special functional benefits has a brand identity of its own. The island's natural capital could be harnessed by the creation of "Mauritius Island Tea or thé de l'île Maurice" as a brand. Focusing on creating a regional variety, while responding to terroir and production techniques would help create something extremely valuable for the Mauritian industry. It is important to create a generic national brand focused on the natural capital of the island, its unique qualities and the health benefits of tea.

The promotion and branding programmes should start with an "in-country" focus, which would regenerate itself into a promotion for the export market through the affinity of the tourist sector. Branding and promotion of the Mauritius tea should focus on the chemical free product instead of pesticide free aspect. Many countries are producing pesticide free tea, hence using pesticide free as a branding concept will dilute the uniqueness of Mauritian tea. To strengthen the national image of Mauritian tea a single logo should be developed for the brand "Mauritius Island Tea or thé de l'île Maurice".

G. Rising cost of green leaf, labour shortage and ageing tea growers

The poor performance of tea has been attributed to the high cost of green leaf and the shortage of labour. To reduce the high cost of green leaf production to actively promote mechanization for harvesting green leaf and pruning. On an individual basis, the STG will not be able to invest in mechanization. Cooperatives can play a major role in advancing the agenda of mechanization or can be the service providers for mechanization. Even the young STG can be incentivized to group together to be service providers. Mechanization depends on the size of tea gardens. It is recommended to conduct an economic analysis to determine the optimum size of the tea field and to allocate the new tea field based on the optimum size.

Mechanization and adoption of modern production technology in the field will address the impending labour shortage and at the same time improve yields, consistency and quality of green leaf. Because of the lack of incentives for the next generation and the rising cost of green leaf, it is imperative that mechanized/motorized harvesting be used throughout most of the season. Some level of hand plucking should be left to produce high-end tea that conforms to a closely managed Mauritian tea identity. Mechanized tea production (tea harvesting, garden maintenance) requires a substantial capital investment that needs proper management and institutional organization. The proposed mechanization strategy and cooperative alliance among the STG for field management will contribute greatly to the objectives to increase productivity and the quality of made-tea.

H. Climate change challenge and greening the tea sector

Tea crop is highly sensitive to climate, a critical factor in determining both the quality and quantity of tea. Climate change affects tea production because weather conditions have an influence on the optimal growth of tea shoots and bushes. Furthermore, climate change has a significant impact on yields and the quality of green leaves. It is essential to develop national climate change policy for tea. Technology extension and capacity are necessary to implement climate change policy and there is an urgent need to develop a climate resistant clone. It is

important to develop crop insurance to minimize the risks of weather disasters on STG.

Tea processing is energy intensive. Depending on process and equipment efficiencies and types and local cost of fuels used, energy can make up as much as 25% of the total cost of tea production. Present source of energy is electricity and heavy oil is expensive, and greenhouse gas intensive, its recommended to investment in alternative source of energy, solar, wind energy and renewable energy, for processing and drying. Another important source of energy for the boilers are bioenergy briquettes made from bagasse from sugarcane. If these sources of energy are used and managed in a sustainable manner, they would fall into the category of carbon neutral. Pursuing a low carbon tea processing strategy can be used as a promotional label as well. Mauritius should explore the use of sugar cane bagasse briquettes as a sustainable alternative to conventional fuels as one way to cut costs. Tea factories should pursue a carbon neutral tea processing strategy and action by using renewable energy. Certified carbon neutral tea products with zero-carbon labels have great appeal to current and future consumers; therefore, Mauritius should explore the possibilities for producing carbon neutral tea. Many new market requirements, including product carbon footprint standards, have begun to emerge.

I. Price of made-tea

The steep increase in the domestic price of tea since 2015 does not seem to reflect the cost of production or the declining global prices. One element that can be noted is the asymmetric price movement between domestic retail prices and global prices, particularly since 2015. Prior to the demise of the TB between 2009 and 2015, the retail price was in the range of MUR 140 to MUR 160/kg, and in 2018/19 the price doubled to MUR 340/Kg. The price of tea nearly doubled, while the global price of tea declined. The government could consider reviewing its trade policy for tea as well as the economic efficiency of the domestic market structure. The tea sector is a classic case of oligopoly. To build a strong domestic consumer-based for locally produced tea, it is recommended to revisit the retail price, possibly conduct a study whether there has been price fixing of made-tea.

