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REVIEW ARTICLE

Macadamia Nuts (*Macadamia intergrifolia*) Value Chain and Technical Efficiency among the Small-scale Farmers in Zimbabwe

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Abstract: Agriculture value chains are an indispensable tool for stakeholder collaboration, improving market access, foreign currency generation and increase in macadamia nut production in most developing countries. In Zimbabwe macadamia nut is a relatively new crop that has potential to alleviate poverty and enhance livelihoods. Zimbabwe's macadamia nut industry is still at its infancy and remains an under-researched area. Despite this, the technical efficiency of macadamia nuts production systems as proxied by production levels among small-scale farmers in the country is least understood. This study analyses the existing value chains by scrutinizing every step required in the production and marketing of macadamia nuts focusing on technical efficiency of value chain nodes. Macadamia nut value chain in Zimbabwe is predominantly an emergency value chain system that does not embrace the modular value chain model and associated networks to enhance technical efficiency and overall welfare. The value chain system is characterised by imperfect market conditions with limited knowledge of exact specifications, attributes and price of macadamia nuts. The existing value chain models for macadamia nut need to be re-aligned to accommodate all stakeholders, hence widening resource and knowledge sharing platforms. There is a need for the Zimbabwe macadamia nut value chain to shift towards captive networks which embrace and scale out practices such as out-grower contractual arrangements. There is potential to design macadamia nut value chain models in Zimbabwe to increase the technical efficiency of the industry.

Keywords: Technical efficiency; Value chain analysis; Value chain model

1. Introduction

Globally, macadamia remains at the forefront of nut consumption growth and the major consumers are high income countries [1]. Over the past decade, the global increase towards healthy eating has driven the growth in the macadamia nut industry, increasing by 24% compared to

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previous decade [2]. The world macadamia production and consumption can be attributed to the growth in demand, the popularity of the commodity, lucrative markets, population growth and per capita income in Gross Domestic Product [3]. While native to Australia, the nuts are now grown in many countries, including South Africa, Kenya, the U.S. (Hawaii), China, Guatemala, Malawi, Zimbabwe and Brazil. The global demand for macadamia nuts is driven by the wide application and use of processed tree nuts in the food, cosmetics and personal care industries. Nuts and dried fruits are rich in nutrients, bioactive and antioxidants and are good for promoting a healthy lifestyle [4]. Unlike other crop enterprises, the macadamia nut industry has more revenue streams and lucrative markets but according to ITC [5] and INC [6]. Zimbabwe is still lagging behind in terms of production and export trade due to rudimentary production systems, policy interventions, and centralised markets for macadamia nuts. The technical efficiency of macadamia nuts production systems in Zimbabwe as proxied by productivity levels has declined from approximately 54% in 2005 to 38% in 2020 [7]. The productivity levels are below breakeven levels coupled with unfavourable market prices which are on average 50% of the global weighted prices. Smallholder farmers do not possess the required technology to process nuts and they sell raw nuts at cheaper prices, due to this, the margins are highly tilted towards agents and intermediaries leaving the smallholder at a disadvantage. The existing value chains are not favourable to primary producers so they remain the least beneficial cluster. Macadamia nuts regulations under statutory 138 of 2019 give the government of Zimbabwe authority to control and regulate marketing of macadamia as well as promoting, protecting, and maintaining sales of macadamia. Macadamia tree requires temperatures of about 16 °C and an annual rainfall averaging 600 mm to achieve good yield. At an ideal planting density of 312 plants per hectare, the crop can yield up to 31.2 t/ha per year. However, in Zimbabwe the average yield is 7.2 t/ha per year with droughts and heavy frost noted as major problems in macadamia production [8].

Macadamia trees have been known to thrive in areas where average yearly rainfall is only about 600 mm, provided it is well distributed. Once the trees have become well established, they will survive considerable periods of drought [8]. Macadamia nuts are the fruit of the evergreen macadamia tree and the three species with commercial importance are *Macadamia intergrifolia*, Macadamia ternifolia and Macadamia tetraphyla [9]. Only two species are grown for their edible nuts; M. intergrifolia and M. tetraphyla. The M. tetraphylla is more adaptive to cooler climate and has rough shelled bush nuts while the M. intergrifolia has a smooth nut surface and is adaptive to diverse agro-climatic conditions. In Zimbabwe, M. intergrifolia is commonly grown in the cooler parts of the Southern Eastern districts. According to INC [6], macadamia nuts have a subtle, buttery flavour and velvety soft crunch that make them highly regarded by consumers. They are perfect as a snack, breakfast topping, in salads or as part of main meal, either raw, roasted or salted, or with flavourings [6]. The macadamia nuts industry has multiple revenue driven by the wide application and use of processed tree nuts in the food, cosmetics and personal care industries [4].

