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Tea Value Chains Viability in Limpopo Province of South Africa: A Cost-Benefit Analysis

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Abstract

The research was conducted to investigate the production of value-added tea as part of the resuscitation of Tshivhase-Mukumbani Tea Estate. Data were mainly obtained from records kept at the Tshivhase-Mukumbani Tea Estate, through a review of literature and interviews of the selected respondents. Evaluation of economic viability of the value-adding initiative was based on Net Present Value (NPV) and the Benefit-Cost Ratio (BCR) calculated from time-series data obtained for the period 2005–2012. The quantity of value-added tea produced varied across years, geographical locations, and seasons, with production higher for wetter seasons. The NPV was consistently negative, while the BCR was below unity throughout the study period, implying that the value-adding initiative was economically not feasible. Initiatives for achieving economic sustainability of the value addition were (1) Improve the marketing of the made tea brand Midi Tea as organic and longer shelf life. (2) Good labor contracting management practices to deal with labor disputes and unrest. (3) Good supply chain and procurement management practices to reduce the cost of production (4) Monitoring the impact of climate variability and mitigate by providing irrigation (5) Intercropping tea with a suitable winter yielding crops such as avocados or Macadamia.

Keywords: value-adding, economic viability, Tshivhase-Mukumbani tea estate, benefit–cost ratio, net present value

1. Introduction

The historical background of tea production in South Africa has been in the World of Tea [1]. The narrative indicates that the first time tea was grown was in Durban in the year 1850. The material used for the first planting was imported from London's Kew Gardens. It was only 27 years later that commercialization was emphasized. With the experience of the growers, production was made steady only after the 1960s [1]. Market-oriented tea production in South Africa started in 1964 and the industry was supported by the government and later Industrial Development Corporation (IDC) as one of the “mass employers in the rural areas” and the strategy worked with absorption rates of over 1000 workers on a 500-hectare farm. The effect of democracy in 1994, globalization, and SADC Trade Protocols on agribusiness enterprises was massive and left many agribusinesses battling to remain profitable [1, 2].

The main challenges were high worker minimum wage rates; no protection against tea imports from SADC; high production cost structure (*due to labor wages, electricity, and inputs costs*); the strong brand against the US Dollar; and land claims on tea estates [3].

Value addition and integration of tea production were then adopted by the Limpopo Department of Agriculture in 2006 as a strategy to revitalize the Limpopo Tea Estates [3]. It was an understanding that the extent of the economic viability of the tea business enterprise was going to be influenced by activities performed along the value chain [4]. The thinking has been that by introducing value-adding, business enterprises would be able to increase the revenue and overall profitability of their products [5, 6]. Based on the studies conducted [7–9] indicated that agricultural value-adding initiatives have been recognized as a way of assisting business enterprises to understand the shocks brought about by globalization. Factors influencing commoditization of agricultural products include increasing consumer demand for convenient, ready to eat, safe, and nutritious food products and willingness to pay premium prices for such value-added products [10, 11].

The Tshivhase-Mukumbani Tea Estate adopted the concept of integrated value addition in 2009. This was given impetus by the building of infrastructure inclusive of the erecting of the tea processing plant. Black tea was locally processed, branded, and packaged resulting in the production of the Midi Tea range comprising Midi Gold Tagged, Midi Tag-less tea bags, and Midi loose tea. The focus of this study was to investigate: (a) to establish the production trends prevailing at Tshivhase-Mukumbani Tea Estates under rainfed conditions, (b) the extent to which value-adding implemented by Tshivhase-Mukumbani Tea Estate was economically viable, and (c) considerations for improving the economic viability of the value-adding initiative.