J. Capacity development

Capacity development refers to a process of change in which people, organizations, and institutions improve their performance and refine, strengthen, and adapt their capacity over time in response to changing circumstances. Low skills and labour productivity levels present serious challenges within the tea industry, therefore the technical capacities of STG need strengthening to boost the volume and improve the quality of green leave production. Capacity building for STG can have a mixture of modalities, training such as a “FAO’s Farmers Field School” or field visits and exchanges are recommended. The field school should be highly adaptive and context-specific and include individual as well as collective learning. Factory operators need to improve their skills.

FAREI and MTIDA will have a major role in developing capacity building and must conduct a capacity assessment at field level and factory level. Various mechanisms may enable farmers and factory operators to express their technology needs and participate in designing, testing, and disseminating appropriate technologies. Capacity development should be an integral part of the Function of FAREI and MTIDA.

K. Cooperative to strengthen the governance of the sector

For the significant expansion of tea growing and the upstream industry, the Cooperatives Division of the Ministry of Industrial Development, SMEs, and Cooperatives will have to encourage STG to group themselves into cooperatives and possibly vertically integrate. Cooperation is already successfully entrenched in the tea industry, which is a good start, but this needs to be refined and expanded to enable mechanical harvesting of tea, controlling green leaf quality, and the mechanization of other green leaf production. Cooperation needs to be set up between growers who are able to execute a mechanized harvesting strategy in practical terms, based on the contiguous nature of their fields and the aptness of the topography and planting.

A strategic cooperative alliance model like the Japanese cooperative model for tea can help improve the weak performance of the Mauritian Tea sector. The cooperative tea processing system helps to share the leaf production risk among farmers. Currently, cooperative serves the sole purpose of issuing credit and act as paying agents for green leaf. Cooperative should aim to provide innovative organizational support to enhance productivity, the quality of made-tea and minimized risk, while ensuring that the value of the tea is fair for the STG.

L. Digitalization and data-driven tea sector

Digital innovations and technologies will be integral part of the solution for an innovative tea business model for Mauritius. Digital technologies are creating new opportunities to integrate smallholders in a data driven smallholder production. Access to digital technology can offer significant advantage to revive the tea sector as Mauritius looks to innovative and inclusive business model for increasing productivity, efficiency and sustainability. Tea production in Mauritius occurs through networks of actors; tea pluckers, STG, tea processors, tea factory owners, NAPRO, cooperative associations, and so on. Tea processors, STG, NAPRO and government official were often frustrated at the lack of impetus in the sector in transitioning to digitalization of the sector.

Experience from tea producing have shown a spatial data management system to profile tea farmers and map tea plots among members to an immediate impact on increasing productivity and efficiency. Currently, there is no data, on information of STG, geo-physical characteristics of tea garden, type of cultivars and age of tea bushes etc. With demise of the TB these data have been buried. Most of existing individual data set are incomplete, not necessarily verified and lack crucial geo-reference.

To address the challenges of tea sector a spatial data management system needs to be built. The digital profiling of tea farmers, which will include geo-reference information about tea farmers

and their land using GPS will form the basis data architecture of proposed tea business model. The system will offer a fully functioning data collection platform and a Geographic Information System.

The farmer profiling can also help solve the issue of quality of green leaf. The use of soil scanner to identify success factors, possible bottlenecks and the added value of innovative soil testing services can contribute to fertilizer efficiency and increase yields. Data driven tea sector will make pricing and tea production at all level more transparent. Finally, youth have a key role to play in the digitalization of the tea sector.

Section VIII: Conclusion

The Mauritian tea sector has been operating against changing global demand and rising production costs, the highest being labour and energy costs and declining global prices of tea. Ageing farmers and shortage of labour have been a major challenge for the survival of the sector. Despite these challenges, domestic production accounted for more than 90 percent of domestic consumption until recently, when this share dropped to 75 percent.

