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# RWANDA'S ESSENTIAL OILS VALUE CHAIN: A diagnostic



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This document was prepared by a team of graduate students from Columbia University's School of International and Public Affairs, working through the United Nations Industrial Development Organization and the East-West Management Institute (EWMI), in collaboration with Ministry of Trade and Industry of the Government of Rwanda.

The authors – Priya Bapat, Giancarlo Cavallo, Eva Conway, Andreas Fransius, Julia Naegele, Yannick Saleman, and Hari Subhash – would like to thank Carl Aaron and Professor Akbar Noman for their guidance and feedback throughout the process, as well as Canisius Karuranga and Telesphore Mugwiza for their critical partnership in conducting the in-country research and interviews upon which much of this report is based. And thanks to all stakeholders within the Government and the essential oils value chain who offered their time and insights into the challenges and opportunities in this emerging sector.

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## EXECUTIVE SUMMARY

This report encapsulates findings from a diagnostic of the current status of the essential oil value chain in Rwanda. Graduate students from Columbia University, in conjunction with the United Nations Industrial Development Organization (UNIDO) and Rwanda's Ministry of Trade and Industry (MINICOM), carried out this analysis in March 2012. The UNIDO approach focuses on seven value chain dimensions: primary production and inputs; processing capacity and technology; end-markets and trade; governance of value chains; sustainable production and energy use; value chain finance; and business environment and socio-political context.

The findings presented draw from observations during field visits to the Ruhango, Kirehe, and Musanze districts, from information collected during interviews and consultations with key actors and stakeholders in the value chain, and from desk research on market trends and constraints.

The results highlight three areas where key constraints exist for the essential oils value chain in Rwanda:

1. Access to land
2. Labor
3. Public-Private dialogue

These issues are inter-connected and should be addressed collectively. Due to land scarcity and food security issues, the government maintains tight control of the allocation of wet lands. Access to land, however, is the leading difficulty cited by firms within the value chain. The lack of public-private dialogue on issues such as land policy limits the potential for reaching outcomes that are favorable to the private sector. The disconnect between the industry's need for land and the amount of land being allocated is partially due to the importance the government places on efficient uses of scarce land and management of risk associated with the current over-reliance on a single firm. Certain types of labor management structures may be more effective than others in mitigating risk in the Rwandan context, but the government and firms in the value chain have yet to agree on how to determine which models to encourage.

Other difficulties revolve around the underdevelopment of the chain. Limited knowledge of and support for essential oils crops has led to low yields and high risks for independent farmers. Furthermore, a single firm dominates the market in Rwanda. In combination with a lack of access to finance, this constrains the development of the value chain.

Based on findings and an analysis of Rwanda's development strategy documents, we propose certain recommendations based on our analysis of the weakness of the chain:

1. Forums for dialogue with the private sector should be expanded so as to decrease inefficiencies associated with the lack of transparency.
2. Research and Development (R&D) is critical for the upgrading of the value chain and must be targeted at yield improvements, and complemented by the training of farmers.
3. Energy and water management infrastructure is critical for the sustainability of the value chain and the government must work with the private sector to develop appropriate solutions.
4. Financing options should be expanded to reduce constraints for current and future essential oils entrepreneurs.

5. Monitoring and Evaluation (M&E) systems will need to be put in place to manage labor model experimentation to optimize the social impact of the sector, but also to maintain its competitiveness by being more reactive to sectoral needs.
6. Finally, the diagnostic suggests that the different ministries within the Government should first engage with each other in a coordinated effort to build the value chain. In particular, MINICOM and MINAGRI will need to develop their communication channels in order to inform each other's actions in the sector.



Ikirezi geranium field

## INTRODUCTION

This study diagnoses the current status of the essential oils value chain in Rwanda, identifies bottlenecks preventing its development, and provides recommendations to remove these bottlenecks. The diagnostic was conducted to support two major objectives: (1) providing an overview of the essential oils industry to the Government of Rwanda (GoR) in order to assess its potential to become one of the axes of export diversification to fulfill its development objectives as specified in its Vision 2020 policy document; (2) piloting the UNIDO methodology to demonstrate its utility and diagnostic capabilities for MINICOM, which actively supported the study. The views expressed here, and all errors and omissions are to be attributed only to the authors.