Globally, Australia and South Africa alone produce 50% of the world macadamia production [8]. According to Mbaka [10] the technical efficiency levels of macadamia nuts production systems in most African countries have not been in sync with the market demands for raw nuts across the various value chain nodes. This further points to the need to re-align the value chain models with the realities of the stakeholders' capabilities, institutional arrangements and marketing networks. In Africa, lessons for successful implementation of value chain models can be traced to for example Kenya [11,12]. Zimbabwe needs to run while others walk towards increasing production and its market share of macadamia exports in the global market. This review argues that there is evidence showing that macadamia nuts production, processing and consumption as the value chains remain technically inefficient and do not enable smallholder farmers to access high value markets. Even in these contexts, there are challenges such as the lack of information on the cultivars, lack of awareness on agronomic practices, price volatility, inconsistent market information and poor handling of the nuts after harvesting that limits the growth of the industry [13].

The main observation from literature is that major macadamia nut production and marketing challenges are attributed to poorly designed and malfunctioning value chain models [14]. Mazhar and Méon [15] allude and note that the marketing of macadamia nuts could also be affected by the involvement of intermediaries, the poor physical condition of markets, and an absence of modern infrastructure and logistical arrangements, such as storage, transportation and modern grading equipment. It has also been noted that, the distribution of profits among the value chain participants is uneven with small-scale growers receiving a relatively low share of the price paid by consumers [16]. Furthermore, they contend that the exclusion of small-scale farmers from the mainstream macadamia value chain functions has crowded out these farmers. A value chain analysis needs to be conducted to examine the current and future aspects of the macadamia industry in Zimbabwe. With the global macadamia consumption

expected to increase, efficient production and market linkages could be an advantage for smallholder farmers.

Current recommendations for research show that agricultural diversity has also emerged strongly as an option to reduce the food and income insecurity risks among small-scale farmers in Zimbabwe. In the Eastern region of Zimbabwe, macadamia nuts have been widely adopted as a hedge against the underperformance of traditional crops such as maize [17]. Given the favourable climatic conditions of some areas e.g., Chipinge which favour the growing of macadamia nuts compared to other crops like maize and other cereals, macadamia nut production can make farmers to be income secure because of the increase in global demand. Macadamia can potentially reduce poverty since it is a high value crop with a low-input requirement of about US$2300/ha compared to US$3100/ha needed for commercial tobacco. An exploratory survey conducted by AGRITEX [18] revealed that there are 530 farmers who are into macadamia nut farming in the Manicaland province of Zimbabwe. These farmers have an average yield of 11.9 t/ha/per year cropping on average 0.3 ha per household, but they are failing to realize handsome profits because of lack of processing technology and poor market access. According to AGRITEX [7], the marketing of macadamia nuts is controlled by only five companies namely Parrogate Pvt Ltd, Cropate, Mac Nut Company, Afri-China and Sime. A study by Barrueto, Merz [19] noted that farmers are able to practice modern production techniques which they understand and have technical know-how. However, the value chain impetus for this from the social, economic, institutional frontiers is currently lacking in Zimbabwe, hence the noted low productivity levels among small-scale farmers. As such, although the macadamia nut industry has the potential to contribute significantly to sustainable development in Zimbabwe, it is also confronted by low productivity and inefficient market for the commodity and these have an effect of reducing the potential of the industry through a reduction in the profitability. Therefore, understanding value chain actor behaviour, dynamics and opportunities about the functioning of macadamia nut value chains is critical for designing appropriate strategies to improve their efficiency. The findings of this paper will enable developing countries to craft policy shifts that encourage increased production and marketing of macadamia nuts.

1.1 A Global Overview of Macadamia Nut Leading Producers and Exporters

The world macadamia nut production can be broadly defined either as the production tons measured in the nut in shell (NIS) or based on the kernel basis, which excludes the mass of the shell. Using the former metric, world production showed a continued growth, adding up to more than 60,000 tons in 2019 [20]. In 2009, the total supply of macadamia nuts was 28,000 tons, which translates into 57% increase of the past decade [21]. Macadamias constitute a small sub-sector of all nuts on the world stage market, with only 1.28% of the total market share [22]. Macadamias are still viewed as a luxury crop but world exports continue to indicate a growth driven by a rapid increase in production and world demand [23].