This report assessed the current business model of the Mauritian tea industry, its limitations, challenges and opportunities along the value chain, and proposes actions to revive the sector. The report argues that the decline in the tea sector is the result of a lack of coordination among the different institutions, both formal and informal, and ineffective programmes and national strategies. The absence of a comprehensive policy, weak legislation and regulation, low adoption of technology, and the lack of organizational innovation in the business model of the tea industry contributed to near collapse of the sector in the 1990's.

Innovation and coordination are necessary ingredients for a successful transformation of the Mauritian tea industry, starting from the field to the end product - made-tea. The report acknowledges that Mauritius has an ideal natural capital and ecosystem for producing medium to high quality tea, which need to be capitalized on.

The proposed revival programme of the Mauritian tea industry requires a hand-in-hand approach with coordination, collaboration and partnership of the public and private sectors, with a strategic focus on small tea growers. For a successful transformative change in the tea industry, the revival programme should not be treated in isolation. The tea development strategy and recommendations proposed in this report present a hopeful scenario for success in the future.

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Appendix 1: Sensory score

Table 1.1: Sensory score Kenya benchmark

Tea Sample	Sparkle	Color	Impact	Body	Astringency	Dry Leaf	Infused Leaf	Liquor
Bois Cheri PFi	11.2	4.4	5.2	4.8	4.8	Black, little open, little fibrous	Little dull	Little soft, balanced but no impact
Chartreuse PFi	11.2	5	5.6	5	5.4	Brown, little fibrous, well graded	Coppery, even, well developed	Bright, brisk, good flavour development
Chartreuse PD	10	4.6	5	5	4.8	Brown, neat	Brown to coppery	Some flavour development but little plain and soft
Kenya	11.2	4.6	4.8	5.4	4.8	Black well graded. No fibre	Brown to coppery	Some flavour, good body, medium quality

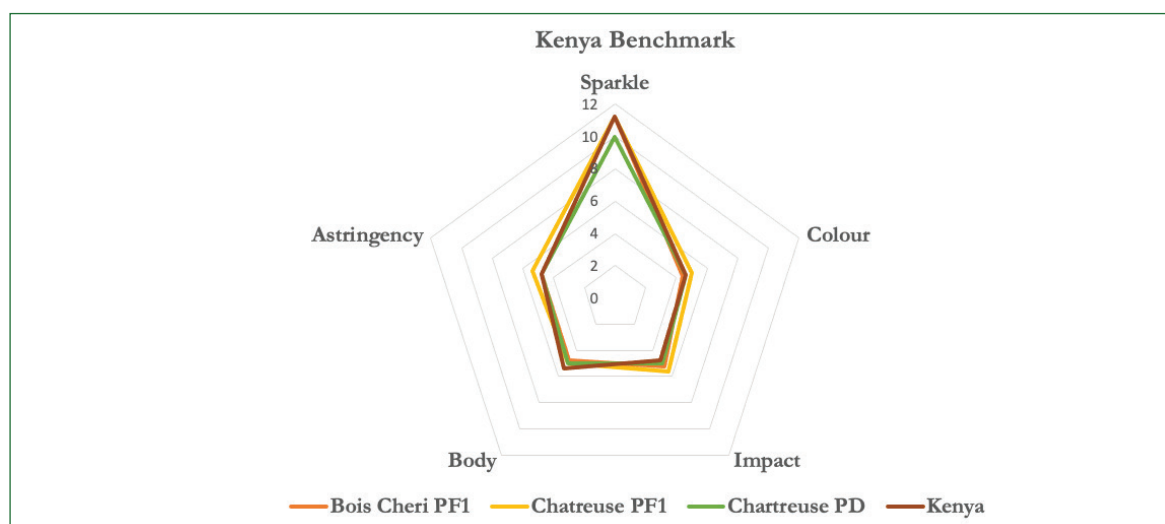


Table 1.2: Sensory score Malawi benchmark

Tea Sample	Sparkle	Color	Impact	Body	Astringency	Dry Leaf	Infused Leaf	Liquor
Bois Cheri PFI	11.2	4.4	5.2	4.8	4.8	Black little open, little fibrous	Little dull	Little soft, balanced but no impact
Chatreuse PFI	11.2	5	5.6	5	5.4	Brown, little fibrous, well graded	Coppery, even, well developed	Bright, brisk, good flavour development
Chartreuse PD	10	4.6	5	5	4.8	Brown, neat	Brown to coppery	Some flavour development but little plain and soft
Malawi PD	10	4.6	4.8	4.8	5	Black small well graded	Brown to coppery	Medium bodied, plain, little soft