The study follows the UNIDO methodology of industrial value chain diagnostics (UNIDO 2011) that provides for an integrated view of the value chain emphasizing the dimensions of inputs and supplies, production and processing technology and innovation, markets and trade, value chain governance, value chain finance, energy and cleaner production and policy, environment and institutions.

The findings presented draw from existing analyses and are complemented by information collected during interviews and consultations with key actors in the value chain as well as a range of stakeholders. The authors acknowledge the limits of this information base and propose that a more detailed value chain analysis be conducted.

## MAPPING OF THE VALUE CHAIN

### PRODUCT

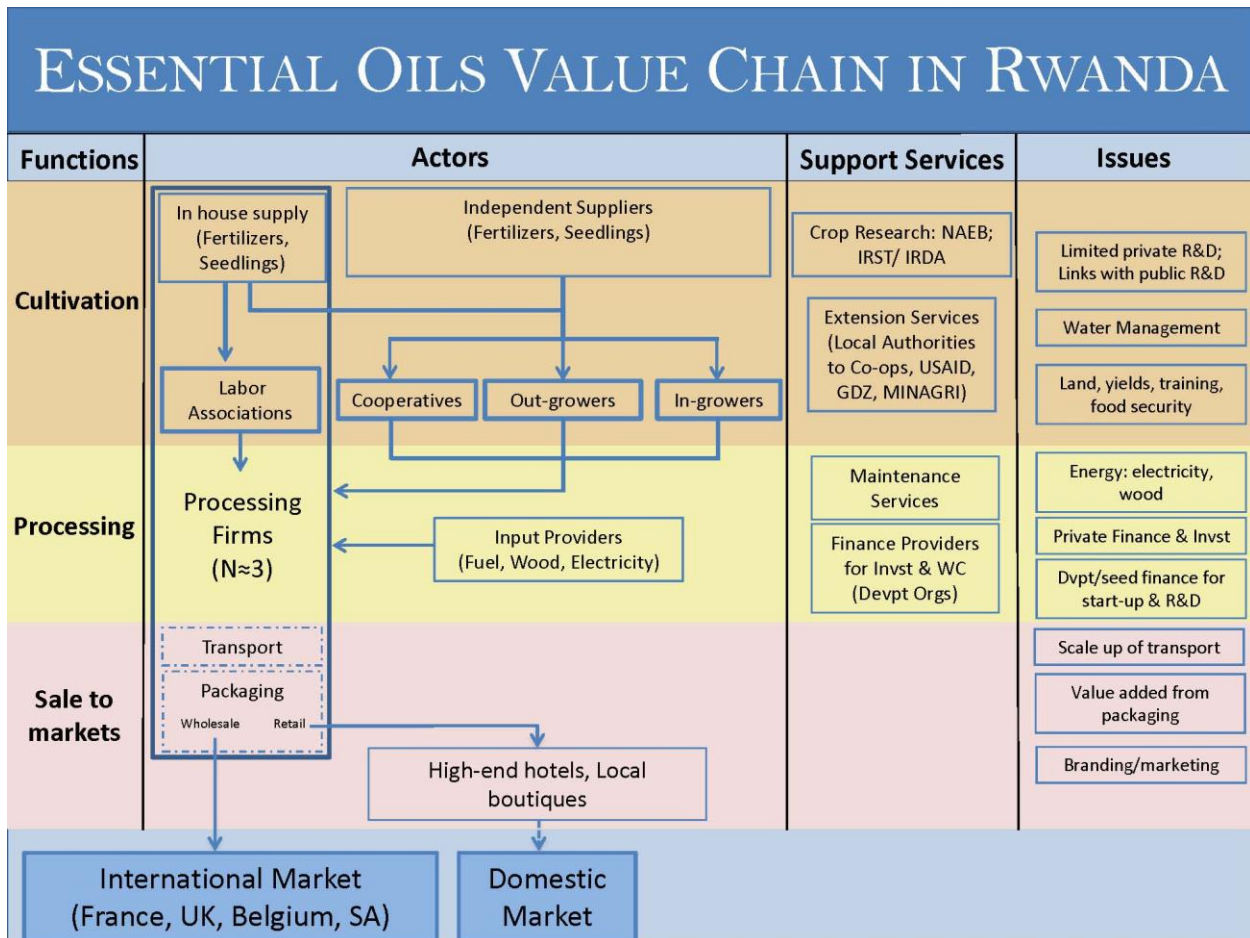
The main product in the essential oils value chain in Rwanda is the oil obtained from processing essential oil crops. These essential oils are further processed in the international market to produce perfumes, pharmaceutical and even phyto-sanitary products, depending on the plant used. So far, the few existing Rwandan firms have focused on high-value added essential oils mainly used in perfumes, such as geranium, patchouli and rose oils.