From Table 1 it is clear that South Africa and Australia each had a 27% share in macadamia production. This can be attributed to the extended area under production, new varieties and continuous investment in the macadamia nut industry in South Africa and Australia. In 2019, South Africa had 44,775 hectares under macadamia production, with 2019 seeing 5,962 new hectares planted [24]. Australia's macadamia nut area planted increased from 18,000 ha in 2011 to 26 000 ha in 2019 [25]. In Kenya for example, macadamia nuts production is dominated by smallholder producers. More than 100,000 mostly small-scale farmers are cultivating the trees primarily in mixed cropping with coffee and other products [4].

Table 1. Major macadamia nut producing countries (metric tons): Kernel basis.

Countries	Kernel Basis (Metric Tons)	% share
South Africa	144,288	27
Australia	144,192	27
Kenya	7,002	13
USA	4,153	8
China	3,859	7
Guatamela	2,190	4
Malawi	1,620	3
Brazil	1,450	3
Zimbabwe	43	0.008
Others	4,172	8

Source: INC (6)

Table 2. Leading world exporters of macadamia

Rank	Exporters	Tons	5-year growth %
1	South Africa	37,440	5.89
2	Australia	23,057	32.02
3	Hong-Kong	10,897	–10.02
4	Zimbabwe	7,426	21.60
5	Guatamala	6,792	19.99
6	USA	5,760	9.41
7	Kenya	5,322	1.70
8	China	4,572	6.17

Source: ITC (5)and INC (6)

With exports of 37,000 tons in 2019, South Africa is the top exporter of macadamia nuts globally (Table 2). In the last five years, its market share has increased at a consistent 3% rate. Australia with 23,057 thousand tons and Hong-Kong at 10,897 tons emerged the second- and third-best exporters in 2019, respectively [5]. Zimbabwe is currently exporting macadamia as raw nut-in-shell (NIS) worth about US$4.2 million, at an average of US$2.65/kg, thus contributing to the global value of about US$317 million [5]. This is against the alternative value added (cracked to release the kernel) nut which can be sold at US$4.85/kg [5]. This pattern shows the income potential that is there but not being exploited by producers in Zimbabwe. Additionally, other private stakeholders can also take advantage of the investment opportunities along the value chain. Zimbabwe is thus part of the emerging producers of this relatively young and unknown nut in the world's nut selection, forming a mere 1.2% of total global tree nut production [24]. There is scope for expansion in production, marketing and processing activities if macadamia nuts value chain fundamentals are well understood and documented.

1.2 The Value Chain Context of Macadamia Nuts in Zimbabwe

The value chain approach traces the connections from buyers to the producers (farmers in the case of the macadamia nuts). As this is done, gaps become evident and form the basis for establishing priorities for action. Given that the Zimbabwean macadamia nut farmers sell NIS, they have not been generating income comparable to other producers in the world who sell processed nuts at a price which is almost double that offered to Zimbabwean farmers. More than 75% of the macadamia production in Zimbabwe is rain-fed. The small-scale macadamia nuts farms are 0.3 to 3 hectares on average. Small-scale farmers are producing less volumes of macadamia nuts which fail to meet the demands of organized and international markets, further, they do not have access to required inputs and market information. Studies however show that households can boost rural employment and generate income [26] through processing and value adding [27]. Figure 1 shows the macadamia value chain in Zimbabwe while highlighting the missing links which are compromising its efficiency. The fundamental aspects of the value chain hinge on the coordination of various sub-systems to sustain the broader development of synergies among stakeholders for the common goal of strengthening the value chain. The implications of all these interactions need to be viewed from the lens of the value to be extracted from participating in the various functions along the value chain. Macadamia nuts in Zimbabwe pass through several other formal and informal value chain nodes as consumers have potential to access product from several other actors, indicating governance challenges in this value chain. There is a dearth in knowledge on how decisions to participate on a stakeholders' interaction platform are made by emerging strategic crop value chains such as macadamia nuts.