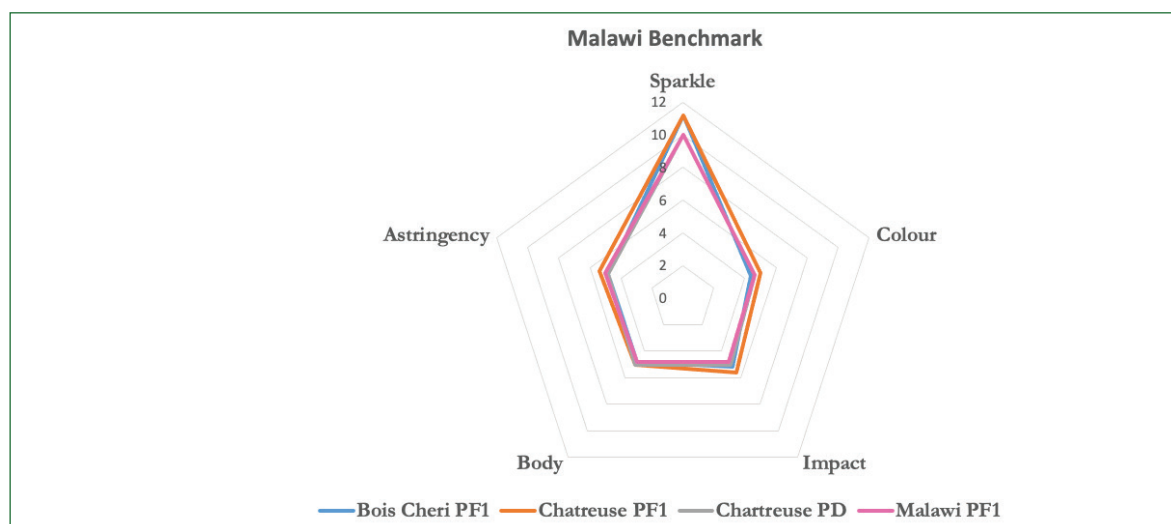


Table 1.3: International Sensory Score and Comparable international Price of Mauritian Tea

Origin	Description	Density	Average bandwidths of origins and types over a 10 year period 2009-2019						
			OS Astringency	OS Astringency	OS Body Min	OS Body Max	OS Colour Min	OS Colour Max	OS Impact Min
Kenya	Kericho	265-352	2,5	3,5	2,5	3,5	2,5	3,5	2,5
Sri Lanka	Low grown leaf	300-340	2,5	3,5	2,4	3,4	2	3	2,3
Malawi	EP	287-351	2,2	2,8	2,2	3	2,3	3,3	2,2
Vietnam	Lamdong	287-417	0,5	1,5	1,5	2,5	1,5	2,4	1
Argentina	Maingrade	301-428	1	2	1,5	2,5	2	2,8	1
China	Green steamed	247-440	3	4	1,5	2,4	1,5	2,5	2,5
India	Nilgiri orthodox	347-362	3	4	1,8	2,8	1,8	2,5	2,5
Kenya	KTDA East of Rift	300-350	2,5	3,5	2,2	3	2	3	2,5
India	Assam post second flush	320-400	2,5	3,5	2,7	4	2	3	2,8
India	Darjeeling	277-384	3	5	1,5	2,4	1,5	2,4	3
Indonesia	W.Java	257-433	2	3	2	3	2	3	2,5
China	Green Pan fired	200-240	1	2	1,5	2,4	1,5	2,5	1,5

Evaluation of bulk teas

Mauritius	Bois Cheri		2,4		2,4		2,2		2,6
Mauritius	Chartreuse		2,7		2,5		2,2		2,8

Source: StatMauritius.