2. Methodology

2.1 Study area

2.1.1 Location

The Tshivhase-Mukumbani Tea Estate is located in the Thulamela Municipality of Vhembe District under Limpopo Province of South Africa (**Figure 1**). The tea estate is comprised of the Tshivhase Farm located at 30.314: 30.367 E and – 22.968: –22.994 S and the Mukumbani Farm located at 30.386: 30.437 E and – 22.904: –22.940 S. The road (Route R523) connecting Thohoyandou with Makhado Town cuts through the Tshivhase Farm with a major portion of the farm on the south of the road while Mukumbani Farm lies on the north of this road.

The road serves as strategic transportation infrastructure for the Tshivhase-Mukumbani Tea Estate. Although tea production at the Tshivhase Farm is rainfed, this portion of the estate lies adjacent to the Vondo Dam, a strategic water reservoir in the Mutshindudi River that supplies water to Thohoyandou and neighboring areas. Production at the Mukumbani Farm is dependent on some supplementary irrigation from the small dam located on the west of this portion of the estate.

2.1.2 Climate

2.1.2.1 Rainfall

Rainfall and temperature are important climatic factors for optimum production of all crops, including tea. Annual rainfall of 2500–3000 mm is considered optimum

Figure 1.
Location of Tshivhase-Mukumbani tea estate in Vhembe District under Limpopo Province of South Africa (source: GIS unit, Limpopo Department of Agriculture and Rural Development).

for tea production, and the minimum requirement is estimated at 1200 mm [12]. Other than total rainfall received, the distribution of the rainfall is an important determinant of the optimum yield of tea. The annual rainfall at Tshivhase-Mukumbani Tea Estate was 1758.0 mm, well above the minimum requirement for tea production. The distribution of the rainfall was rather uneven (**Table 1**). The Tshivhase- Mukumbani Tea Estate is situated in a micro-climatic area.

Month	Mean monthly rainfall (mm)	Mean monthly rainfall (% of annual)	Mean quarterly rainfall (mm)	Mean quarterly rainfall (% of annual)
January	340.0	19.3	898.0	51.1
February	327.0	18.6		
March	231.0	13.1		
April	90.0	5.1		
May	41.0	2.3	157.0	8.9
June	26.0	1.5		
July	31.0	1.8		
August	31.0	1.8		
September	64.0	3.6	577.0	32.8
October	120.0	6.8		
November	193.0	11.0		
December	264.0	15.0		
Annual	1758.0	100.0	1758.0	100.0

Source: Climate records, Tshivhase-Mukumbani tea estate.

Table 1.
Rainfall distribution at Tshivhase-Mukumbani tea Estate in Vhembe District under Limpopo Province of South Africa.

The rainfall distribution patterns in this area are above normal, in other words, this area receives more than 1750 mm per annum [13]. The rainfall records concurred with the studies conducted by the Agricultural Research Council [13] in 2006. It was noted that half (51.1%) of the rainfall at Tshivhase-Mukumbani Tea Estate was received in the first quarter (January to March) of the calendar year. This followed one-third (32.8%) of the rainfall received in the preceding quarter (fourth quarter, October to December). The second (April to June) and third (July to September) quarters of the year shared the remaining 16.1% of the rainfall. Improvement of soil moisture for increased tea production at the Tshivhase-Mukumbani Tea Estate may be achieved through introduction (Tshivhase Farm) or improvement (Mukumbani Farm) of irrigation.

2.1.2.2 Temperature

The ideal temperature for tea production is 18–25°C with a minimum recommended temperature of 13°C (average for the coldest month) and a maximum of 30°C (average for the warmest month) [12]. Temperatures at Tshivhase-Mukumbani Tea Estate are lower in winter, and these result in tea plants becoming dormant. Excessively high summer temperature may result in wilting of tea leaves, especially at the Tshivhase Farm without irrigation. Not much can be done to change the temperatures for tea production at the estate.

