

Review of Macadamia Production in Malawi: Focusing on What, Where, How much is Produced and Major Constraints.

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Abstract

Macadamia (*Macadamia integrifolia*) nuts have become an essential commodity crop in Malawi. The nuts are a lucrative commodity and are used for household consumption and income generation among farming families and as a foreign exchange earning crop at country-level. In addition, macadamia production has increased significantly in recent years in the country. Currently, Malawi is the seventh top producer of macadamia nuts, with a global market share of three percent (1,846 metric tonnes on kernel basis). In 2018, exports of macadamia kernel had a value of US\$24.3 million (£19.8 million or MKW 18.01 billion). However, the bulk (85%) of the crop is grown on large commercial plantations, but the smallholder sector is emerging as vital for the future growth of the macadamia sub-sector in Malawi. Furthermore, Malawian smallholders consider macadamia production to be a low-input crop with large returns per unit area (US\$14.37 kg⁻¹ha⁻¹ or MKW 10,701kg⁻¹ha⁻¹) thus a lucrative crop with high potential for poverty reduction and wealth creation among these farming families. This paper, therefore, explores: (i) the historical and current trends in macadamia nut production in Malawi; (ii) analyses the country's macadamia value chain and (iii) discusses the constraints of macadamia production in Malawi for informed policymaking. Thus, the synthesis of the Malawian macadamia sub-sector provides an understanding of the vital contributions of macadamias to Malawi's economic growth and improvement of livelihoods.

Keywords: Macadamia, Smallholder farmers, Lucrative crop, Poverty reduction, Consumption.

Introduction

Malawi is a landlocked nation in southern Africa squeezed between Mozambique in the south-east and Zambia in the north-west. The country covers an area of 118, 484 km² with a rapidly growing population of over 18 million inhabitants in 2020 according to [Population Pyramid](#). The economy and food security of Malawi is heavily agro-based (Malawi Government 2018). The sector contributes 44% of the country's gross domestic product (GDP) and accounts for 82.5% of the country's foreign exchange earnings (Makoka et al. 2016; Malawi Government 2013). Furthermore, the Malawian agricultural sector comprises of the commercial sub-sector and smallholder sub-sector (Chinyamunye 2014; Minde et al. 2008).

Smallholder agricultural production contributes around 25% of the total GDP, employs 95% of the total agricultural labour force, and almost 70% of the agricultural produce consumed in Malawi comes from smallholder farmers (Harrigan, 2008; Makoka et al. 2016). Despite the smallholder sub-sector contributions to Malawi's food security and economy, production volumes from each farming family are small, and many of the smallholders are food insecure on an annual basis (WFP 2015). Attributing that food security¹ (availability, access and utilisation) are lost by sudden economic and environmental shocks each year, and climate change worsens the situation (Ellis and Manda 2012).

The promotion of Climate Smart agricultural technologies, especially crop diversification is vital for addressing the issues smallholder farmers face in crop production. Crop diversification can be defined from two perspectives (horizontal and vertical diversification). Adjimoti et al. (2017) define horizontal crop diversification as the addition of crops to an existing cropping system for purposes of food security, soil fertility improvement and diet diversification and vertical crop diversification as the additional high-value crops to an existing system that can be processed and exported for income generation.

¹ Food security is defined as a condition that exists when “all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (World Food Summit, 1996).

Tobacco is considered to be the main cash crop in Malawi and contributed to over 70% of the total export value in 2005. However, the export value from tobacco has been decreasing year on year and is currently at 52% (Makoka et al. 2016; WTO 2019). Currently, 95% of the output is by smallholder farmers (Malawi Government 2018). But, with the negative market trend of tobacco and the debate by the World Health Organization² (WHO) Framework Convention for Tobacco Control, smallholder farmers are required to identify alternative cash crops for survival. It is for the same reason, the government of Malawi is keen to reduce its dependence on tobacco, as demonstrated by its explicit focus on diversification and sustainable agricultural transformation in Malawi's key policy frameworks including the National Export Strategy (NES). This is apparent by the government's support in the promotion of traditional high-value crops such as; pulses (common beans, groundnuts, sunflower), sugar and tree crops such as coffee, macadamia and tea. Macadamia production is currently considered as a potential alternative to tobacco, given its lucrative nature in Malawi.

Macadamia species are evergreen trees indigenous to the coastal rain forest areas of Australia but was first cultivated in Hawai'i (Hamilton et al. 1985; Mast 2008). Macadamia production has continuously increased in recent years (Figure 1) and is expected to continue in the coming years globally (Quiloz et al. 2019). However, production of the nuts only accounts for less than two percent (%) of the worldwide tree nut production (INC 2018). Macadamias are mainly grown in Australia, Brazil, China, Colombia, Costa Rica, Guatemala, Hawai'i, Kenya, Malawi and South Africa (INC 2018). Smaller-scale cultivation is conducted in Argentina, Fiji, Jamaica, Mexico, Mozambique, New Zealand, Swaziland, Tanzania, Venezuela, Vietnam and Zimbabwe.

² According to the WHO FCTC, "tobacco control" refers to a range of supply, demand and harm reduction strategies that aim to improve the health of a population by eliminating or reducing their consumption of tobacco products and exposure to tobacco smoke (WHO, 2005).