In Zimbabwe, as opposed to other countries such as South Africa and Kenya, the value addition dimension is still the missing link in the macadamia nut business cycle since most farmers sell NIS raw nuts at unfavourable prices [8]. There is also untapped potential to increase access to production resources, enhance marketing opportunities, reduce poverty and improve the quality of life of the poor through improved incomes and employment. It is therefore critical to conduct a study that looks at the costs, returns and profit distributed along the macadamia nuts value chain by each actor. This study seeks to bridge the research gap in terms of the value chain including the linkages and relationships between actors especially between the farmers and middlemen, producers, transporters, buyers and consumers as well as the whole range of activities required to produce macadamia nuts from the farm to the final market.

2. Value Chain Models Used by Agricultural Stakeholders

There is limited information on whether it is purely policy bias that has kept small-scale macadamia nuts farmers out of viable markets or it is a combination of household specific decision-making processes and the value chain models that are not adequately accommodative. UNIDO [28] observed that within the framework of product-income flow processes and networks, there is a notable distinction among a number of value chain models. The defining differences across these value chain patterns are the trade-off that has to be made between the benefits and risks involved when decisions regarding how outsourcing of key ingredients such as information and production resources are made. These fundamental decisions are the key drivers of commercialisation prospects for agricultural enterprises in the small-scale sectors of southern Africa [29]. The value chain models patterns encompass a continuum of power asymmetry and explicit networking mechanisms bounded by the pure market-based model at the lower end and the hierarchy-based models on the upper end. For stakeholders in their various decision-making contexts to understand where macadamia nuts have fallen short, there is need to trace the dominant existing value chain models practised by the small-scale macadamia nuts markets of Zimbabwe, as is the motivation of this study. A simplified value chain from which all the aforementioned models have emerged is illustrated in Figure 2.