2.2 Research approach

The mixed methods research approach was chosen for its flexibility to combine the attributes of both quantitative and qualitative methods [14]. The multi-methods procedures have the advantage of enlarging the choice of and expanding the investigator's understanding of any study. Researchers [15, 16] defined a quantitative approach as an inquiry into a social or human problem based on testing a theory made up of variables, measured with numbers, and analyzed using statistical procedures to determine whether the predictive generalizations of the theory hold true. On the contrary, the qualitative approach was referred to as an inquiry process of comprehending a social or human problem or phenomenon based on building a complex holistic picture formed with words. It also helps to capture detailed views of informants, which are collected in a local familiar situation [15, 17].

2.2.1 Sampling and data collection

The study employed purposive sampling to select the individuals who had deeper knowledge about overall management and the introduction of value-adding in the tea estate. In that regard, top managers of the tea estate were selected for the study, and those included: the General Manager, Farm Managers, Manager of Value Adding Facility (tea factory), Financial Manager, and Marketing Manager. The selection of these managers was important for both expert and local knowledge to be sourced as this was necessary to respond appropriately to the challenges experienced by the tea estate [18, 19].

As guided by the study on improved competitiveness of the tea industry in South Africa [20], data was mainly obtained from records kept at the Tshivhase-Mukumbani Tea Estate, through a review of literature and interviews of the selected respondents. The literature review focused mainly on scientific journals and books, while interviews focused on the selected managers of the tea estate. Both quantitative and qualitative data were collected, hence, the research method was described as mixed [16, 21].

2.2.2 Analytical technique

To determine the status regarding the economic viability of the value addition initiative, the Net Present Value (NPV) and Benefit–Cost Ratio (BCR) were used. An initiative or project is considered financially viable when the NPV is positive and the BCR is greater than unity [22]. To determine the NPV for the value-added Mukumbani-Tshivhase Tea Estate, the cash flow was determined by deducting the Cash Outflow from the Cash Inflow to obtain the Net Cash Flow (NCF), and that (NCF) was discounted. Discounting may be described as the opposite of compounding [23]. The standard models for determining NPV and BCR are as follows:

1. The Net Present Value (NPV)

$$NPV = \sum_{t=0}^n (B_t - C_t) / ((1+i)^t)$$

2. The Benefit–Cost Ratio (BCR)

$$BCR = \sum_{t=0}^n (B_t / (1+i)^t) / (C_t / (1+i)^t)$$

Where:

B_t = Benefits in year t .

C_t = Costs in year t .

n = Number of years the initiative or project will be under operation.

i = Discount rate.

3. Results and discussion

3.1 Tea production trends at Tshivhase-Mukumbani since revitalization in 2006

The Tshivhase tea project was projected to be sustainable under a fully integrated strategy where the enterprise was able to package black tea, market, and distribute it for retail and wholesale market outlets. The diagrams in this section seek to depict the impact of yearly and seasonal variation since the rehabilitation of the tea estates in 2006.

3.1.1 Annual trends in tea production parameters

3.1.1.1 Trend in green leaf production (kg) in Tshivhase and Mukumbani estates

Figure 2 shows the trend in green leaf production (Kg) in Tshivhase and Mukumbani estates from 2007 to 2013. Tshivhase estate (TTP) is bigger in size of 577 ha compared to Mukumbani which is 500 ha. The decrease in the production of green leaf in 2011–2012 was due to an industrial strike that started in September 2011 and ended in June 2012. Production of the green leaf then picked up slowly from October 2012 onwards. The size of the estate in a large part explains the large differences of 371,729 kg in 2007–2008 financial year to 827,803 kg in 2010–2011 financial year green leaf production between the two estates. Within the industry domain, there has been a school of thought to the effect that competitiveness is higher in estates compared to smallholdings.

Figure 2. Annual green leaf production in (kg) in Tshivhase (TTP) and Mukumbani (VM) estates from the year 2007 to 2012.