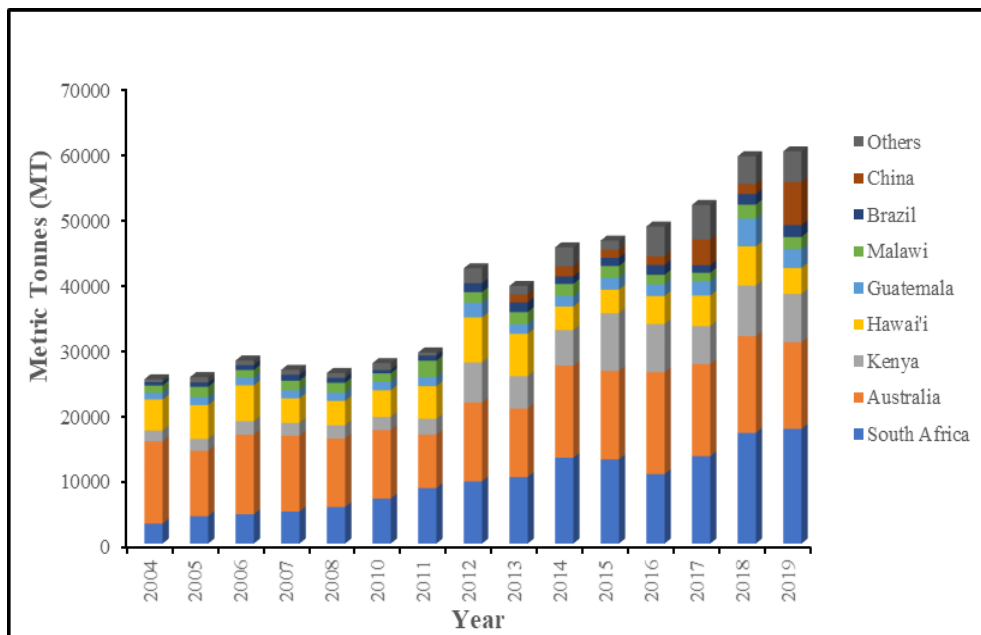


Figure 1: Macadamia kernel production by country (INC 2019).

Malawi is the seventh top producer of macadamia nuts in the world (3% world contribution on a five-year average) with the potential of becoming one of the top three producers in the near future. The country has a suitable climate, and altitude conditions for macadamia production and the vast tracts of land available in the country, especially in the central and northern regions provide an area for expansion of production (Toit et al. 2018).

Despite this potential, the contribution of macadamia nuts to Malawi's economic growth is not well documented (Toit et al. 2018). According to Neno Macadamia Trust (NMT), macadamia nuts contribute to Malawi's food security and foreign exchange earnings. Therefore, the government of Malawi (GoM) and the private sector can potentially take advantage of the growing world demand to produce finished macadamia products for both local and export markets. To fill this gap, a firm and comprehensive understanding of the fundamental dynamics of the macadamia industry in Malawi is required regarding (i) the historical and current production trends of macadamia nuts; (ii) the macadamia value chain structure and (iii) constraints of macadamia production the country.

Macadamia production in Malawi a historical background

The early history of the first planting of macadamia trees in Malawi is not well documented but old trees (≥ 50 years of planting) believed to have been the first

introductions and still surviving to date and are found in Bvumbwe, Ntchisi and Rumphi districts (Hancock 1992). These macadamia trees were introduced from Hawaii for research trial purposes in Malawi in the early 1960s. Nevertheless, it was until the late 1960s that the first commercial macadamia planting occurred in Malawi in Nkhatabay district at Kawaladzi Estate (KE) and Thyolo district at Naming'omba Tea Estate Limited (NTEL) and spread over 573ha (Emmott 1989; Emmott 2020). The research on macadamia production was being conducted at Bvumbwe Agricultural Research Station (BARS), Kalira Extension Planning Area (KEPA) and Lunyangwa Agricultural Research Station (LARS) (Hancock 1992).

The macadamia research was commissioned in response to the GoM and estates industry demands. At the time the macadamia nut sub-sector was estate based (mostly under NTEL, Eastern Produce (EP) and KE and consisted of extensive land holdings, most of which existed before independence (1964) and were controlled by the United Kingdom-based multi-national companies (Emmott 1989). However, Press Cooperation Trust was the only locally based multi-national company but still had strong links with the U.K. During this period the estates predominantly focussed on coffee and tea production, while tung oil was a declining industry.

Although the hectareage of macadamia was often large among the large estates, it was still considered a small crop of importance in the overall estate production systems (Hancock 1992). Macadamia was planted on poor land not suitable for coffee and tea, or as a replacement for tung oil trees (Phiri 1991; Parshotam 2018). Macadamia production by smallholders started at the same time as the commercial estate production (Hancock 1989; Phiri 1991; Parshotam 2018). However, this was majorly by smallholder farmers located close to BARS, KEPA and LARS (Phiri 1988). At the time smallholders delivered nuts to the factory but were insignificant in terms of total production.

By the early 1980s, seventeen estates had gone into operation, producing more than 311 MT of saleable kernels annually (AfDB 1998). Ninety-five percent of all of this produce was processed respectively at NTEL and KE factories. According to a report published by the Malawi Tree Nut Authority (TNA 1991), the 1989 production of saleable kernel amounted to 150 MT and returned MWK3.18 million (the exchange rate during this period was MWK4 = £1, MWK = Malawi kwacha). During the 1990s, the macadamia hectareage had steadily increased to over 2,000 ha (Phiri 1991).

Smallholder macadamia production between 1980 – 1990 was still in its infancy phase with farmers abandoning the crop annually due to low pay-outs from the commercial estate and lack of organized market from the government (Hancock 1992). However, in 1992 David Emmott (then manager of NTEL) with his ex-foreman Timothy Kanthiti who helped run the family farm in Neno in the 1950s started promoting smallholder planting of macadamia trees in the district (Emmott 2020). As a result of Emmott's activities, smallholder macadamia production started to spread to Mwanza a district west of Neno district.

Realizing the potential of smallholder macadamia, the Government of Malawi (GoM) implemented a feasibility study on macadamia suitability within the country (1985 – 1980). This was followed by significant reforms in the agricultural sector in the country in 1995. This included deregulation of particular crops (coffee, tea, macadamia and tobacco) production by smallholder farmers and liberation of prices from the 1995 – 1996 season (Chirwa 2004). As a result of the market potential and food value of macadamia nuts, in 1998 the GoM were funded money by the African Development Bank to implement the Macadamia Smallholder Development Project (MSDP) (AfDB 1998; AfDB 2009). The project aimed at improving the welfare of smallholder farmers through the provision of income-generating activities and on the other hand, to increase foreign exchange earnings for the agricultural sector through crop diversification. Despite the potential and the keen interest from smallholder farmers, the AfDB project is regarded as unsuccessful and resulted in many farmers neglecting their macadamia trees after the project phased out opting for more profitable crops with established markets and support from the government.