### FUNCTIONS, ACTORS AND SUPPORT SERVICES

The essential oils value chain is comprised of three main stages or functions: cultivation of essential oil crops, processing of these crops into essential oils, and sale to end markets. The primary actors are farmers and processing firms, but they require input suppliers at different stages. Support services are also necessary at all three stages of the value chain.

The map below summarizes functions, actors, support services and the issues we have identified at each stage and for each function of the value chain. It is followed by a description of each item in the map.

**Figure 1:** Essential Oils Value Chain Map



- Actors and their functions:
  - Farmers:** there are four forms of contractual agreements between farmers and processing firms: cooperatives, labor associations, in-growers and out-growers (see details in the input & supplies section, as well as the Appendix). The labor association model is the only one where it is the processing firm that owns the land and retains it. The processing firm pays a wage to the farmer partly based on output.
  - Processing firms:** there are only three active processing firms in the essential oils value chain in Rwanda at the moment. Among these three, only one is currently producing non-negligible volumes, and it is also the only one exporting. All processing firms potentially cover all functions of the value chain: they can produce their own fertilizers and seedlings in-house; as explained above, they can create their own labor associations of farmers for the cultivation of crops; they process the oil; given current low volumes they can organize transportation, do low volume retail packaging for the domestic market and wholesale packaging for export markets.



- **Input suppliers:** input suppliers are necessary in the first two stages of the value chain. When fertilizers and seedlings are not grown in-house by processing firms, or when in-house production is insufficient, processing firms or farmers call on independent, specialized suppliers of these inputs. At the processing stage, the main input required is energy, from wood and electricity. Processing units require these sources of energy to generate heat – typically through a wood furnace – and extract the oil. The most modern and efficient machines require a regular supply of electricity.
- Support Services:
  - **Cultivation stage:** crop research is mainly provided by the public sector through the recently created National Agriculture Export Development Board (NAEB), created jointly by the Ministry of Agriculture (MINAGRI) and the Ministry of Trade and Industry (MINICOM). Extension services are currently provided by several actors: local authorities, who however serve only co-operatives – a government choice; development organizations like USAID and the German GDZ; and MINAGRI itself.
  - **Processing stage:** processing units require maintenance, which is provided externally. However, this support service did not appear very prevalent at this stage as processing capacity is largely under-utilized. What is most critical at this stage is financing for investment in new machines and for working capital (WC in the diagram). Land acquisition and land preparation are also capital intensive and therefore require financing. This could be added to support services at the cultivation stage.
- Issues:
  - This value chain map has been supplemented with a column listing issues and bottlenecks at the different stages of the value chain.
  - The issues identified were analyzed to devise an action plan that will assist the government to prioritizing and sequencing its interventions. The result is the *Issues and Recommendations Map* presented below (**Figure 2**). More details are provided on the various bottlenecks throughout the Diagnostics section.

## FLOW OF PRODUCTS AND END-MARKETS

Essential oils produced in Rwanda are currently sold directly by the processing firms. The domestic market is small and reached through high-end hotels and boutiques. Retail packaging is carried out in-house for this marketing channel. The main market is the international market, though only one firm, Ikirezi, is currently selling its essential oils products for exports. Ikirezi sold around 405kg of geranium oil in fiscal year 2011, which represented most of the total turnover of around USD 90,000. In the international market, there is a further distinction between direct sales to end-user markets and sales to re-exporters, the latter further processing and adding greater value to the product before re-exporting.