The challenge with small farms is that they do not have the advantage of the processing profits of made tea that accrue to big estates as small farm’s activities end in the harvesting of green leaves. The second school of thought is to the contrary, advocating for small farms on the basis that there tends to be a higher output per workday and higher land competitiveness per unit of area. For tea to be profitable efforts should be to ensure a model that led to processing and or any value-adding especially where smallholder farmers are involved. The model should be coupled with a strong and efficient advisory system with appropriate factory infrastructure for processing the green leaves [24–27].

3.1.1.2 Trends man-days in Tshivhase (TTP) and Mukumbani (VM) estates

Central to the production of green leaf is the demand for labor to do the plucking for processing. **Figure 3** indicates the annual estimated labor per unit in Tshivhase (TTP) and Mukumbani (VM) estates from the year 2007 to 2013. The trend follows the same pattern as that of **Figure 2**, mainly because these are the number of days that a labor force equivalent to 12 people per hector is deployed to pluck the tea, weed, clear the bushes table, and all other labor-related activities. The labor force in Tshivhase is always higher than that of Mukumbani which also relates to the size of the estate as indicated in Section 3.1.1.1. There seems to be a consensus that the workday requirements and the labor per unit of area is the central measure on which to improve the competitiveness of tea enterprises.

It should be indicated that these measures of efficiency will vary from one nation to the other, region and continents. Technologies being introduced to the industry also create a variation worth registering through the introduction of computer programming [27].

3.1.1.3 Trends in green leaf production in (kg) per labor unit in Tshivhase (TTP) and Mukumbani (VM) estates

The trend indicated in **Figure 4** is the amount of green leaf produced per day per worker. Tshivhase Tea Estate had higher production per labor unit as follows: 10.16 in 2007–2008, 3.82 in 2008–2009, 5.55 in 2009–2010 with very little differences

Figure 3. Annual estimated man-days in Tshivhase (TTP) and Mukumbani (VM) estates from the year 2007 to 2012.

Figure 4. Annual average green leaf production in (kg) per labor unit in Tshivhase (TTP) and Mukumbani (VM) estates from the year 2007 to 2012.

in the other years except a marked difference in 2012–2013 of 13.94 higher for Mukumbani compared to Tshivhase. The production of the green leaf at Tshivhase and Mukumbani per day per worker was lower compared to other countries. The recorded figures that were also developed in trends over the years show an amount of 36 kg green leaf per day per worker. The average green leaf produced per day per worker was found to be about 24 kg in India and private estates in Sri Lanka. The values were far less when compared to between 40 to 50 kg per day per worker recorded in Kenya. Higher values were recorded in Zimbabwe to as high as 68 kg per day per worker [2, 28].

Due to shortages of labor, there has been an attempt to introduce novel labor schemes and mechanical harvesters especially in periods with high leaf volumes. The biggest disadvantage has been its effect on the leaf quality that will yield extremely poor made tea despite its effect on the savings on labor [26, 27].

3.1.1.4 Trend in minimum wage for both Tshivhase and Mukumbani

Tea production is a land-intensive and a labor-intensive enterprise. Both these factors of production especially labor is now scarce and costly. Labor at Tshivhase and Mukumbani was governed by the South African Sectorial Determination (minimum wage). The minimum wage increased from R885.00 in 2007–2008 financial years to R2274.84 in 2014 (Figure 5). The percentage increase was zero in 2007 to 51 percent in 2013 2014 financial year. Subsequently, government intervention on labor led to an increase of 61 percent over a period of 7 years. It is worth noting that workforce requirements should be based on competitiveness levels for existing tasks. For Tshivhase and Mukumbani new cost-effective norms must be established. Due to the increase in the minimum wage, there may be a need to reduce the man-days per labor unit from 12 to eight in order to hire less labor for the activities at hand. When that happens and labor competitiveness improves, there will be savings on labor which, in turn, will have a salutary effect on the cost of production [2, 28, 29].