However, within the same period (2004), David Emmott created the Neno Macadamia Trust whose aim was to promote smallholder macadamia production in Malawi and led to the creation of macadamia smallholder owned cooperatives in Neno and Mwanza which now fall under the umbrella body of Highlands Macadamia Cooperative Union Limited (HIMACUL) established as a second-tier cooperative union to the primary district-level cooperative which is still vibrant and operational to date.

Macadamia production in Malawi today

Macadamia is now a fully established crop and competes with other crops for land in Malawi. Having been set up by the estate sector, the macadamia industry is currently well established with strong growth potential (Eed et al., 2016). Total ha has increased from 5, 280 to 9, 660 an increase of 83% while approximately 1, 500 ha is under smallholder management. Disaggregated, this represents a 35% increase in the mature crop, a 4-fold increase in immature trees (Evans, 2020). Annual plantings have been increasing annually, and 2019 recorded 1,202 ha the highest annual establishment recorded in 20 years and an average of 980 ha/year since 2016 (**Error! Reference source not found.**Figure 2). There has been an acceleration of new establishments: 1, 975 ha in the northern and central region account for almost half of the expansion during the period.

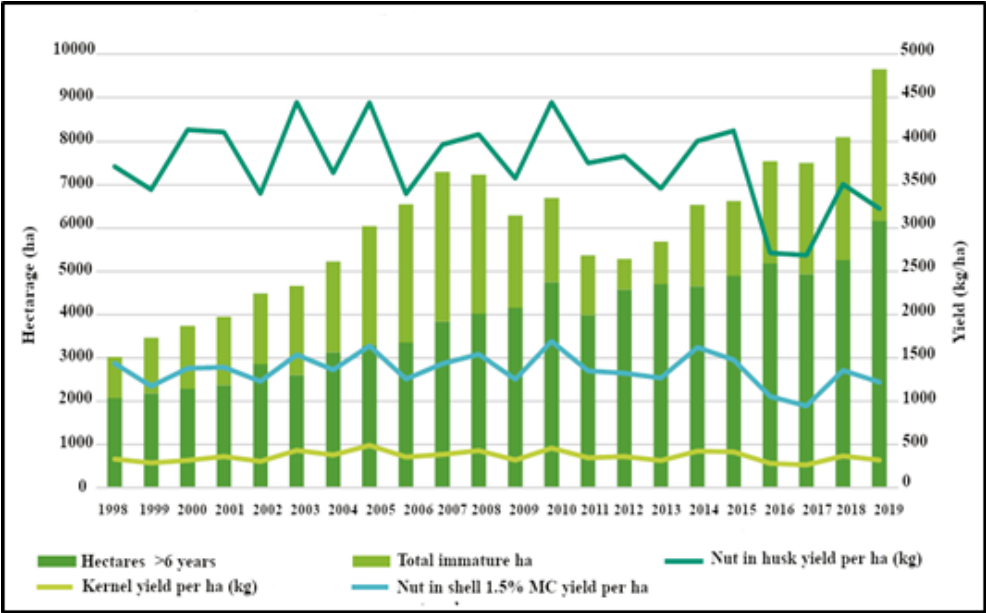


Figure 2: Area allocated to macadamia production in Malawi based on orchard age (Parshotam, 2018).

Smallholder tree plantings total over 300,000 compared to over one million under the commercial estate sub-sector and are expected to increase in the future years as a result of government and private sector involvement in the value chain (Irish Aid 2012). Additionally, smallholder production is dominant in Chitipa, Dowa, Mwanza, Mzimba, Neno, Ntchisi and Rumphi districts. However, recently some smallholder activity has been observed in Kasungu, Lilongwe and Mchinji districts as well. **Figure 3: Macadamia growing districts in Malawi.**Figure 3**Error! Reference source not found.** shows the macadamia growing districts in Malawi. Light green shaded districts are those in which HIMACUL is actively operating, representing more than 3, 850 smallholder

growers. The dark green districts are commercial macadamia plantations and processing locations. Pink shaded districts are those where activities are at an early stage of development or have a high potential for the establishment to be extended with HIMACUL targeted Extension Planning Areas.