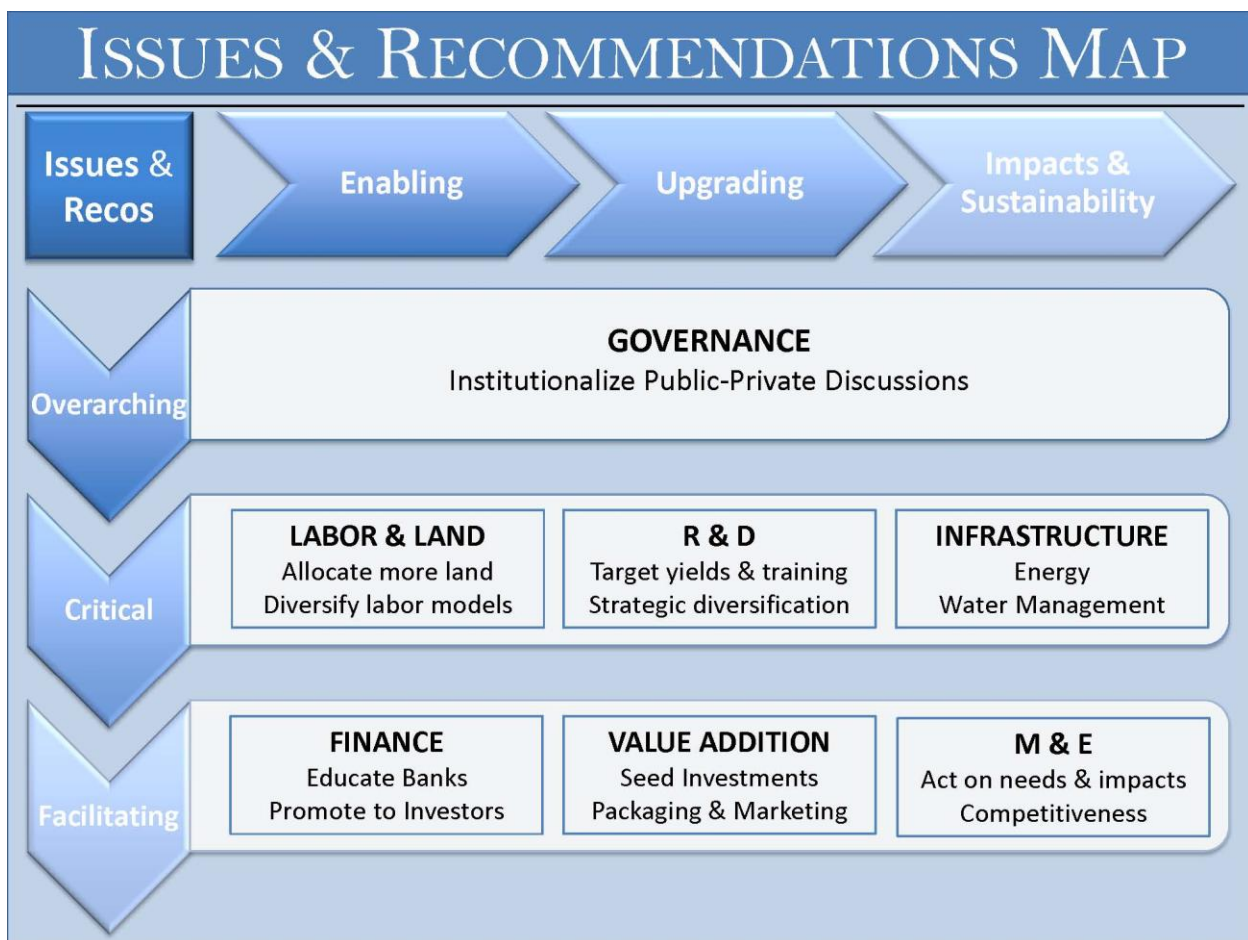
## VALUE CHAIN ISSUES AND RECOMMENDATIONS

Findings in terms of bottlenecks for the development of the essential oils value chain in Rwanda have been organized in a practical diagram below, to provide a basis for prioritizing and sequencing policy initiatives, given the multiple and complex set of development goals facing the Government of Rwanda.

