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Wealth Creation and Distribution along the Emerging Chisumbanje Sugarcane Bio-ethanol Value Chain in Zimbabwe

Cuthbert Kambanje[1*], Abenet Belete[2] and Petronella Chaminuka[3]

[1, 2]University of Limpopo, Faculty of Science and Agriculture, School of Agriculture and Environmental Sciences, Department of Agricultural Economics and Animal Production
[3]Economic Analysis: Agricultural Research Council, South Africa
[*]Cell: 00277 84 857 5640, [*]E-mail: Ckambanje@Gmail.Com

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ABSTRACT Within the context of large scale investments on agricultural land for biofuels, this paper analyses the creation and distribution of value added and gross margins along the emerging Chisumbanje sugarcane bio-ethanol value chain in Zimbabwe. Using empirical data collected using different approaches, the study customised input-output modelling and multiple gross margin analysis to analyse wealth creation and distribution along this chain. The evidence shows that income distribution is skewed towards vertically integrated large corporates and this value chain in general is not inclusive of smallholder farmers. The private investor is getting more than seventy-three percent of the income that is generated along the whole chain while the rest is shared among the settler farmers, war veterans and the government agency. The pricing of US$4 per tonne makes primary production of sugarcane a loss-making enterprise, systematically this disincentivising any potential entrants into primary sugarcane production. The emerging sugarcane bio-ethanol value chain is not inclusive.

INTRODUCTION

Large scale investments on agricultural land for biofuels production have become a common phenomenon in Africa. Private multinational companies from Western countries, Asian countries and sometimes from African countries are acquiring large tracts of land for purposes of investment for biofuels production (Cotula et al. 2008). In the growing body of knowledge on the large scale land investments scholars for instance, CGIAR (2017), Hall (2011), Cotula et al. (2011) and Mutopo (2011) have highlighted issues related to loss of livelihoods as well as impacts on the environment. Some have quantified the amount of land that has been acquired and the reasons driving these investments (Anseew 2013; Hall 2011; Boche and Anseew 2013). This growing body of knowledge still lacks the analysis related to wealth creation and distribution. Within the wider context of the of large-scale land investments, the paper generates evidence on how wealth is being created and distributed along the emerging biofuel chains. In Zimbabwe, the government through the Agriculture and Rural Development Authority went into a partnership with the Zimbabwe Bio-Energy Ltd operating as Green Fuels in February 2009 to set up the Chisumbanje ethanol[1] project. The project involves primary production of sugarcane and processing it into anhydrous bio-ethanol. The Chisumbanje project which at the time of its conception was based on a build, operate and transfer model established in a 20-year agreement. Primary production of sugarcane was projected to be established on over 40,000 hectares of land[2].

The creation and distribution of profits or gross margins along any value chain provides important indications of efficiency of a value chain. At each stage of any commodity business chain value is created. More often if the specific business units along the chain are not vertically integrated, it is possible to determine the gross margins at each stage of the chain. Vertical integration in some cases makes it difficult to clearly separate the stages along a value into clear business units in which computable value added and subsequent profits are identifiable. Because there are a number of actors involved at each stage of the chain creating value, one can relate the value added to the gross mar-

Address for correspondence:
606, Unidia, 745 Arcadia Street,
Pretoria, 001, South Africa
Cell: 00277 84 857 5640
E-mail: ckambanje@gmail.com

gins/income that accrue to specific economic actors along the chain. The focus of the analysis presented in this paper was to investigate the creation and distribution of both value added and gross margins along the sugarcane bio-ethanol value chain in Zimbabwe. The paper begins by a brief theoretical review of the concepts of value added and gross margins and their distribution along value chains. This is followed by a presentation of the Input output (I-O) analytical model and approach which is applied to pursue the objective. The rest of the paper presents the findings on the creation and distribution of value added and gross margins along the sugarcane bio-ethanol value chain.

Objectives of the Paper

This paper analyses Gross Value Added (GVA), and profit/ gross margins at each stage of the sugarcane bio-ethanol value chain and further demonstrates the distribution of value addition activities and profits among the economic agents along the sugarcane bio-ethanol value chain. Value added can be seen as a measure of the wealth created by an economic activity. The purpose of the analysis is to show how wealth creation is occurring and how the wealth created is being distributed among the various actors. The paper investigates the benefits (costs) and in general the welfare gains that accrue to different actors along the sugarcane bio-ethanol value chain.