3.2 Value-added tea production at Tshivhase (TTP) and Mukumbani (VM) estates

3.2.1 Trends in made tea production in (kg) in Tshivhase (TTP) and Mukumbani (VM) estates

Figure 6 shows the production trend of made tea which is green leaf processed into black tea. The highest production figures were in the year 2010–2011 with Tshivhase at 884064 kg and Mukumbani at 625767 kg. This was followed by the years 2008–2009 which recorded the figures of 739,788 at Tshivhase and 534,286 at Mukumbani and 2009 and 2010 years with records of 760,729 at Tshivhase and 525,303 at Mukumbani respectively. The lowest production was in 2006–2007 at the start of the rehabilitation and the 2011–2012 due to the industrial strike. The standards set by the tea industry are that the factory requires at least 4.5 kg of green leaf to process 1 kg of tea. The challenge in many parts of the world is that the land in the amount of made tea that can be produced. The processing methods also create a variation in the amount of made tea from green leaves [25].

Comparison between the CTC (cut, tear, and curl) and the orthodox method shows that the CTC gives more cups of tea and quick brewing than the orthodox method. This has led to the shift in processing methods to CTC at the ratio of 85:15

Figure 5. The annual minimum wage with associated percentage increase factored by 10 from the year 2006 to 2013 for both Tshivhase and Mukumbani.

Figure 6.
Annual made tea production in (kg) in Tshivhase (TTP) and Mukumbani (VM) estates from the year 2006 to 2013.

in India, 10: 90 in Sri Lanka, and 100 percent in Bangladesh. The competitive advantage of a shift into CTC is that labor requirement is half that of the orthodox method across all types of tea estates [25–27].

Annual quantities of made tea, production was the lowest at 60753 kg in 2006/2007, and this was probably due to the fact that the tea scrubs had to recover from the shock of having been neglected in previous years. The annual production of made tea continually increased up to 2010/2011 cycle with a maximum of 1509 831 kg recorded, followed by a decline in 2011/2012 cycle and some increase in 2012/2013 (**Figure 6**). In the 2011/2012 cycle, the estates experienced major labor unrest which cause a decline in the production of made tea. The experience of the tea estate management (R.W. Topham - personal communication, June 06, 2016), the tea estate had the potential to produce up to 2 million kg of made tea per annum (about 1 million from the Tshivhase Farm and 1 million from the Mukumbani Farm).

3.2.2 Seasonal production in (kg) of made tea in Tshivhase and Mukumbani tea estates

The ultimate income to any tea estate is the amount of made tea after processing. **Figure 7** shows the production of made black tea as influenced by seasonal variations. The pattern on the monthly variations follows the same trend as that of green leaf production. Due to the lag that occurs between when the first leaf is picked to production and the logistic of processing that takes only at the most 2 days the data recorded shifts by almost a month. Made tea is lowest in production in July August and September. Made tea is also highest in December, January, February, and March. The only year where there was minimal black tea made was 2006–2007.

The lowest quantity (11,991 kg) of made tea was in the months of spring (July to September) of the year (**Figure 7**), probably a result of the fact that rainfall was the lowest (126 mm, 7.2% of annual rainfall) during this season (**Table 1**). This had an impact on the yields and ultimate quantity of made tea produced. An increased amount of rainfall (577 mm, 32.8% of annual) was received in the summer season, and this was followed by an increased production (212,880 kg) of made tea. As the rainfall continued to increase (898.0 mm, 51.1% of annual) in the summer of the following year, so was the production of made tea (462,073 kg). The production of made tea fell in the second quarter as the rainfall declined.

Figure 7.
Monthly production made tea in (kg) from 2006 to 2014 across Tshivhase and Mukumbani tea estates.

3.2.3 Net present value

The NPV is the difference in the present value of cash inflows and the present value of cash outflows and is used in capital budgeting to analyze the profitability of a projected investment (Firer et al., 2012). A project is considered economically viable when the NPV is positive [22, 30]. The NPV for Tshivhase-Mukumbani Tea Estate was consistently negative throughout the study period (**Table 2**). The NPV fluctuated showing a decrease (becoming more negative) from 2005 to 2008 after which it increased (became less negative) to 2010 and again decreased to 2012. For the whole study period, the NPV was highly negative (– R153 530,525–70) and this implied that the value-adding initiative was economically not feasible [22, 31, 32].