Issues and recommendations have organized according to the following:

- Three levels of importance: Overarching, Critical, and Facilitating
- Three stages in the development of the value chain: **Enabling** factors that allow the growth of the value chain; **Upgrading** factors that will allow a competitive position in the current and future international market; and **Impacts and Sustainability** factors that will allow the value chain generate sustainable development for Rwanda

**Figure 2:** Issues and Recommendations Map



Below the main takeaways from this map are highlighted, in order of increasing importance, then along the stages of development of the value chain:

- **Overarching:**
  - **Governance** appeared as an omnipresent issue during field research. Interviews with key actors in the value chain and government ministries, as well as visits to the main growing and processing sites, revealed that most if not all current and future expected bottlenecks would have a much higher chance of being resolved through institutionalized Public-Private Discussions (PPD). Processing firms are expressing needs and exposing arguments that the government may not be fully aware of, at least not systematically. Similarly, the grounds for hesitation of support from the government seem unclear to the private sector. Banks and financial institutions did not seem involved in any sort of organized discussion with the sector. An institutionalized partnership should therefore be created, including all major stakeholders, to find a common ground on some of the difficult issues preventing the development of the value chain.
- **Critical:**
  - **Labor and land** issues are critical impediments to the successful development of the essential oils sector in Rwanda. Land issues revolve mainly around land allocation decisions by the government: additional land is necessary for essential oil crop cultivation to achieve economies of scale that would allow the sector to become profitable and grow. However, as land is a scarce resource in Rwanda, there are many competing potential uses. Similarly the optimization of labor practices could increase yields and therefore productivity to a profitable level, but this depends on achieving a balance between the economic and social priorities of the government.
  - **Research and Development (R&D)** is critical for the upgrading of the value chain and must be targeted at yield improvements, but also complemented by the training of farmers on new planting and growing practices and by research on new seeds and plants adapted to the Rwandan environment.
  - **Infrastructure** is critical for the sustainability of the value chain, especially in terms of energy and water management. Energy is already an issue despite low production levels and water management is critical if Rwanda is to preserve the ecosystems of its marshlands and water security for its citizens.
- **Facilitating:**
  - **Finance** is necessary for the expansion of the value chain. Constraints for current and future essential oils entrepreneurs could be reduced if commercial banks were more aware of the sector, and local and outside investors highlighted its growth potential. This will only be impactful when land and labor issues have been at least partially resolved, however.
  - **Value addition** will be necessary as the sector grows and international competition intensifies to keep margins high enough that growing of essential oil crops remains a profitable use of scarce land. Value addition could come from advanced processing of oils through seed investments and the development of packaging and marketing services.
  - **Monitoring and Evaluation (M&E)** systems will need to be put in place to manage “experiments” on labor models and land to optimize the social impact of the sector, but also to maintain its competitiveness by being more reactive to the sector’s needs. This could be done within the recommended PPD framework.

## DIAGNOSTIC OF THE ESSENTIAL OILS VALUE CHAIN

### SOURCING OF INPUTS AND SUPPLIES

Essential oil cultivation is new to Rwanda; farmers therefore have limited knowledge and support for growing this crop leading to low yields, volumes and high risks. The primary recommendations for addressing these issues are as follows,

- Dissemination of crop research: The Ministry of Trade and Industry should develop an online repository that gathers and disseminates information and research on essential oil crop production. This research can then inform farming practices and choice of inputs through extension services provided by the processing firm or by the government.
- Lowering input costs and improving quality: Farmers should be provided access to low cost irrigation technologies that do not require electricity use. There should be more research done on better quality organic fertilizers that could raise essential oil crop yields.
- Explore ways to leverage existing distribution networks: MINICOM and oil processing firms should explore how to leverage existing distribution networks so that processing firms can access produce from farms that are more distant in order to increase production capacities.
- Increase volumes and reduce risks: MINICOM should work with farmers and processors to arrive at a suitable contractual arrangement that minimizes risk for farmers while maximizing volumes.

The essential oils value chain has a limited and simple range of products and inputs, most of which are sourced locally. The primary inputs for growing an essential oil crop are seedlings, fertilizer, water, energy, labor, and farm equipment, while the primary inputs for distilling the essential oils are energy (either firewood or electricity) and water.

Currently some essential oil processors cultivate plant seedlings in nurseries and provide them directly to the farmer free of charge. This system can potentially allow the processing firm to improve the quality of seed inputs through crop research.

Another input that could be improved through more research is organic fertilizers. Farmers do not commonly use chemical fertilizers because



Ikirezi's production technician demonstrates preparation of geranium seedlings.

most oil processors buy only organic crops. They however, primarily use unprocessed manure that they source locally from either other farmers or the processor. Oil processors could therefore potentially increase yields by offering farmers better quality processed organic fertilizers rather than just manure.