Origin	Pricing ratio	TBC (USD/Kg) FOB	Leaf grade + 20%	Leaf score	Total leaf Value (USD/Kg)	Discounts for defects	Gross price (USD/Kg)	Market weighting	Market price (USD/kg)
Kenya	2,20	USD 2,20	USD 2,20	4	USD 3,40	1	USD 3,20	0,8	USD 2,56
Sri Lanka	2,08	USD 2,08	USD 2,08	7	USD 4,18	0	USD 4,18	1	USD 4,18
Malawi	1,77	USD 1,77	USD 1,77	4	USD 2,97	1	USD 2,77	1	USD 2,77
Vietnam	1,40	USD 1,40	USD 1,40	3	USD 2,30	4	USD 1,50	0,75	USD 1,13
Argentina	1,60	USD 1,60	USD 1,60	3	USD 2,50	4	USD 1,70	0,75	USD 1,28
China	2,35	USD 2,35	USD 2,35	4	USD 3,55	2	USD 3,15	1,5	USD 4,73
India	2,48	USD 2,48	USD 2,48	3	USD 3,38	1	USD 3,18	1,25	USD 3,98
Kenya	2,43	USD 2,43	USD 2,43	4	USD 3,63	1	USD 3,43	0,75	USD 2,57
India	2,33	USD 2,33	USD 2,33	4	USD 3,53	0	USD 3,53	0,9	USD 3,18
India	2,45	USD 2,45	USD 2,45	8	USD 4,85	0	USD 4,85	2,5	USD 12,13
Indonesia	1,70	USD 1,70	USD 1,70	3	USD 2,60	1	USD 2,40	1	USD 2,40
China	0,85	USD 0,85	USD 0,85	9	USD 3,55	1	USD 3,35	2,5	USD 8,38

Bois Cheri		USD 2,12	USD 2,12	2	USD 2,72	2	USD 2,32	1	USD 2,32
Chartreuse		USD 2,24	USD 2,24	2,5	USD 2,99	1	USD 2,79	1	USD 2,79

Appendix 2: Statistics

Table 2.1: Area harvested, green leaves production, manufactured tea and yields

Year	Area Harvested (Hectare)	Green Leave (Tonne)	Manufacture Tea (Tonne)	Yield of Manufactured Tea (%)	Green Tea (kg/hectare)
1985	3 907	45 291	8 115	17.9	1 159
1986	3 775	43 423	7 876	18.1	1 150
1987	3 757	39 917	7 147	17.9	1 062
1988	3 600	36 163	6 857	19.0	1 005
1989	3 071	29 239	5 500	18.8	952
1990	3 070	29 868	5 751	19.3	973
1991	2 871	30 635	5 934	19.4	1 067
1992	3 133	30 162	5 845	19.4	963
1993	3 140	30 900	5 931	19.2	984
1994	3 028	27 204	5 089	18.7	898
1995	2 077	21 419	3 785	17.7	1 031
1996	1 019	13 209	2 497	18.9	1 296
1997	797	9 026	1 787	19.8	1 132
1998	688	7 393	1 488	20.1	1 075
1999	671	7 134	1 473	20.6	1 063
2000	670	6 440	1 313	20.4	961
2001	660	7 440	1 517	20.4	1 127
2002	680	6 870	1 381	20.1	1 010
2003	681	6 973	1 436	20.6	1 024
2004	674	7 229	1 482	20.5	1 073
2005	670	6 798	1 387	20.4	1 015
2006	688	7 649	1 567	20.5	1 112
2007	709	8 027	1 563	19.5	1 132
2008	702	8 672	1 668	19.2	1 235
2009	713	7 663	1 481	19.3	1 075
2010	698	7 370	1 467	19.9	1 056
2011	651	8 975	1 787	19.9	1 379
2012	669	7 648	1 577	20.6	1 143
2013	672	7 981	1 563	19.6	1 188
2014	672	7 607	1 504	19.8	1 132
2015	574	6 732	1 295	19.2	1 173
2016	622	7 301	1 353	18.5	1 174
2017	622	7 309	1 379	18.9	1 175
2018	656	8 056	1 470	18.2	1 228