3.2.4 Benefit–Cost ratio

The BCR is a ratio attempting to identify the relationship between the cost and benefits of a proposed project, [22]. The BCR for Tshivhase-Mukumbani Tea Estate

Year	Total cost (R)	Revenue (R)	Discount factor (12%)	Net present value
2005	3,416,481.0	46,900.0	0.12	–3,374,606.00
2007	8,275,029.0	100,038.0	0.12	–8,195,279.32
2008	29,764,438.0	382,293.0	0.12	–29,492,329.39
2009	36,856,647.0	18,946,979.0	0.12	–24,815,499.31
2010	22,777,283.0	20,053,808.0	0.12	–11,398,213.78
2011	46,401,574.0	19,145,523.0	0.12	–36,701,856.22
2012	48,561,787.0	19,916,129.0	0.12	–39,552,741.67
Total	196,053,239.0	78,591,670.0		–153,530,525.7

Source: Financial records, Tshivhase-Mukumbani tea estate.

Table 2.
Net present value for Tshivhase-Mukumbani tea estate for the period 2005 to 2012.

was less than unity throughout the study period (**Table 3**). For the period 2005 to 2008, the BCR values recorded were much less ($BCR < 0.05$), suggesting that much less benefits were derived for the value-adding investment during this period. The situation improved for the period 2009 to 2012 ($0.4 < BCR < 1$) although the BCR remained less than unity. The fact that the BCR was less than unity implies that the value-adding activity at Tshivhase-Mukumbani Tea Estate was economically unfeasible. The result of the BCR analysis supports that of the NPV analysis, and this confirms that the value-adding initiative at the tea estate understudy was economically unfeasible. The findings from the economic analyses suggest that the Tshivhase-Mukumbani Tea Estate should consider revising its strategies if it wants the investment in value-adding initiatives to be economically feasible.

3.3 Essential strategies for achieving economic feasibility

Considering the model used to determine the NPV and that for BCR, achievement of economic feasibility (a positive NPV and $BCR > 1$) requires an increase of revenue and/or a decline of total costs. Revenue is a product of *Quantity of produce* and *Unit price* while total costs are comprised of *establishment, fixed, and variable costs*.

3.3.1 Quantity of tea produced

The quantity of tea produced at the Tshivhase-Mukumbani Tea Estate was highly influenced by such issues as moisture availability and production management.

3.3.1.1 Increase supply of soil moisture

The quantity of processed tea produced at Tshivhase-Mukumbani Tea Estate was highly influenced by rainfall and its influence on moisture availability. The rainfall in the area was less than the 2500 mm-3000 mm required for optimum production [12], and this resulted in a reduced quantity of tea produced. Increasing the supply of soil moisture through irrigation would therefore result in a rising yield of tea leaves and subsequently increased quantity of value-added tea. Such an irrigation initiative could be introduced at the Tshivhase Farm while more water could be availed for the current supplementary irrigation at Mukumbani Farm. The initiative of increasing soil moisture supply through irrigation would need to be considered for the warm months of the year when temperatures are suitable for tea growth. In

Year	Total cost	Revenue	Discount factor (12%)	BCR
2005	3,416,481.0	46,900.0	0.12	0.013727575
2007	8,275,029.0	100,038.0	0.12	0.012089142
2008	29,764,438.0	382,293.0	0.12	0.012843952
2009	36,856,647.0	18,946,979.0	0.12	0.514072238
2010	22,777,283.0	20,053,808.0	0.12	0.880430208
2011	46,401,574.0	19,145,523.0	0.12	0.412605034
2012	48,561,787.0	19,916,129.0	0.12	0.410119360
Total	196,053,239.0	78,591,670.0	0.12	0.400869021

Source: Financial records, Tshivhase-Mukumbani tea estate.