Theoretical Context

Value Added and Its Distribution along the Value Chain

Value added (VA) can be regarded as the enhancement a firm/farm/company gives its product or service before offering the product to customers. It can, therefore, describe instances where a firm takes a product that may be considered a homogeneous product, with few differences (if any) from that of a competitor, and provides potential customers with a feature or add-on that gives it a greater sense of value (Coltrain et al. 2000).

Some scholars (for instance, Amanor-Boadu 2003) argue that economists have long measured added value using the metric value added. It is highlighted that VA is regarded as the difference between value of shipments and the cost of all purchased inputs used in the production. The author notes that Value Added can be estimated at the firm level and aggregated across firms in an industry to get industry value added. When summed across all industries, we get the value added of the whole economy, or gross domestic product. The same author quoting earlier scholars (Wood 1978) also highlights that value added is, thus, a measure of the wealth generated by the efforts and ingenuity of mankind and avoids problems of double counting when aggregated across firms and industries. Any step in the production process that improves the product for the customer and results in a higher net worth. Other authors (Bellù 2013) support the notion that Value Added is a measure of the wealth created by an economic activity. Basing on this analysis of literature, the study computes value added at each stage of the sugarcane bio-ethanol value chain and attempts to explain its distribution among economic actors.

Profits and Their Distribution along the Value Chain

Gross margin analysis is a concept that has been used as measure of profitability that is a useful tool for cash flow planning and determining the relative profitability of farm enterprises. The essence of gross margin analysis is to compare the relative profitability of current enterprises; estimate changes in enterprise profit caused by changes in price, cost or yields; pinpoint high cost or low income areas in the existing plan; and, evaluate the profitability of a reorganisation of the enterprise mix (Wong et al. 2011). Along the value chain, profits can be calculated at each stage to determine who is making what profit along a value chain (Bellù 2013). In this regard, this is adapted in this study as a key analytical entry point, to determine profitability of activities along the sugarcane bio-ethanol value chain.

METHODOLOGY

Empirical Model Used to Investigate Wealth Creation and Distribution along Sugarcane Bio-ethanol Value Chain

As discussed in the preceding section, the analysis was aimed at determining the creation and distribution of value added and profits as

well as the net gains to the society when all activities in the sugar value chain are considered. To determine wealth creation and its distribution along the sugarcane bio-ethanol value chain, the analysis calculates gross profits and value added at each stage of the chain. The empirical data used in the analysis was collected along the ethanol value chain starting from the primary sugarcane production process in Chisumbanje to the consumption of ethanol. Data collection involved multiple approaches including household level questionnaires, focus group discussions, key informant interviews and observation. A total of 200 questionnaires were administered at household level in Chisumbanje, while 10 focus group discussions were held with various groups including war veterans, women's groups, youths and other community members. Key informant interviews were held with a number of actors along the chain including the company's management, political leaders, traditional leaders, local and national level government officials and regulatory officials.

Input-Output Model for analysing Value Added and Profits along a Value Chain

The approach for computing value added and profits along the sugarcane bio-ethanol value chain used in this paper is based on input-output modelling and concepts. The basis of the concept of I-O approach is that production of an output requires inputs (Rey 2000). Based on this I-O approach, the model puts together the analysis done in this paper and can be expressed as follows:

Let:

- Outside intermediate inputs used by *i* (IIOC) be denoted x_i
- Total output value in the Account for agent I be denoted y_i
- Total intermediate inputs (from outside and inside chain) used be agent i be z_i
- And value added created by agent I be denoted $ë_i$ (that is, $VA_i = ë_i$)

Also note:
When i=1 then agent is producer
When i=2 then agent is processor
When i=3 then agent is trader
Assuming the above then the following hold:
VAprod= $ë_i = x_1 - z_1$
VAproc= $ë_{ii} = z_1 + x_2 - z_2$
VAtrad= $ë_{iii} = z_2 + x_3 - z_3$