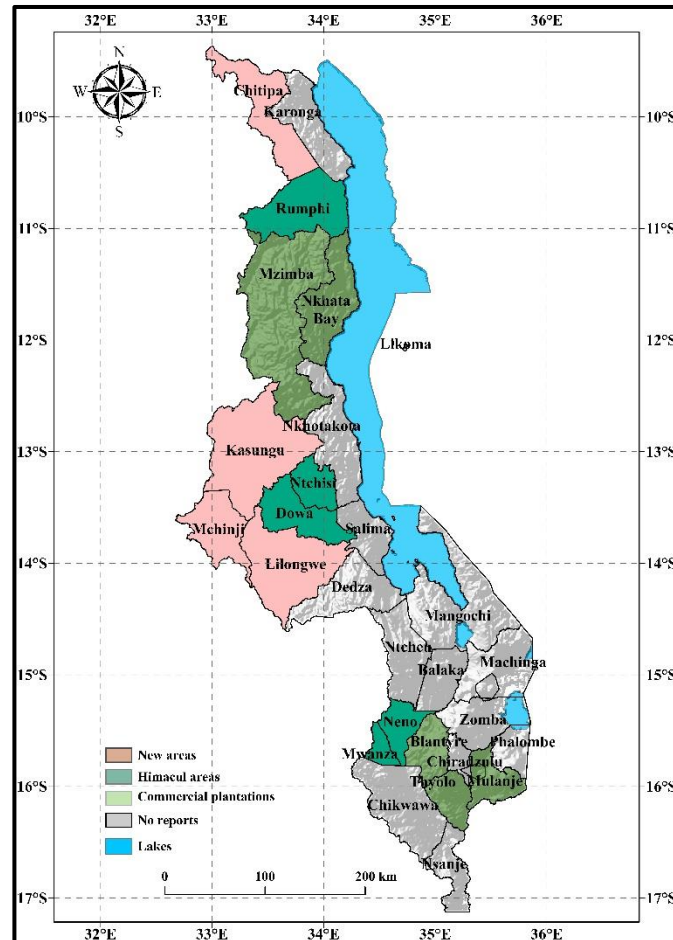


Figure 3: Macadamia growing districts in Malawi.

Malawi currently has seven commercial macadamia processing/marketers (PMs) (Toit et al. 2018). Macadamia PMs include firms that are either exclusively involved in the processing or marketing of macadamia nuts, or in the combined activities of growing, processing and marketing of macadamia nuts (Khan 2016). Similar to the South African and Kenyan macadamia industry, the Malawian macadamia industry is also built up around PMs because these firms perform the leading share of the industry's value chain activities (SAMAC 2019). PMs have developed bulk and retail lines of macadamia products and have established domestic and export markets for these product lines. Additionally, PMs provide research and extension services to growers and develop new macadamia products, as well as markets for existing and new products.

Three PMs in Malawi (NTEL, SF and TE) are involved in both production and processing of the crop from their farms and that of smallholder farmers while CF, EP, KE and PGI focus on their production and processing (Khan 2016). Further, PMs are considered as a leading party that determine the overall characteristics of the macadamia value chain (Gereffi 2005; Toit et al. 2017). Their responsibilities also include upgrading possibilities, knowledge transfer, and integration and coordination within the value chain (Fabe et al. 2009).

Historically Malawi was the third-largest macadamia producer in the world in the mid-80s, but this declined over the years as a result of changes in ownership of the commercial estate plantation leaderships (Irish Aid 2012). However, Malawi still has a strong competitive edge of growing its production base and if managed constructively has the potential to obtain its past rankings (Parshotam 2018). The country has a suitable climate, and altitude conditions for macadamia production and the vast tracts of land available in the country, especially in the central and northern regions provide an area for expansion of production (Toit et al. 2018). Additionally, demand for seedlings, particularly from smallholder farmers, has been increasing over the past years than the supply implying that the hectareage of the crop is also increasing (Parshotam, 2018). However, macadamia nut production in Malawi is almost entirely for exports, with a small (5%), yet the growing volume of the nuts consumed locally (AfDB 2009).

Production of the crop has also increased by 53.5% over the last decade (2009 - 2019) (INC 2019). Growth in production is majorly attributed to an increase in smallholder tonnage of the nuts (HIMACUL members), access of smallholders to processing facilities and the modernization of the NTEL processing plant in 2015 (Figure 4). In addition, with the bulk of smallholder young orchards only starting to produce, or still having to come into production, it is expected that the Malawian crop will double in volume in the next two to five years (2019 personal interview K M Kangala). However, in some years, significant decreases in yields were incurred (2006, 2009, 2011, 2016) owing it to erratic weather events, especially droughts and flooding. Another factor affecting macadamia yields in Malawi are pests and diseases. Specifically, macadamia stink bugs and fruit borers that can cause up to 80% yield losses depending on the location of the orchard (Schoeman 2009).

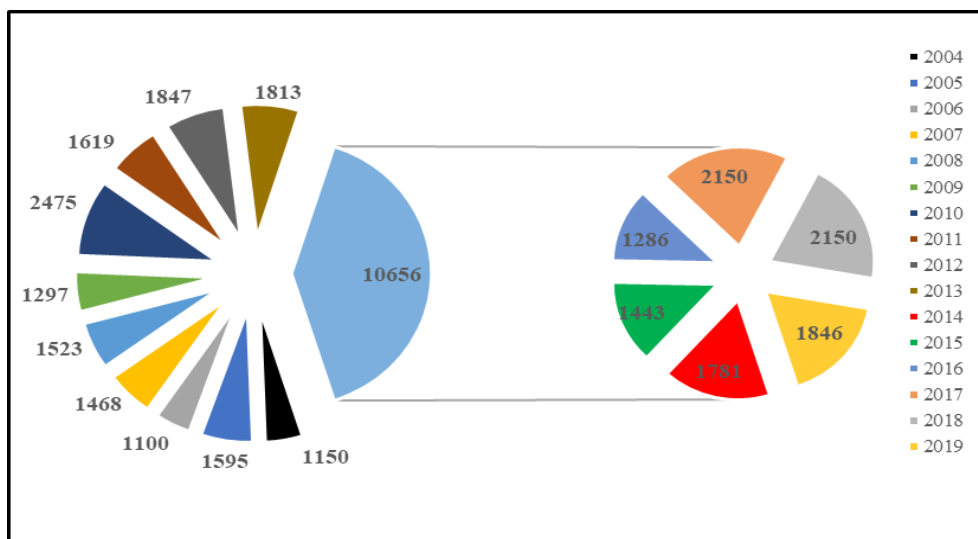


Figure 4: Macadamia kernel production trends in Malawi (2004 - 2019) (INC 2019).

Malawi is the fifth largest exporter of macadamia nuts globally. In 2018 the country contributed about 5% (**Error! Reference source not found.**5) of the total world macadamia kernel exports at a value of US\$24.3 million. Looking at average prices for macadamia kernel imports, an upward trend can be observed in the last five years: the average price across all imports increased from USD\$12,825.45 to USD\$17,561.51 per MT (Quiloz et al. 2019). Despite that Malawian macadamia used to achieve comparatively low prices but have shown a strong increasing trend from USD\$11,879.64 kg MT⁻¹ in 2014 to 17,561.51 in 2018 (Quiroz et al. 2019), almost catching up with other key origins in 2018. This could be attributed to maturing of macadamia trees, especially among smallholder farmers that are complementing the commercial estate production.