Essential oil crops like Geranium and Patchouli are water intensive; however, deficiencies in electricity supply make watering fields a labor-intensive process. Only about 0.7 percent of cropland in Rwanda is irrigated<sup>1</sup>, while the rest is rain fed; and farmers observed during field visits watered their fields using hand held cans; work that is inefficient and involves hard labor. Research into small innovations such as gravity pumps or low cost foot pumps or better hand held irrigation devices could therefore go a long way in increasing productivity and reducing drudgery. While this is not a serious constraint right now since cultivation of essential oil crops primarily happens in wetlands, it could be a hurdle to extension to dryer lands in the future.

Production units currently source crops from farms near the facility (most within walking distance). The dependence on locally cultivated essential oil crops, however, may be a constraint on capacity and the operational efficiencies of production units since there is a limit on the amount of geranium that can be grown in a given area. Further development of the value chain would therefore benefit from leveraging existing distribution chains to allow production units to source from farms that are further away.

Production units located in rural areas also lack maintenance and quality transport facilities. Currently, final products are transported in small quantities using local transport means through poor-quality, unpaved feeder roads, but these will be inadequate when processing capacities increase. The nearest maintenance facilities tend to be in urban areas, which delays repairs for up to a few days for small mechanical failures.

At present, there are four forms of contractual agreements between farmers and processing firms - cooperatives, labor associations, in-growers and out-growers.

- The Government of Rwanda promotes the cooperative model in order to mitigate risks for farmers. However, some firms have reported that this model results in lower average yields, and believe that is due to a poor incentive structure that does not link effort on the commonly managed land directly to individual personal reward.
- In the labor association model, the processing firm owns the land and pays a wage partly based on output. This model, however, is constrained by the often-prohibitive cost of land that makes large-scale ownership of land infeasible for a single enterprise.
- In the in-grower model, the processing firm leases out land to farmers. Once they lease it out, they have limited control over the land or the yields. The farmer, however, is contracted to produce a particular kind of essential oil crop.
- The fourth option is the out-grower model in which farmers grow the crop on their own land and sell directly to the production unit. This arrangement is most prevalent for popular crops like cassava. However, the lack of experience in growing essential oil crops and lowered food crop production lead to higher risks for farmers. Moreover, processors do not prefer the out-grower model because they have limited control over the quality and organic nature of the crop.

In order to increase take-up in an out-grower model the Government of Rwanda and processing firms will need to augment current levels of production, lower risk for farmers and assure the quality and organic nature of the crop. This would involve risk mitigation strategies such as crop insurances, technical assistance, extension services, and loans for farmers growing essential oil crops. Processors and the government should also encourage and train farmers to grow organic essential oil crops.

## PRODUCTION CAPACITY AND TECHNOLOGY

A low level of crop production is the primary constraint to essential oil production in Rwanda. If production of biomass (raw plant material) is increased through greater land cultivation for essential oil crops, then lack of electricity and high-volume processing machinery will become significant constraints.

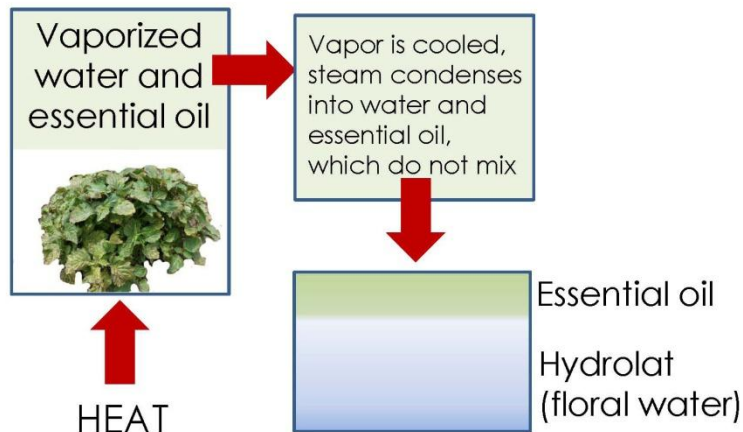
The following strategies, if implemented complementarily, could enhance productivity in the essential oils sector:

- Government policies must encourage allocation of sufficient land for cultivation and provide firms access to electricity
- Essential oil firms must be able to upgrade to more efficient, modern, high-volume processing units by utilizing a variety of financing mechanisms (discussed in detail in Section 7).