Table 3.
Benefit–cost ratio for Tshivhase-Mukumbani tea estate for the period 2005 to 2012.

some places in the district tea can only be produced under irrigation since Vhembe District is known for high climatic variability and change [33].

3.3.1.2 Improve production management

Production of made tea was far less than the potential of the estate, and this was perceived to be partly a result of poor management (R.W. Topham, personal communication, June 06, 2016). Mukumbani-Tshivhase Tea Estate occasionally had some labor unrests resulting in extended work stoppages during the 2011/2012 cycle. Human Resources Management especially labor contracting as part of recruitment is, therefore, necessary to avoid labor disputes and unrest. This in turn will save on time lost during the unrest and increase the quantity of tea produced, both infield and at the factory for the production of made tea.

3.3.2 Increase unit price of sold tea

The unit price of tea produced at the estate was influenced by value-adding and by market demand.

3.3.2.1 Increase sales of value-added tea

The essence of the value-adding initiative at Tshivhase-Mukumbani Tea Estate was to sell the made tea at competitive prices. Although the value-adding initiative was performed well, a lot of the tea was still sold in bulk (only partially value added) at low prices. The tea should be sold as a complete value-added product in order to fetch higher prices, and this is influenced by the market demand for the tea.

3.3.2.2 Increase market demand for value-added tea

The unit price of tea sold by the estate was highly influenced by the market demand for the tea. The value-added tea had not performed well in the market compared to its competitors. As a result, the value-added tea from the estate occupied only a small shelf space in the market, hence a lot of the tea was sold in bulk at low prices. Thorough market research would therefore be necessary, and this should result in improved marketing strategies that increase the market demand for the tea brand (Midi Tea) produced at Tshivhase-Mukumbani Tea Estate.

3.3.3 Reducing costs

Total costs may be calculated as the sum of establishment costs, fixed costs, and variable costs. Establishment costs at Tshivhase-Mukumbani Tea Estate were mostly for the establishment of infrastructure, mainly fencing, irrigation, storage, housing, and value-adding infrastructure. For the period under investigation, the major establishment costs incurred were on constructing and equipping the tea value-adding facility. The cost for the establishment of the value-adding facility was R196 053239-00 (**Table 2**), which was high.

The higher cost may have been due to the practice of inflating costs of construction by contractors without appropriate monitoring by government project managers. As these costs were historic in nature there was no intervention to reduce them. Fixed and variable costs incurred in production and value-adding operations should, where possible, be reduced for the value-adding initiative to be economically feasible. Such costs would include those incurred on labor, maintenance of infrastructure and machinery, electricity, water, and other consumables. Effective

cost reduction would require proper management for efficient use of resources. Good labor contracting coupled with supply chain and procurement management practices can optimize the production of made tea.

4. Conclusions

The quantity of rainfed value-added tea produced varied based on year and season of production. Production of both unprocessed and made tea is perceived to be below the potential of the tea estate. The NPV was consistently negative while the BCR was below unity throughout the study period, implying that the value-adding initiative was economically not sustainable. However, the study only covered a period of not more than 7 years. A further study is recommended with outer years covering at least 20 years. The following major initiatives are recommended for achieving economic sustainability of the value addition were: (1) Improve the marketing of the made tea brand Midi Tea as organic and fresh.

The whole production value chain from picking to packaging done in the same estate; (2) Good labor contracting management practices to deal with labor disputes and unrest; (3) Good supply chain and procurement management practices to reduce the cost of production; 4) To increase the quantity of value-added tea produced, it would be necessary to monitor the impact of climate variability and mitigate by providing irrigation especially in the spring and summer months and (5) Tea production at the estates is seasonal, for long term economic sustainability there is a need for inter-cropping tea with a suitable winter yielding crops such as Avocadoes or Macadamia.

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Conflict of interest

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