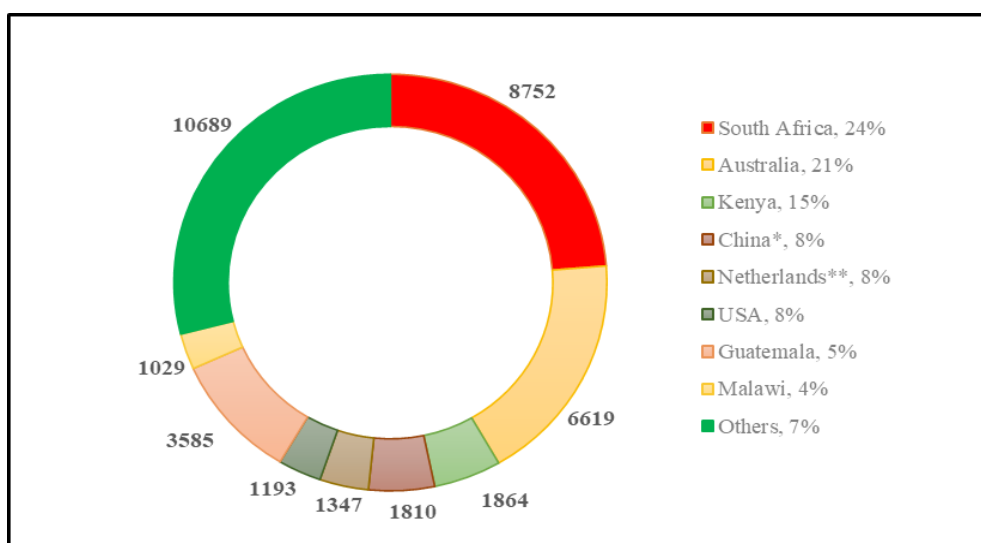


Figure 5: Global macadamia kernel exports (2018).

About 95% of all the macadamia nut in shell (NIS) from Malawi are exported to South Africa, primarily for the snacking market (ITC 2018). Although, with the increasing demand for macadamia nuts in China and Vietnam, it is expected that Malawi will have new export markets through these two countries, as shown in Figure 6. In addition, between 2014 - 2018, Germany and Malaysia, who had been traditionally kernel importers, started to import NIS macadamia from Malawi. Thus, expanding the NIS market for the produce. The exported value (GBP £/USD\$) of macadamia kernels from Malawi has also been increasing at a steady rate.

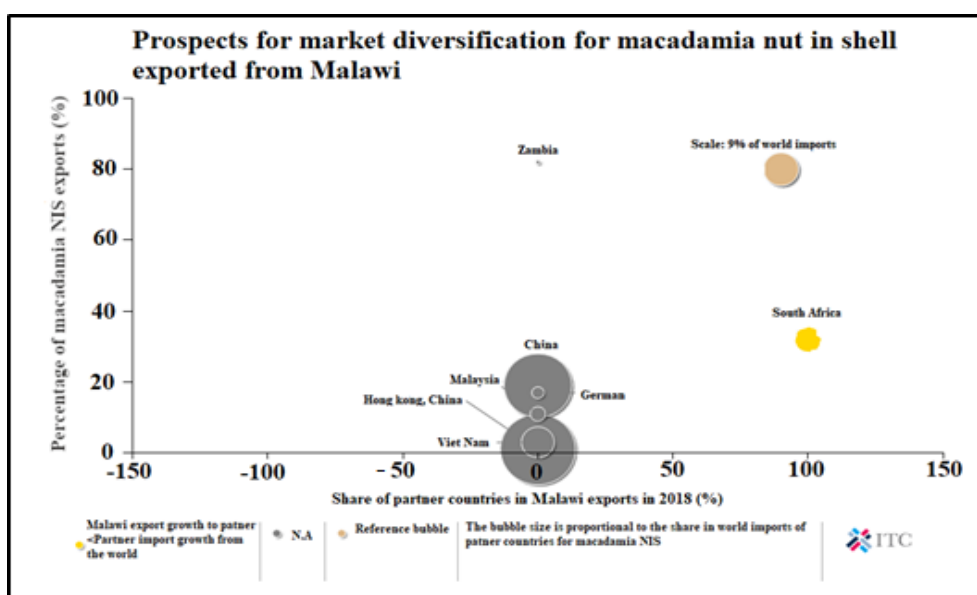


Figure 6: Growth of Malawi’s macadamia NIS exports to the partner countries between 2014 and 2018 (ITC Trade Map 2020).

The macadamia supply chain in Malawi

The Malawian macadamia value chain (VC) comprises producers (commercial estates/ macadamia processors and smallholders), aggregators (traders and associations), processors (who also export), influencers and supporting organisations. Leading influencers in Malawi’s macadamia value chain include the Ministry of Agriculture, Irrigation and Water Development, Malawi Bureau of Standards, Ministry of Industry, Trade and Tourism, the Tree Nut Growers Association of Malawi and HIMACUL. Other stakeholders supporting the macadamia value chain are AgDevCo and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). The visual mapping of Malawi’s macadamia value chain is shown in Figure 7.