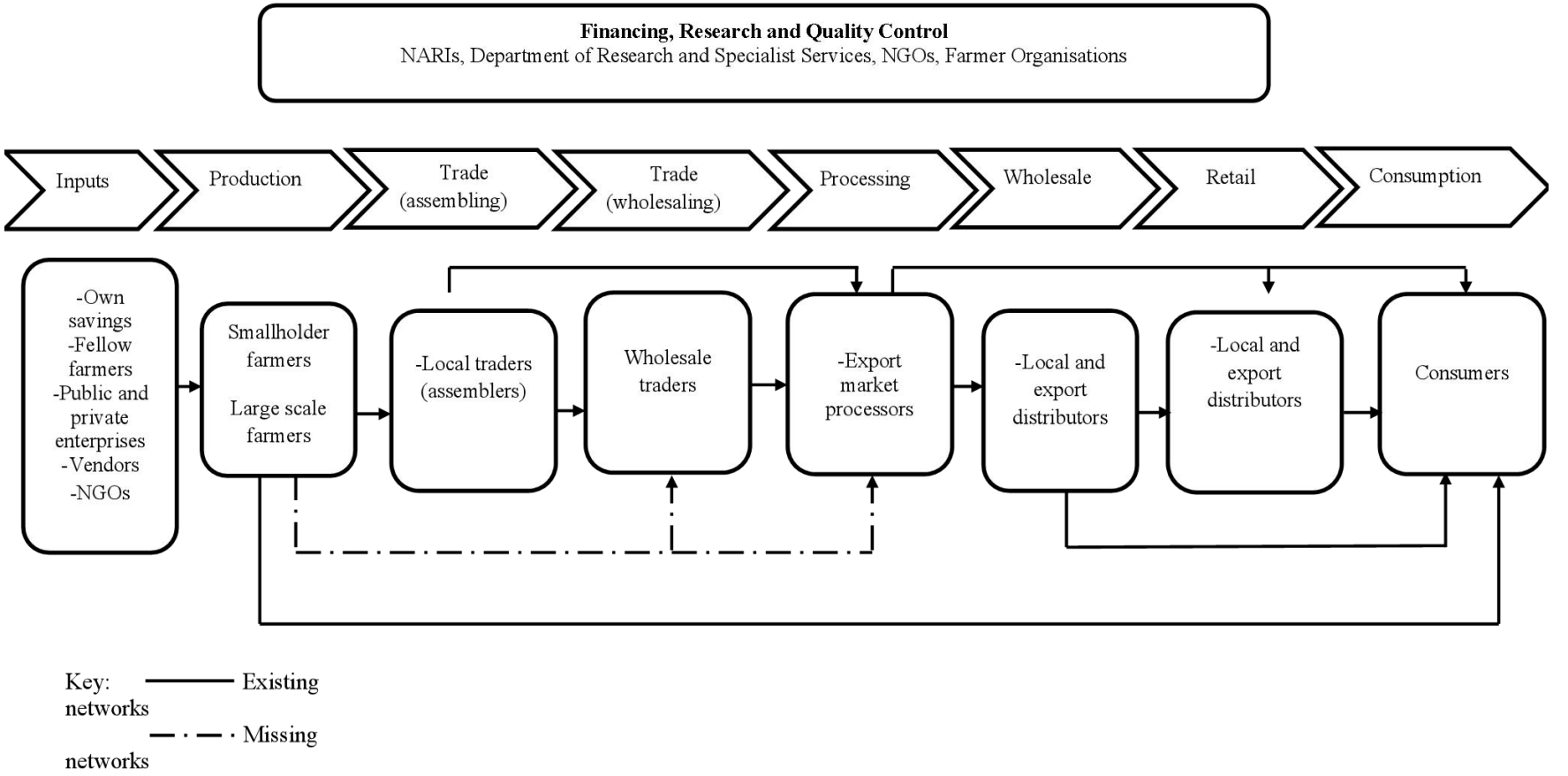

Figure 1. Macadamia nuts value chain

Source: Adapted from Scheepers [25]

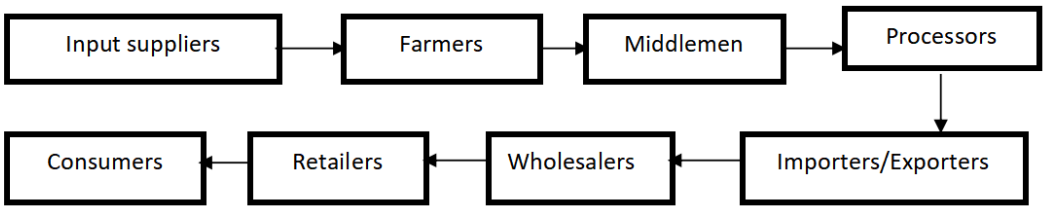

Figure 2. A simplified value chain model

Source: Adopted from Sanogo (2010)

Characteristically, the arm's length market model is the most rudimentary value chain model [30,31]. As such, most small-scale farmers find solace in participating in this model structure because buyers and suppliers are not necessarily closely related because the product involved is apparently logically standardised [32]. However, this has not been the case with macadamia nuts farmers because in literature there are reports that farmers and processing firms are not meeting the demands of customers in various critical success factor pillars such as the quality, pricing and reliability of supply. This can therefore be attributed to land allocation decisions which do not accommodate macadamia nuts across geo-spatial locations in Zimbabwe, therefore creating artificial shortages of the product in potentially viable markets, while at the same time negatively impacting on the income generating capacity. The argument against this value chain model is that, if any challenges become apparent with the product, then buyers cannot easily switch to a new different supplier in the production zone. This is because the supplier is not available or will need substantial time to provide the macadamia nuts given its production cycle. This has created a disincentive for macadamia nuts utilisation by local processors especially in the food industry because it becomes risky given that the small-scale producers can easily have an upper bargaining hand using price as the core governance tool [24]. However, experiences in Kenya show a different picture where small-scale macadamia nuts farmers in the southern and drier parts have strong direct linkages with processors in multiple nodes [8]. The study therefore argues that the lessons from these environments can be used to meaningfully support the participation of macadamia nuts farmers in Zimbabwe if the model is restructured to suit the local contexts.

Given experiences in Zimbabwe, the immediate question then becomes whether the macadamia nuts value chain stakeholders embrace the modular value chain model and associated networks to enhance technical efficiency and overall welfare. As noted by UNIDO [28], in this arrangement, the firms develop information-intensive linkages with clearly defined core competences among themselves. The buyer then comes on board and determines what is to be produced in terms of the quantity, design and product specifications. This provides an opportunity for the highly competent suppliers to provide the product at the shortest notice since they have a cluster of product specifications readily available at their disposal. Small scale macadamia nuts farmers in arid and semi-arid zones of Zimbabwe have failed to capitalise on this attribute of consumers through networks which foster information sharing intensity and allowing buyers to gain confidence in their competence as suppliers. According to Munoz-Pina, De Janvry [33], examples of modular value chain model linkages are successfully exhibited in financed value chains where buyers are committed to few suppliers such as in contractual arrangements. Sadly, embracing this approach has manifested in the form of macadamia nuts processors choosing the reliable supplies from the large-scale producers. This has a negative bearing on the sustainability of the small-scale macadamia nuts enterprises as farmers end up having no reliable markets to supply their produce.