Table 2.2: Green leaves production by different group of tea growers

Year	Estates	Metayers	Free Planters	Planters in Cooperatives	Others Inc. TDA	Total
1985	4 165	3 623	2 306	34 903	294	45 291
1986	3 686	3 270	2 287	33 864	316	43 423
1987	3 024	3 212	2 244	31 116	321	39 917
1988	2 918	3 553	2 582	26 798	312	36 163
1989	2 155	2 803	2 403	21 637	241	29 239
1990	1 851	2 338	2 460	22 932	287	29 868
1991	1 740	2 156	2 189	24 326	224	30 635
1992	1 743	1 953	2 159	24 106	201	30 162
1993	1 672	1 898	2 380	24 747	203	30 900
1994	1 618	1 393	2 877	21 159	157	27 204
1995	1 667	1 389	3 166	15 108	89	21 419
1996	1 432	1 651	2 623	7 438	65	13 209
1997	1 059	2 250	2 983	2 685	49	9 026
1998	917	2 240	2 769	1 450	17	7 393
1999	793	2 357	2 672	1 312		7 134
2000	1 015	2 143	2 171	1 111		6 440
2001	1 106	2 416	2 792	1 126		7 440
2002	830	2 182	2 669	1 189		6 870
2003	1 216	2 266	2 208	1 283		6 973
2004	1 426	2 228	2 268	1 307		7 229
2005	1 393	2 061	2 145	1 199		6 798
2006	1 434	2 216	2 703	1 296		7 649
2007	1 686	2 233	2 870	1 238		8 027
2008	1 788	2 424	3 113	1 347		8 672
2009	1 375	2 256	2 788	1 244		7 663
2010	1 372	2 081	2 770	1 147		7 370
2011	1 807	2 494	3 390	1 284		8 975
2012	1 397	2 090	3 247	1 214		7 948
2013	1 103	2 055	3 519	1 305		7 982
2014	1 137	2 111	3 232	1 127		7 607
2015	1 001	1 691	2 922	1 118		6 732
2016	1 053	1 800	3 191	1 257		7 301
2017	785	1 682	3 447	1 395		7 309
2018	968	1 641	3 841	1 602		8 052

Source: StatMauritius.

Table 2.4: Share of production

Year	Estates	Metayers	Free Planters	Planters in Cooperatives	Others Inc. TDA
1985	9.2	8.0	5.1	77.1	0.6
1986	8.5	7.5	5.3	78.0	0.7
1987	7.6	8.0	5.6	78.0	0.8
1988	8.1	9.8	7.1	74.1	0.9
1989	7.4	9.6	8.2	74.0	0.8
1990	6.2	7.8	8.2	76.8	1.0
1991	5.7	7.0	7.1	79.4	0.7
1992	5.8	6.5	7.2	79.9	0.7
1993	5.4	6.1	7.7	80.1	0.7
1994	5.9	5.1	10.6	77.8	0.6
1995	7.8	6.5	14.8	70.5	0.4
1996	10.8	12.5	19.9	56.3	0.5
1997	11.7	24.9	33.0	29.7	0.5
1998	12.4	30.3	37.5	19.6	0.2
1999	11.1	33.0	37.5	18.4	
2000	15.8	33.3	33.7	17.3	
2001	14.9	32.5	37.5	15.1	
2002	12.1	31.8	38.9	17.3	
2003	17.4	32.5	31.7	18.4	
2004	19.7	30.8	31.4	18.1	
2005	20.5	30.3	31.6	17.6	
2006	18.7	29.0	35.3	16.9	
2007	21.0	27.8	35.8	15.4	
2008	20.6	28.0	35.9	15.5	
2009	17.9	29.4	36.4	16.2	
2010	18.6	28.2	37.6	15.6	
2011	20.1	27.8	37.8	14.3	
2012	17.6	26.3	40.9	15.3	
2013	13.8	25.7	44.1	16.3	
2014	14.9	27.8	42.5	14.8	
2015	14.9	25.1	43.4	16.6	
2016	14.4	24.7	43.7	17.2	
2017	10.7	23.0	47.2	19.1	
2018	12.0	20.4	47.7	19.9	

Source: StatMauritius.

Table 2.5: Made-tea, production, consumption, exports and total imports (tonne)

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Production	1 467	1 787	1 577	1 563	1 504	1 295	1 353	1 379	1 470
Export	37	33	35	67	52	41	41	47	33
Import	37	41	38	69	50	126	222	418	467
Consumption	1 550	1 627	1 615	1 616	1 592	1 380	1 557	1 704	1 784

Source: StatMauritius.



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