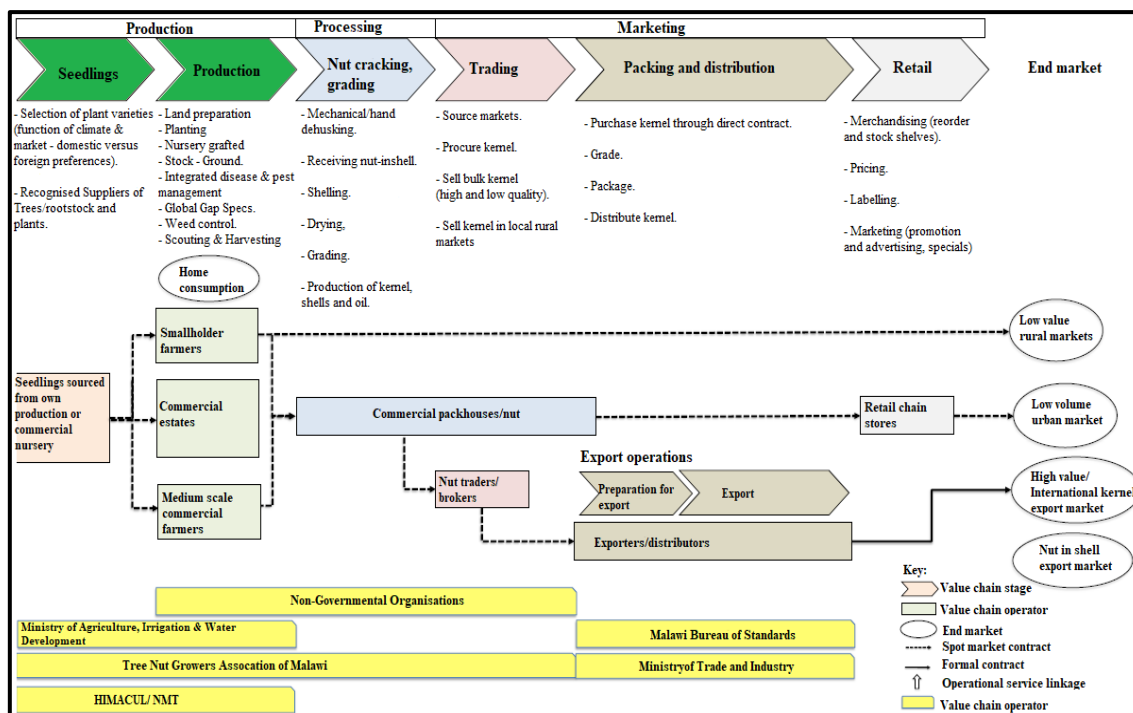


Figure 7: Malawian macadamia value chain.

Producers (commercial estates and smallholder farmers)

Macadamia production in Malawi is mainly commercially estate owned with some 3,850 macadamia smallholders spread out over the southern (Mulanje, Mwanza, Neno and Thyolo districts) and central (Dowa and Ntchisi districts) regions in the country. Until recently smallholder production was concentrated in these two regions in Malawi. However, TE has established a macadamia processing plant in the northern region, which has led to an increase in smallholder macadamia planting in the region, especially in Chitipa, Mzimba, Nkhatabay and Rumphi districts. In addition, smallholder macadamia production has also started to take shape in Lilongwe and Kasungu district, which are in the central region of the country. Toit et al. (2018) reported that the bulk of expansion in macadamia production in terms of area and volumes predominantly emanates from existing farmers expanding primary operations, while new entrants contribute very little growth into primary production.

Farming units for macadamia production among smallholder farmers vary in size and can range from tiny (≤ 0.1 ha) to larger profitable farms (≥ 4 ha). However, the majority of smallholder macadamia producers individually do not produce sufficient volumes (≤ 100 kg ha⁻¹) to justify the time and capital investment involved in processing and market development. These key-value chain activities of processing and marketing have been

taken on by a few large-enough horizontally integrated individual PMs such as NTEL (Kuilman 2010). Because of this, the buying and selling power in a small market like macadamia is concentrated in the hands of a few large PMs that ultimately control the industry value chain. Further, the control of the industry value chain by a few large PMs is not ideal, but without them, the industry value chain would fail (Kuilman 2010).

Individual growers have a choice of delivering nuts to any of the seven PM plants, most of which are conveniently located within a small distance to their farms. Additionally, these farmers also tend to sell some of their nuts to intermediaries, who later deliver them to the PMs. In contrast, HIMACUL members aggregated the nuts in their respective cooperative business centres which are further dried to a moisture content of less than 5% and are later delivered to HIMACUL central warehouses in Ntchisi or Neno. HIMACUL take responsibility for further drying and grading of the nuts before delivering them to either one of the PMs.

With high pest and disease incidences, the relevance of agricultural input supply shops cannot be overemphasised. To facilitate access to farm inputs, HIMACUL provides input loans (fertiliser) to their member cooperatives and individual clubs which is repaid at the end of each harvest season. The same has been reported to the in-grower smallholders associated with the PMs. Macadamia seedlings are mainly sourced from HIMACUL and estate nurseries. However, some farmers, especially members of HIMACUL, produce their seedlings through grafting techniques for their use and sell the excess to other farmers.

Nut vendors or middlemen

Macadamia nut vendors or go-betweens are unregistered buyers of macadamia nuts. The vendors buy macadamia nuts from farmers at farm gate prices and sell them again to registered traders or processors. Therefore, the central role of vendors is buying and assembling the nuts. Vendors do this through a door to door buying and involve the use of pails and tins as standard measures at pre-established non-negotiable prices. Vendors are predominantly men as the activity of buying requires much heavy lifting of produce, walking long distances and spending long periods away from home.

Vendors are perceived as tricksters because they buy macadamia nuts cheaply from farmers than cooperatives and estates and usually buy the crop without any quality

specification. For example, farmers had reported instances when the vendors bought the crop while it was still not adequately dried taking advantage of the farmers' financial hardships when they are looking for school fees and other household necessities, especially in January.

HIMACUL

Highland Macadamia Cooperative Union Limited conducts and coordinates various activities of seven primary cooperatives in Malawi. HIMACUL is involved in various activities of macadamia nut aggregation which include bulking of macadamia nuts from its member farmers, further drying and grading of the crop and further facilitation in the transportation of the nuts to processors and trading.