It can therefore be argued that, given the prevailing scenario in the small-scale macadamia nuts sector, the best way is to shift towards captive networks which embrace and scale out practices such as out-grower contractual arrangements [34]. Alternatively, a hierarchical value chain model which is characterised by various forms of vertical integration can be adopted. The strategy will be to isolate some lead firm which takes overall control and ownership of some strategic production operations [33], given that competent farming households cannot easily be found or it is difficult to codify desired products such as macadamia nuts. In the medium to long term, this evolution will have direct implications on domestic and international trade along multiple macadamia nuts value chain nodes [35]. This will naturally trigger changes in consumer tastes and preferences and have a net effect on land allocation decisions towards the crop and its marketing along many channels.

2.1 Determinants of Emerging Value Chain Models Used by Macadamia Stakeholders

As alluded to by Scheepers [25], there are numerous determinants of using the value chain models in agricultural organisations. These emanate from within the organisations and from within the wider agriculture sector and are usually context specific depending on the sector's performance. The modern perspective acknowledges that there are intricate and overlapping relationships among these various factors. This, according to Quiroz, Kuepper [8] creates additional pressure on the decision makers to opt for the traditional models as a hedge against the potential numerous risks of emerging value chain models' management requirements if not well coordinated. This refined perspective therefore looks at these core determinants of value chain model choices in the context of possible value creation. The foremost factor is the consideration for the transaction costs associated with the collaboration partners in most modern value chain models. Fundamental to this process, the macadamia nuts stakeholders need to commence the search for alliance partners by weighing the potential of a prospective partner to possess sustainable harmonising resources which can enhance networking activities including the skills to coordinate the coordination. As such, in most of these decisions, the complementary resources factor acts as the major driver of cooperation and precedes the other factors such as the potential for value creation. However, Parshotam [34] suggests that the composite set of factors including knowledge-sharing routines (KSR), complementary resources, relation-specific assets (RSA) and effective governance (EG) are sources of value creation and co-determine the use of value chain models by stakeholders. This matrix is presented in Figure 3 below.

Limited KSR among the small-scale farmers hinders continuous production of high-quality nuts, market access, value addition, and adoption of competitive pricing among macadamia nut producers in Zimbabwe. The excellent uses of macadamia nuts like apple crisp, roasted nuts give green salads crunch, and chopped macadamia nuts give white chocolate biscuits a buttery flavour have limited market in Zimbabwe, affecting its demand and price in the local market. Macadamia value chains in Zimbabwe face challenges related to RSA and GA, through limited financial and policy support. However, Munoz-Pina, De Janvry [33] further expounded this argument and posited that the decision makers need to comprehensively interrogate the dynamic relationships among these sources of value creation, as well as the weights assigned to them by various stakeholders as they consider venturing in value chain alliance relationships.

The complexity of emerging value chain models as presented by Scheepers [25] are that the macadamia nuts stakeholders need to closely assess availability of tangible resources such as equipment or intangible resources such as knowledge or a combination of the two. These factors guide decision making since they influence the levels of future investments in RSA and/or KSR for creating long-term collaborations from the value chain relationships. In most instances, given the nature of the value chain functions, in many alliances, the value is created by merging tangible assets. In these instances, the stakeholders benefit from leveraging and exploiting complementary physical assets in the value chains. This study argues that this scenario significantly crowds out the small-scale macadamia