From the above total value added can be defined as follows:

$$TVA = VAprod + VAproc + VAtrad$$
$$= \Sigma_{i=1}^{3} X_i - z_3$$

RESULTS AND DISCUSSION

Creation and Distribution of VA and GMS at Primary Production Stage

Inputs in Production

The primary production of sugarcane in Chisumbanje is a world class operation implying that the costs could potentially be compared to any similar operation in other countries with certain adjustments to match the local operating environment. There are special differences, which especially have to do with the overall macro-economic environment impacting on unit costs of inputs. Based on these issues, most of the production costs used in the model was extrapolated from similar sugarcane production operations in countries such as Brazil, Hawaii, and South Africa adjusted for the higher cost of doing business guided by the World Bank (World Bank 2014). The primary producers along the sugarcane bio-ethanol value chain were not forthcoming with the specific production costs. Interviews with households and war veterans who own some land in which production of sugarcane is being done showed that they are not aware of the actual costs.

Sunk Costs Assumption on Land and Capital

With respect to land as a primary input, part of the land being used in the production of sugarcane for processing into bio-ethanol is contested. The same applies to the initial investments made in preparing land for production, setting up irrigation systems and so on. Some of the land belongs to the Agricultural and Rural Development Authority (ARDA) while the communities have alleged encroachment into communal land by the investors; while there is limited clarity on the actual capital investment that could be classified as part of primary production. The assumption that is made therefore is to assume both land and initial capital investments as sunk costs and only the costs of maintenance are included. This assumption affects government, communities and the investor in terms of initial investment.

Caveats for Comparing Chisumbanje to Brazilian Ethanol Production Systems

Although Brazil's ethanol production sector provides important benchmarks for analysis of the Chisumbanje bio-ethanol value chain, several caveats have to be understood in order for one to not make myopic translation of what is happening in Brazil as a perfect match to Zimbabwe. The factors contributing to Brazil's competitiveness include favourable climate conditions, low labor costs, and mature infrastructure built over atleast three decades (Xavier 2007). Some aspects are similar, for instance the favourable climate, low labour costs and high productivity, in fact productivity in Zimbabwe at 135t/ha is actually higher than that of Brazil estimated at 90t/ha. Between 1975 and 2000, modernization of the sugarcane yield per hectare increased by thirty-three percent and ethanol yield from sugar rose by fourteen percent (Valdes 2011). Currently in Brazil the economic cost of production of a litre of ethanol equivalent is between US$0.18 and US$0.25 (Valdes 2011). The same author also notes that one potential area of huge differences are investment costs which are estimated at around US$ 0.017 per liter of ethanol.

Outputs in Primary Production

The production process has two closely related companies doing the actual production, having put together 10000 hectares under sugarcane crop in 2014. There are however, some war veterans and settler farmers who have been allocated plots in the plantations but the companies do the farming for them. The estimated yield of raw sugarcane per hectare is 135 tonnes. The price per tonne of raw sugarcane offered to the war veterans and settler farmers is USD$4/tonne. The inputs and outputs and related prices at the primary production stage are as presented in Table 1.

Gross Margins and Value Added at Primary Production

At a yield of 135t/ha and a price of US$4 per tonne of raw sugarcane, the primary production process is a loss-making venture. Table 2 shows

Table 1: Estimated inputs and outputs at the primary production (2013 values)

Parameter	*Value/Ha (US$)*	*Source/Comments*
Price per tonne	4	This is the price paid per tonne of raw sugarcane by Greenfuels
Yield per hectare (tonnes)	135	This are the estimated yields at Macdom and Rating, No production is being done by smallholders
Estimated total costs per hectare	4541.81	Includes fixed costs and variable costs
TVC	3841.81	Costs incurred only when operations are going on
TFC	700	Costs incurred even if operations are not underway
Seed	0	The cost of cuttings required for planting a hectare of sugarcane is assumed to be a sunk cost
Fertiliser	370	For Chisumbanje: 10 bags of 3 different types of fertilisers valued at us$37
Operations	221	Includes all other consumables that are involved in running the business; for instance stationary, advertising , printing and so on
Fuel and lubrication	400	Includes all costs consumables that are incurred in day to day operation of machinery(fuels, lubricants,
Repairs	600	Costs of repairing the huge fleet
Hired labour	1900	As an input into production, labour is calculated as the total labour requirements for large-scale sugarcane production per hectare.
Purchases/Irrigation water	22.3	22.3us$/1000$m^3$
Miscellaneous	328.51	Haulage, adjustments for higher costs of doing business in Zimbabwe
Total estimated variable costs	3841.81	
General farm overhead	700	Interests, capital replacement etc
Total fixed cash expenses	700	

Source: Interviews with Greenfuels officials

the value added and gross margins at the primary production phase. The estimated loss per hectare is US$4001 when the estimated inputs costs of US$4541/ha are considered. Computations done using the conversions of yield/ha and tonnes/litre of ethanol showed that the value that is placed on sugarcane feedstock at the factory gate is US$1447/ha, and this also does not compare with the costs of production per hectare.