Macadamia Processors/marketers (PMs)

The Malawian macadamia industry receives very little assistance in terms of infrastructure development from the government. It is, therefore, consisted of privately-owned processing plants that perform the complete and fundamental processing procedure, covering dehusking, NIS grading, curing, cracking, kernel grading, and packaging. Marketing is the responsibility of the PMs who find buyers and negotiate a price for the product. Apart from adding value to macadamia by processing it, processors also act as traders, in that they aggregate small amounts of the crop through vendors. However, no governing authority for macadamia exists, and the processors themselves determine commission tariffs.

Government of Malawi

The main influencers in Malawi's macadamia value chain under the mandate of the GoM are the Ministry of Agriculture, Irrigation and Water Development, Malawi Bureau of Standards and Ministry of Industry, Trade and Tourism. The Ministry of Agriculture, Irrigation and Water Development is responsible for various tasks within the value chain which are outlined below:

- Provision of agricultural advisory services (Department of Agricultural Extension Services).
- Research services (Department of Agricultural Research Services).

- Provision of irrigation services such as drilling of boreholes (Irrigation Department).

The Malawi Bureau of Standards (MSB) is the national standards organization of the Republic of Malawi. MSB is responsible for standardization and quality assurance of products being processed and sold within and outside of Malawi. The Ministry of Industry, Trade and Tourism is mandated to facilitate the trade of goods and services within Malawi and in international markets. They are also responsible for the promotion of the Malawi National Export Strategy.

Tree Nut Growers Association of Malawi

The Tree Nut Growers Association of Malawi (TNGAM) acts as the bridge between macadamia PMs and producers. Additionally, TNGAM is responsible for representing Malawi nut growers at a world scale. However, the organization has not been as vibrant as it should have been, and farmers describe somewhat not performing its duties.

Non-Governmental Organizations (NGOs)

Various NGOs play different roles in the macadamia value chain in Malawi. One of the prominent NGOs is GIZ which has been working in Malawi to improve the macadamia value chain through the inclusion of more smallholder farmers in macadamia production as a way of diet and income diversification, training smallholders in farm business management and facilitation of linkages between public and private actors within the value chain. Another important NGO in Malawi's macadamia value chain is AgDevCo which is a social impact investor and fund manager. AgDevCo invested \$2.1m in TE in 2014 to develop a 518ha irrigated macadamia hub farm and a 1,000 MT processing facility and is looking at a second phase investment of \$3.5m to further increase their production base and outreach program (Khan 2016).

Wholesalers, retailers and value-adding sector (WVAs)

Macadamia nuts from Malawi are mostly sold as NIS to South African traders who pack and distribute the NIS into the European snacking market (Scheepers 2018). Macadamia kernel mainly finds its way on to the European and USA market as an ingredient in candy and confectionery. Recently, packers of snacking food also roast and flavour macadamia

kernel, after which it is packed as part of a nut mix or pure macadamia snack pack destined for the snacking market both locally and internationally (Emmott 2020).

Sound kernel not suitable for the snacking, candy or confectionery markets is processed into oil or macadamia butter. Macadamia oil is used as a salad dressing or cooking oil or as a base for lotions and creams in the cosmetic industry. Macadamia butter is used as a spread or as a base for pesto and flavouring (AMS 2015).

Macadamia shells have various applications which include being processed into charcoal briquettes, pressed board wood products, brake linings, sandblasting agent and carbonated shells are used for cleaning water. In unprocessed form, macadamia shells are used as mulch in gardens, as well as fuel in the boilers of the macadamia processing plants and for cooking or warming water.

Current and future of macadamia production in Malawi

Access to quality seedlings

Lack of access to quality seedlings is a significant challenge that many smallholders face in Malawi. The country has a limited number of certified seedling supplies to cater for the growing demand of macadamia seedlings (Toit et al. 2018). Another limiting factor is the high-cost cost of seedlings (\$3.30 seedling⁻¹) which is prohibitive for many smallholder farmers in the country (many smallholders considers macadamia production to be an expensive venture, which is due to a few seedling suppliers who take advantage of the situation). However, there has been an increase in capacity building of smallholders in nursery/seedling production by HIMACUL, and commercial estates to overcome this challenge.

The adaptability of macadamia cultivars in smallholder Agro-Ecological Zones

Macadamia tree yields and whether it thrives in an area depends on its interaction with the Agro-Ecological Zone (AEZ). Malawi consists of eleven distinct AEZs, and a single district can have different microclimates within a single AEZ (Parshotam 2018). This causes varying responses in terms of crop growth and yields within the same district and may affect harvesting patterns among crop cultivars due to altitudinal differences. For instance, differing climatic conditions in the macadamia growing regions of Australia were found to be the primary reason for the poor performance of Hawai'ian cultivars in

the country which has led to lower yields and unpredictable nut quality (Cull 1978). Besides, in Australia trees produce an average yield of 20 kg of nuts tree⁻¹ as compared with 45 kg of nuts tree⁻¹ in Hawai'i. Generally, this is not unexpected as the Hawai'ian cultivars were selected under totally different climatic conditions (Winks 1988). A similar phenomenon has been reported in Malawi, where nut yields of Hawai'ian selections have been as low as 10 kg of nuts tree⁻¹ (Phiri 1991).

Majority of macadamia cultivars grown in Malawi are Hawai'ian selections (Hancock 1991). The cultivars were specifically introduced in Malawi for plantation production in the southern region of the country after recommendations from research work conducted at BARS (Eed et al. 2016). However, promotion of smallholder macadamia production by the GoM has since been extending to the central (Ntchisi, Dowa, Kasungu and Lilongwe) and northern (Rumphi, Chitipa, Mzimba, and Nkhatabay) regions of the country (AfDB 2009).