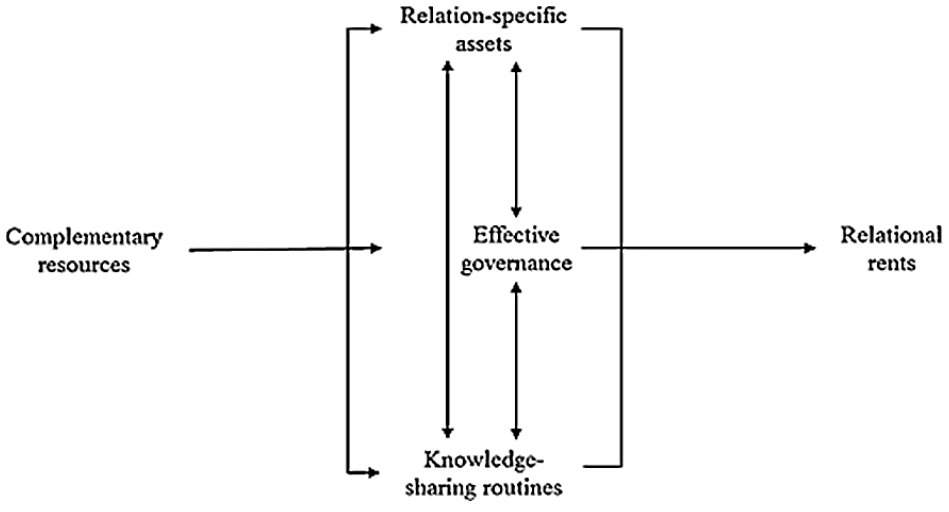

Figure 3. Factors affecting the use of value chain models

Source: Adopted from DAFF [38]

farmers who have no high value assets and resources to bring on to the alliance platform. As such, as a way of adding to the body of knowledge, designing an appropriate value chain networking framework becomes unavoidable for the macadamia nuts industry at this stage.

Scheepers [25] further argues that another important factor in the use of emerging macadamia nuts value chain models the nature of the arrangements in alliances. For example, they posited that in cases of supplier–buyer alliances which are termed to be vertical, within physical product industries such as macadamia nuts, value is created through coordination along the complementary tangible assets. These alliances are more likely to benefit in the initial stages from investments in RSA. In contrast, using experiences from Kenya. Quiroz, Kuepper [8] argues that the value chain alliances that are designed after considering factors including intangible resources such as knowledge are more likely to benefit from future and reliable investments around the KSR factors while creating value in the execution of functions.

In the Zimbabwean case, statistics from SAMAC [24] suggest that the main factors considered in the use of emerging value chain models revolve around government policy. Poor understanding of statutory instrument 138 of 2019 by small-scale producers may affect their market participation and penetration. The argument is that most government strategies that have been recently put in place to manage macadamia nuts, just like most agricultural enterprises are generally unproductive, as shown by reduced economic benefits. Based on South African observations, there is further consensus from Scheepers [25] that the lack of commitment from practitioners in the macadamia nuts industry to adopt and reinforce a stakeholder inclusive approach in the design of policies has weakened the industry's productivity and created additional technical efficiency challenges. There is therefore need to realign the targeted macadamia nuts policy interventions and place significant emphasis on favourable domestic prices, training programmes in emerging practices and consolidation of regulatory institutions' mandates. All these factors have a bearing on the appetite of macadamia nuts value chain stakeholders to engage in collaboration activities as informed by emerging value chain models.

2.2 Economic Analysis through Applying the Value Chain Concept to Macadamia Nuts

It is one of the aims of this study to also identify challenges facing the Zimbabwean macadamia nut value chain. Macadamia imports to Europe increased in recent years because of the nutritive value of the nuts and their emerging uses in food products. They are mostly consumed as roasted and salted snacks and in snack mixes. Key countries of origin are South Africa, accounting for 42% of total imports in 2018, followed by Kenya with 24% and Australia with 18%. Other origins all accounted for less than 10% each [8]. Most macadamia farmers in Zimbabwe are smallholders with limited livelihood options other than subsistence agriculture and small-scale farming. As such the full potential of the macadamia nut industry is yet to be realized. Smallholders tend to lack perfect knowledge of their products. This has resulted in the average price of the macadamia nuts obtaining in Zimbabwe being low compared to other countries. This therefore points to the existence of a problem within the value chain.

2.3 Stakeholder Networking and Technical Efficiency in Macadamia Value Chain Nodes

The Zimbabwean macadamia nut industry seems to exhibit imperfect market conditions, characterized by insufficient product and market knowledge. Buyers and sellers may be lacking adequate knowledge with regard to the exact specifications, attributes and price of the macadamia nuts that they demand or supply. Regardless of the limited value additions on the macadamia, experts still see growth opportunities in international markets for the nuts like in Europe. The Zimbabwean farmers can utilize these opportunities if the quality standards of buyers can be fulfilled.