Table 2: Value added and gross margins at primary production

Parameter	*Computed (Based on 2013 values)*
Inputs costs (USD)/Unit	US$454 1/ha
Total output/unit	135 t/ha
Price per/tonne	US$4
Total gross margins/unit	(4001)/ha
Gross value of feedstock cost per hectare	US$ 1447
Total value of feedstock/annum	14.47 million

Source: Computations from primary data

The continued engagement in this loss-making venture by Macdom and Rating as the main primary producers can be attributed to the fact that they are not independent firms, but are vertically integrated with the processing of sugarcane into ethanol. This is consistent with the arguments put forward by some scholars (Msangi et al. 2009) that securing a stable and consistent biomass supply is crucial for favourable feedstock costs and profit margins. The argument was that long-term contracts with farmers or cooperatives will guarantee demand for the farmers and lower feedstock costs for the biofuel processors.

One entry point for analysis is whether it is feasible for any player (other than Macdom and Rating) to produce sugarcane and supply the processing plant. This discussion also ties up with the issue of outgrowers. The pricing of raw sugarcane (by the company) at unfavourably very low prices could arguably be seen as a mechanism by the vertically integrated economic agents to prevent new entrants into primary production. The unfavourable pricing would appear as a systematic approach to aggregate profits at a higher level of the chain that is not accessible to the ordinary farmer. A key question is whether the price being placed on the raw sugarcane is a true reflection of the opportunity cost. From the analysis it can be concluded that the pricing is distorted and does not reflect the true value of the raw sugarcane.

Distribution of Income at the Primary Production Stage

Out of the estimated 10000 ha that is put under sugarcane for processing into ethanol, 660 hectares belong to the war veterans (250ha) and the settler farmers (410ha). Settler farmers and war veterans are part of the secondary value chain agents, because even though they own the land, they do not work on it and are paid a figure of US$4/tonne. For payment purposes the company uses a lower-band worst-case scenario yield of 100 tonnes/hectare. The analysis also showed that no other smallholder farmers produce sugarcane to supply the ethanol processing plant. Assuming that the losses experienced at primary production are eventually recouped through the profits made along the chain, and considering the aspect of vertical integration raised earlier, it makes sense to determine how the income generated at the primary production stage is distributed. Going by the per hectare allocation of income, the two subsidiaries of Greenfuels get the bulk (93%), while settler farmers and war veterans get four percent and three percent of the income generated at primary production respectively. The dominance of the private corporate is therefore demonstrated in the distribution of income.

Creation and Distribution of VA and GMS Processing Stage

Inputs in Processing

The main inputs in the processing of sugarcane into bio-ethanol at the Chisumbanje Plant include the feedstock (cane), which is estimated at 1.35million tonnes per annum. The price paid per tonne of sugarcane was established as USD4. However, in Brazil, the price paid per tonne of sugarcane is US$11.4 and a feedstock cost of US$0.143 per litre of ethanol are incurred (Valdes 2011). These differences raise important implications on the inclusiveness of the value chain as this pricing could be a disincentive to new entrants as analysis done in this paper will show. The labour costs are estimated at $0.096 per litre and depreciation costs estimated at US$0.0896

per litre. The costs of inputs at the processing stage are presented in Table 3.