Despite this development, the yield of macadamia among the small-holdings is still very low (≤ 200 kg ha⁻¹) than the optimum (1200 kg ha⁻¹), and the quality of the nuts are inferior compared to the large-scale producers (Toit et al. 2018). Low productivity and poor quality reflect inadequate information on the right cultivars for production among the smallholder AEZs within the country. Figure 8 shows the performance of macadamia cultivars grown by HIMACUL cooperatives in Malawi. It can be observed that yields vary as a result of differing AEZs among the cooperatives. Showing that macadamia yield and suitability is thus subject to a robust cultivar-environment interaction. No research currently exists that explores the impact of climate on macadamia growth and development under smallholder production in Malawi (Eed et al. 2016). Therefore, research is required in order to identify and recommend cultivars for the smallholder growing areas for optimum yields.

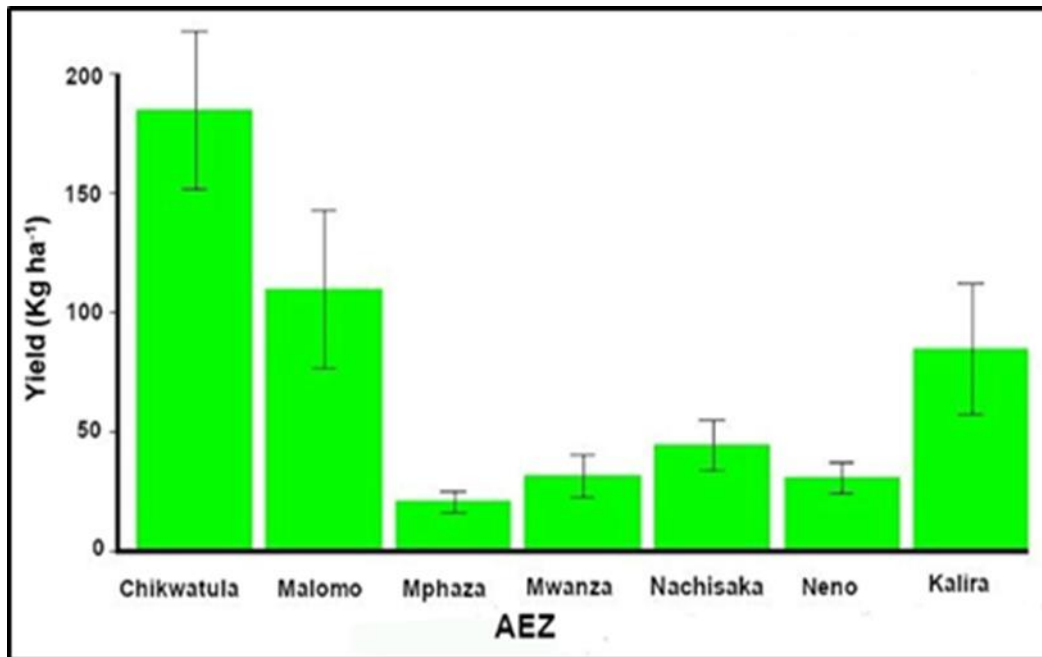


Figure 8: The influence of Agro-Ecological Zone on macadamia yields

Availability of Agricultural Extension Services

The availability of agricultural extension staff and macadamia experts in the macadamia value chain in Malawi is minimal, and this has become less available after the FIDP, and AfDB projects have phased out (Toit et al. 2018). Macadamia activities have become not self-sustainable, and many smallholders have not reaped long term benefits of the crop. Consequently, trees have been neglected, and farmers have received little technical and management support from the government. For macadamia nuts to remain viable in Malawi as a long-term initiative, providing smallholder farmers with the necessary extension services and technical support is essential. Currently, cooperative extension services are a practical solution, for example, HIMACUL has been able to successfully train its lead/model farmers in macadamia good agricultural practices, who in turn train other farmers (2019 personal interview A Emmott and K Mkangala with me; unreferenced).

Infrastructure Development

Macadamia production and processing requires sophisticated infrastructure and equipment (storage sheds, drying racks, a good network of roads and a processing factory within the vicinity of production areas) to be put in place for profitability. Currently, processing companies of macadamia are privately owned, with limited access for smallholder farmers making it expensive for them due to distance. Smallholders

cooperatives travel over 600 km for their nuts to be processed (Parshotam, 2018). The solution to this challenge is smallholder aggregation of NIS macadamia and, in the future, the GoM should assist these smallholders in building their factory for processing the nuts.

Pests and Diseases

Pests and diseases are a significant challenge in macadamia production in Malawi. These can cause yield losses of up to 100% and affects the quality of the crop. Common pests of macadamia of significant importance in Malawi are fruit borers, tropical nut borers, stink bugs and termites.

Conclusions

The macadamia sub-sector in Malawi is currently well established than it was in the early days of establishment and competes with other crops for land. This review has shown for the first time that the macadamia nut production has some positive impacts on Malawi's economy as foreign exchange earning commodity and as a food source. However, there is little government-driven involvement in the sub-sector compared to the enormous investments the private sector is putting in place. There is, therefore, a need for the GoM to take active participation in the macadamia value chain policy formulation, given its importance to Malawi's economy and food security. This would assist smallholder farmers in having better prices of their crop, provision of agricultural advisory services and investments in infrastructure for processing the crop. In addition, the macadamia value chain in Malawi is PM driven and that the governance of the value chain is located at the PM level. There is, therefore, a need for the GoM to work with these PMs to ensure that the crop is productive to all and that pricing is fair for the smallholders supplying these PMs.

Lastly, the researchers have identified that smallholder macadamia cultivation in Malawi has received little attention and cultivars are grown in agro-ecological zones that may not be suitable. This is evident by the lower macadamia yields (less than 200 kg ha⁻¹) among smallholder farmers. To further understand productivity, it will be important to evaluate the influence of climatic factors that may influence macadamia cultivar performance in the smallholder growing areas for a recommendation of suitable cultivars for higher yields and returns.

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