Value chain participants search and collect information on the value and properties of their product such as transaction costs, coordination and management costs, value chain activities and governance structures between buyers and sellers [36]. Understanding of transaction cost economics, transaction costs may be lowered through vertical coordination and integration [37]. Gaining control over transaction costs through vertical coordination/integration improves the competitiveness and thus market position of a business by leaving greater gains/profits to be distributed amongst value chain participants in the coordinated/integrated value chain. This research expects to prescribe policies that will lead to the macadamia nut value chain participants in Zimbabwe (particularly the farmers) realizing greater and equitable profits. The terms of transactions, especially price, are determined by the balance of power between buyers and sellers, a balance that is unpredictable and unstable and which might lead to asymmetric price transmission between value chain participants [38]. The major buyers of Macadamia nuts in Zimbabwe are Parrogate Pvt Ltd, Cropate, Mac Nut Company, Afri-China and Sime. The low prices offered to the farmers by these buyers point to a collusive oligopolistic market which seems to be a problem within the value chain.

Industry actors can be identified through value chain analysis. Through value chain analysis mapping of positions of industry actors and accounting for individual actors' activities is done. It thus also accounts for the governance and structure of production that dictates how the chain operates identifying who controls the diffusion of technology, standards, value creation and distribution of rent along the value chain [39,40]. Information obtained from this research will thus help design appropriate policies and development interventions, thus improving the position of marginalized groups such as smallholder farmers falling along the chain. Furthermore, agribusiness value chains, of which the macadamia nut value chain is part of, are the subject of great interest amongst governments and development partner institutions. They are viewed as pathways for economic growth for developing countries since they do not only contribute to rural livelihoods, but also to poverty alleviation if practiced in a sustainable manner [28,41,42]. On the other hand, a World Bank Report [43] contended that investments in agriculture have a quadruple impact on the economy compared to other sectors. Thus, understanding the macadamia nut value chain is projected to have a positive impact on the lives of the small holders and the economy in general. The inefficiency of the value chain can be a problem in the chain and the proposed study is intended to meet this challenge by mapping, analysing and making policy recommendations with the aim of improving the macadamia nut value chain in Zimbabwe focusing on the Manicaland province.

3. Conclusions

Appropriate value chain modelling has been a source of competitive advantage among macadamia nuts firms as is with many businesses. There is limited uptake of these emerging and effective value chain models among the firms in the macadamia nuts industries due to numerous and overlapping factors emanating from the society, the economy, institutions, the policy environment and the wider global community. Apparently, the macadamia value chain in Zimbabwe was constrained by limited integration into the global market, poor market access, lack of processing technologies, inconsistent institutional arrangements, price volatility, inconsistent market information and poor handling of nuts. Limited motivation from social, economic and institutional frontiers in Zimbabwe contributes to low technical efficiency in the macadamia nuts value chain. Particularly, untapped potential to increase access to production resources, poor marketing opportunities, high poverty levels and poor quality of life have significant impact on the technical efficiency of macadamia nuts production in Zimbabwe. This cocktail of developments has significantly compromised how macadamia nuts producers' response to technical efficiency challenges using emerging methods within the value chain contexts. The ultimate effect is that the macadamia nuts stakeholders, especially the producers, have not extracted optimum value from their operations due to limited access to resources, information and core knowledge on the value chain platforms. Going forward, it becomes unavoidable for various structures at social, economic, institutional, and policy levels to be designed in ways which respond to changes in the value chain modelling landscape.

To increase technical efficiency through enabling diversification along strategic value chains and across value chains, the governments of Zimbabwe need to adopt a more direct and rigorous policy approach. This will motivate the production of macadamia nuts in the country. Further, there is a need to build a funding mechanism for small-scale macadamia farmers to access to improve their technical efficiency. Gradual reduction of value chains length and regulating the existing markets is necessary. Revitalisation of the technical capacity of small-scale macadamia farmers through improving access to production resources and enhancing their production and marketing skills should be done. The formation of a board that addresses all the needs of the small-scale farmers of macadamia will be necessary for them to have improved market access, facilitate training and have a better price bargaining power. One of the critical success factors for the industry is to improve competitiveness and optimize value adding, whilst at the same time enable broader market access. A value chain analysis should be conducted to examine the current and future aspects of the macadamia industry in Zimbabwe.

Availability of Data and Material

Not applicable.

Author Contributions

The corresponding author conceived of the paper, gathered the appropriate literature review articles, and wrote the first draft of the manuscript. The other authors read and approved the final manuscript.

Conflict of Interest

There is no conflict of interest associated with this paper.

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