Table 3: Estimated costs of ethanol production at processing stage (2013 values)

Item	*Values*
Operating costs	0.3837
Feedstock (Raw Sugarcane)	0.1496
Labour	0.096
Maintenance costs	0.0354
Chemicals	0.0185
Energy	0.009
Interest (working capital)	0.0078
Rent	0.0066
Other	0.0608
Fixed costs	0.0961
Depreciation	0.0896
Other	0.0065
Total costs	0.4798

Source: Computations based on primary data generated from interviews with respondents (economic agents) along the sugarcane bio-ethanol value chain

Outputs at Processing

The main output in the processing stage is anhydrous bio-ethanol. Interviews with technical officers showed that the output of the processing plant at Chisumbanje is estimated at around 105 million litres annually, which convert to 350 kilo litres per day or 14,580 litres per hour in a 24-hour day. The processing plant can process 1.5 million tonnes of cane in a 300-day season. The conversion rate of sugarcane to ethanol is estimated at 1(t) of sugarcane to 75 litres of ethanol. Other products include electricity and a number of chemicals that could be used in some downstream industries such as fertiliser manufacture, the cosmetics industry, explosives and beverage makers. These downstream industries are also likely to benefit from the venture. In particular with respect to electricity the company forecasted that 18 Mega Watts of power would be generated as a byproduct and supplied into the national grid as a byproduct of ethanol production. At peak, 50 Mega Watts of electricity will be generated.

Gross Margins and Value Added at Processing Stage

The costs for processing raw sugarcane into ethanol are estimated at US$0.47/litre. This cost is at times contested as it is treated as classified and confidential information by the company. The study had to rely on extrapolation from similar processing technologies in Brazil and adjusted for the higher cost of doing business in Zimbabwe. Table 4 shows value added and gross margins at processing stage.

Table 4: Value added and gross margins at processing stage

Variable	*Computed value*
Inputs costs	US$0.4798/litre
Total output (based on maximum capacity of plant)	105 million litters/ annum
Price /Litre	US$0.95
Gross margins/litre	US$0.49371
Processing gross margin per tonne of raw sugarcane (total gross margin at processing)	US$37
Gross value of ethanol	US$99.75 million

Source: Computations based on primary data generated from interviews with respondents (economic agents) along the sugarcane bio-ethanol value chain (2013)

Earlier sections showed that it costs between US$0.18 and US$0.25 to produce a litre of ethanol in Brazil. Assuming production at full capacity, the plant produces up to 105 million litres of ethanol per annum. This is sold at US$0.95/litre delivered at the blending site. This converts to a gross margin of US$0.49/litre of ethanol and total gross margin of US$51.84 million. The processing gross margin per tonne of raw sugarcane is US$37, while the gross value of the ethanol becomes US$99.75 million. Therefore, at the processing stage, total gross value created is US$85.28 million

Distribution of Income at Processing Stage

The shareholding of Greenfuels is a subject of public contestation and debate. The debates are overshadowed by significant information asymmetries. The provisions of Statutory Instrument 17 of 2013 are that ethanol purchased for the purposes of mandatory blending shall be obtained from a licensed ethanol producer who is in a joint venture partnership with the Government of Zimbabwe. The joint venture should, however, satisfy the country's indigenisation laws, which stipulate that locals should own fifty-one percent of any business, which is over

US$500 000. As of mid-2015, the company has been in operation and has not satisfied the lawful shareholding structure.

The current structure is that ARDA owns ten percent whilst ninety percent is owned by Greenfuels. Given this shareholding structure, the income generated at the processing stage is being distributed between Greenfuels (90%) and ARDA representing government (10%).

Creation and Distribution of VA and GMS at Transport and Distribution Stage

Inputs at Transport and Distribution Stage

The transport and distribution stage along the bio-ethanol value chain is vertically integrated with the processing stage. When ethanol is produced, Greenfuels is directed to supply specific amounts of ethanol to specific blending depots by the Zimbabwe Energy Regulatory Authority (ZERA). The implication of this vertical integration is that until the ethanol reaches these specific sites, no other player can participate in the transport and distribution process. In this regard, the transport and distribution to different blending depots only involves Green fuels as the only economic agent. The company has built into the wholesale price of ethanol the cost of transporting it to the blending sites. The cost of transporting a litre of petroleum according to South African road transport standards oscillates around 2.7 percent of the total price of one litre of petroleum (IFleet 2014). This transport cost has been extrapolated to get a crude cost per litre of transporting ethanol from the plant in Chisumbanje to various blending sites.

Outputs Transport and Distribution Stage

The output at the wholesaling stage is liquid ethanol fuel that has been transported to different blending locations across the country. It is assumed that that the difference between the price of ethanol offered to the blenders and the one they would get if they had purchased and collected at Chisumbanje factory is the transport cost charged (estimated at 2.7% of the total costs of a litre). The value created is in the change space/location of the ethanol.

Gross Margins and Value Added

The transport and distribution of ethanol from the processing plant is carried out by Greenfuels. This stage of the chain is vertically integrated with the processing stage. Approximately 105 million litres are transported to the blending sites at a cost of US0.0256/litre based on transport being 2.7 percent of the value of ethanol per litre. Table 5 shows the computed value added and gross margins at transport and distribution stage.

Table 5: Value added and gross margins at transport and distribution stage

Variable	*Computed value*
Input costs	US$0.95/litre
Outputs	105 million litters/annum
Price per litre	US$1.0165/litre
Gross margins (ethanol only)	US$0.0665
Total gross margins (net income)	US$6.9825 million
Gross value of ethanol at blending stage	US$106.732 5million

Source: Computations based on primary data generated from interviews with respondents (economic agents) along the sugarcane bio-ethanol value chain (2013)

The gross income from the transport and distribution stage is US$2.688 million. The total value of ethanol remains at US$99.75 million as the transport costs are inbuilt in the US$0.95/litre wholesale price of ethanol.

Distribution of Income at Transport and Distribution Stage

As the transport and distribution stage is not separated from the processing stage, all the income that could have been generated had it been treated as a separated value chain enterprise stage or business accrues to Greenfuels. It is not wrong to point out that hundred percent of the income at this stage (amounting to US$2.688 million) is inbuilt in the price of ethanol. The vertical integration with the transport system ensures control over the transport and distribution system, but also increases earnings of the company as it takes hundred percent control of an activity that could have been carried out by other service providers.

Creation and Distribution of VA and GMs at Ethanol Blending Stage

Inputs at Blending Stage

At blending stage liquid ethanol is mixed with unleaded petrol in line with government blend-

ing level requirements. The inputs include storage and other infrastructure, labour, pure petrol and anhydrous ethanol supplied by Greenfuels. Greenfuels sells anhydrous ethanol at an average of 95c/litre to the blenders, with the price being slightly higher depending on the distance from the Chisumbanje plant and vice versa. Assuming a total of both maximum production and total absorption of ethanol output by blenders, approximately 105 million litres are being produced and sold to the 10 licensed blenders, including Greenfuels itself.

Outputs at Blending Stage

The output at the blending stage is the blended fuel, in line with the government mandated blending regime. The ushering in of the multi-currency regime, petroleum consumption has been on the increase, peaking in 2012 at 20,970 barrels per day (2 500 473 million litres), before declining to 19,010 barrels (2 266 761 litres) in 2013 according to Zimbabwe national Chamber of Commerce reports. The prices at wholesaling and retailing of fuel are closely monitored by government. This is because of the multiplier effects that fuel has throughout the economy. Fuel prices in general are however based on "a cost-plus model", which entails the free on board cost plus charges for transportation, levies and taxes, administration and distribution.

Under Statutory Instrument 80 of 2014, crafted by the energy ministry in consultation with the Zimbabwe Energy Regulatory Authority (ZERA), the selling price of any petroleum product shall not exceed seven percent of the oil company's purchase price. In this regard, it is assumed that the blenders or wholesalers put a margin of seven percent on the blended petrol; and therefore, indirectly, the ethanol.

The amount of ethanol that gets blended with petrol directly replaces the pure petrol. The implication is that of this total consumption it can be assumed that fifteen percent of it is bio-ethanol from Chisumbanje. The 2013 consumption level implies that a total of 340 014 litres of ethanol are supposed to be supplied to sustain the blending level. The demand for ethanol being created through the mandatory blending regime is putting pressure on the company to produce to full capacity if it still utilises one plant (with a total production capacity of 350 000 litres per day).

Gross Margins and Value Added at Blending Stage

Blending companies purchase ethanol at US$0.95/litre from Greenfuels for blending and wholesaling at a mark-up which is not more than seven percent under government regulations. Assuming that a total of 105 million litres are traded and that fuel-blenders put the highest mark up for ethanol (which is now blended with petrol); the price of ethanol will be US$1.0165/litre. Table 6 shows value added and gross margins at ethanol-blending stage.

Table 6: Value added and gross margins at ethanol-blending stage

Variable	*Value*
Input costs	US$0.95/litre
Outputs	105 million litters /annum
Price per litre	US$1.0165/litre
Gross margins (ethanol only)	US$0.0665
Total gross margins (net income)	US$6.9825 million
Gross value of ethanol at blending stage	US$106.7325 million

Source: Computations based on primary data generated from interviews with respondents (economic agents) along the sugarcane bio-ethanol value chain (2013)

The gross margin for ethanol only would be US$0.0665/litre while the total gross margin is US$6.982 million. The new gross value of ethanol traded at this stage is US$106.7325.

Distribution of Income at Blending Stage

Although the market shares and quantities that are blended at each of the sites could not be established, the income/profits generated at the blending and wholesaling stage, which amounts to US$6.982 million, is shared among 10 licensed blending sites. The licence is site specific and there are four companies, which include Zuva Petroleum, Engen Petroleum Zimbabwe, Greenfuels and Sakunda Energy. The bulk of the blending takes place in Harare (5 sites), followed by Bulawayo (2 sites), Mutare (2 sites) and Triangle (1 site).

Creation and Distribution of VA and GMs at Retailing Stage

Inputs at Retailing Stage

Assuming the 2013 petroleum consumption levels as presented in the preceding section (outputs at the blending stage), petroleum retailers consume approximately 2, 266, 761 million litres of blended petroleum per day. Different blending levels (such as 5%, 10%, and 15%) would imply different amounts of ethanol actually used to blend pure petrol. Other inputs at this stage would include the other costs of running the petrol retailing business inclusive of government taxes, labour and so on.

Outputs at Retailing Stage

Analysis of prices based on a five percent blending level show spatial differences in the pricing of petrol at retail service stations. In Harare retailers were buying at $1.46 and selling at $1.51 and getting a margin of 5c while in Bulawayo at the same time retailers were buying at $1.51 and selling at $1.56 maintaining the same margin of 5c per litre of petrol. The analysis also shows that any changes in the wholesale price of petrol would simply be passed on to the final consumer. It was shown that a 2c increase in wholesale price resulted in a 2c increase in the retail price. However, in the long run the retailers would need to widen the gap in order to maintain the same percent margin.

Gross Margins and Value Added at Retailing Stage

Over 400 petrol retail companies' purchase blended petrol from the 10 blending sites at different prices. Dealer margins are different but do not exceed the government regulated seven percent. Assuming that 105 million litres of ethanol are blended in petrol and traded, the purchase price would be US$0, 99/litre of ethanol while the selling price would be US$1.0877/per litre. Table 7 shows value added and gross margins at the retailing stage of ethanol.

The gross margins per litre are US$0.0711/litre and the total gross margin or income for the value chain stage is US$7.4713 million for the only volume of ethanol in the blended petrol. The gross value for this ethanol is US$114.204 million.

Table 7: Value added and gross margins at retailing stage

Variable	*Value*
Input costs	US$0.9975/litre
Outputs	105 million litters/annum
Price per litre	US$1.0877/litre
Gross Margins /litre (ethanol only)	US$0.071155/litre
Total Gross margins (net income)	US$7.4713 millon
Gross value of ethanol at blending stage	US$114.204 million

Source: Computations based on primary data generated from interviews with respondents (economic agents) along the sugarcane bio-ethanol value chain (2013)

Distribution of Income at Retailing Stage

There are more than 400 registered fuel retail outlets that buy and sell blended fuel. This is a fairly competitive stage of the chain, although some corporates such as Redan, Engen and Zuva have many retail outlets. The outlets sell directly to consumers of petrol and many factors come into play with respect to final distribution of profits, which have to do with marketing strategies such as promotions, service, and pricing.

Discussion of Results

The purpose of the paper was to investigate the creation and distribution of value added and profits along the sugarcane bio-ethanol value chain. The analysis sought to examine how value added and profits are being created and distributed among different economic agents along the sugarcane bio-ethanol value chain. Table 8 summarises the total gross margins, value added and their distribution along the chain from primary production of sugarcane to retailing of ethanol.

The hypothesis tested to guide the analysis was that the distribution of profits along the value chain is not negatively skewed to smallholder farmers located at the lower end of the value chain. This hypothesis was rejected on the basis that most of the profits along the sugarcane bio-ethanol value chain are accruing to Greenfuels. Greenfuels and its subsidiaries Macdom and Rating is getting more than seventy-three percent of the income that is generated along the whole chain. This percentage (73%) actually excludes the income that accrues to

Table 8: Total gross margins and value added along the value chain

Stage	*Total Gross margin/Income (US$ Million)*	*Gross value (US$ Million)*	*GM as % of Total gross margin generated*	*GM as a % as a percentage of total gross value created*	*Summary of distribution among economic agents*
Primary production		14.47	0	0	93%-Macdom and rating 4%-settle farmers 3%-war veterans
Processing	51.83	99.75	75.1	45.38	90% -Greenfuels 10%- ARDA
Transportation and distribution	2.688	99.75	3.89	2.35	90% -Greenfuels 10%- ARDA
Blending and wholesaling	6.9825	106.73	10.12	6.11	4 registered blending companies
Retailing	7.47	114.20	10.83	6.54	Over 400 registered
Total	68.97	114.20	100	60.39	

Source: Computations based on primary data generated from interviews with respondents (economic agents) along the sugarcane bio-ethanol value chain

Greenfuels at the blending stage since they are one of the four companies. This implies that the figure would be actually higher if incomes generated at blending are added.

The distribution also shows that there are no incomes that are accruing to ordinary smallholder farmers since they are not primary agents along the chain. The war veterans and settler farmers are getting just two percent of the income while government through ARDA is getting eight percent.

Although there are no readily available specific bio-ethanol value chain analyses to which the results of the study can be compared, the finding that income distribution is skewed towards the investors is in line with earlier arguments put forward by various authors for example, Cotula et al. (2011), Matondi et al. (2013), Mutopo (2011) or Hall (2011) among others. Using qualitative approaches of analysis, many of these authors have highlighted that private investments in biofuels have tended to benefit private investors at the expense of local communities.

CONCLUSION

In conclusion, the analysis carried out brings to fore some indications of how inclusive the sugarcane bio-ethanol value chain is. Questions can also be asked on the basis of the findings on whether modern biofuel chains, which are designed along world class standards and well timed systematic line operations, can actually have outgrowers. The issue of outgrowers is important because these are often used to justify large-scale land investments, some of them involving displacements of smallholders and contestations over ownership of land. In this regard, this analysis shows that it may be impossible to get smallholder farmers to be real growers of ethanol processing plants. The processors would prefer to be vertically integrated with the farming operations to ensure consistent supply of quality and sufficient quantities of feedstock. The findings on the pricing of raw sugarcane at US$4 per tonne, suggests that it is distorted and can be interpreted as a systematic disincentive for smallholders to venture into sugarcane production. The analysis showed that the farming operations at the primary production phase at this price are a loss making enterprise, but the investor then recoups their profits after processing and at a level that is not accessible by smallholder farmers. The result is an income distribution which is skewed towards the corporate, with virtually close to nothing going to the smallholders.

RECOMMENDATIONS

It has been shown that the pricing of raw sugarcane at US$4 against a market value of approximately US$70 could be systemically disincentivising any ‘would-be smallholder sugarcane producers’ to participate meaningfully in this value chain. Since government is already controlling many aspects of the value chain, it

could as well control the price of raw sugarcane paid to any smallholder growers. In addition, mechanisms to compel the company to buy from smallholder farmers at market-related prices should be explored. This would also reduce the concentration of power in one economic agent in dictating the yield levels, the prices and, in general, the terms of the agreements.

An independent comprehensive systematic review or enquiry of the costs and benefits of the investment to the local communities and national economy could be useful. This would assist in determining the level of support government should be giving to the investor in relation to other independent ethanol producers. Although ARDA is benefiting as a quasi-government institution and shareholder (currently 10%), it is not obvious that these benefits are meaningful enough for the country to be instituting mandatory blending based on them. Such an enquiry would systematically verify all the perceived/published benefits and costs, shareholding, and rationale for increasing mandatory blending levels based on one producer, a government supported monopoly operating privately.

NOTES

[1] Ethanol fuel is ethanol (ethyl alcohol), the same type of alcohol found in alcoholic beverages. It is most often used as a motor fuel, mainly as a biofuel additive for gasoline.

[2] Some of the land which is under contestation between the investor(Zimbabwe Bio Energy and Agriculture and Rural Development Authority, ARDA) on one side, and communal farmers on one side.

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