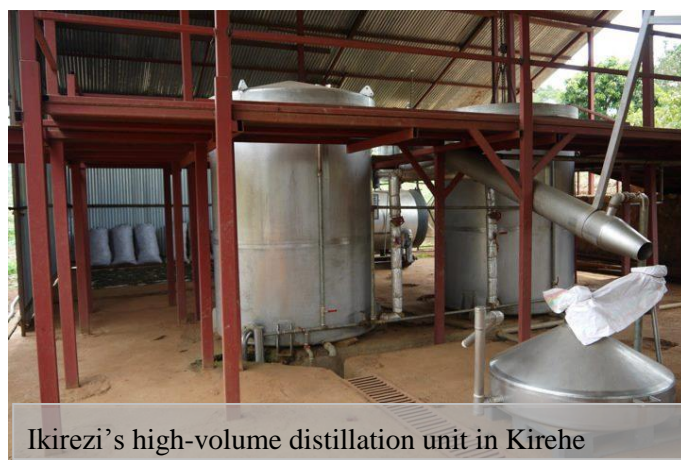
### Technology and Production capacity

Notwithstanding the more technically complex process of solvent extraction used to produce rose absolute,<sup>ii</sup> the distillation process used to produce essential oils from geranium and patchouli (as well as eucalyptus and lemongrass) is relatively simple. And because the value chain in Rwanda does not extend beyond basic distillation, all stages of transformation occur in a single location that includes the growing and processing sites. The proximity of growing sites to processing plants means the costs of transporting biomass after harvest are negligible.<sup>iii</sup> In the long term, successful firms may wish to invest in expanding processing capacities to produce higher value-added products, but such expansions will be contingent upon massive gains in yields.

The basic production process for steam distilled essential oils is as follows: once raw plant materials are harvested and sorted, they are placed in a metal still, where steam is passed through them, vaporizing the plant's volatile components. The steam and oil vapor are channeled through a pipe and condensed to a liquid mixture of water and oil. The water and oil mixture is collected in a flask where it naturally separates, leaving the hydrolat (the water byproduct) and the pure essential oil.

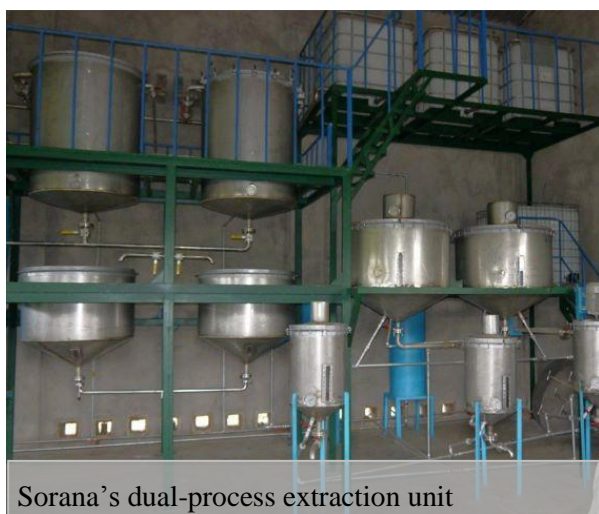


Ikirezi is currently the essential oil industry leader in Rwanda. It is the only firm exporting organic geranium oil.<sup>iv</sup> It has four growing sites, totaling approximately 30 Ha of land cultivated for essential oil production: Gasabo (1 Ha), Ruhango (3 Ha), Kiyombe (6 Ha), and Gahara (20 Ha). Each site is endowed with a low-volume distillation unit that requires fire wood to generate the heat for processing and water for steaming the biomass, and is capable of distilling 1,000 kg of biomass per day (4 batches of 250 kg), which can produce up to 2.2 L of oil. While Ikirezi's main crop is geranium, the firm is actively researching the potential to grow and process patchouli oil, with a nursery and propagation field of about 1 Ha at the Gahara site.



Ikirezi's high-volume distillation unit in Kirehe

Ikirezi has invested in a modern, high-volume distillation unit at its Gahara site that is more efficient than the smaller units, capable of distilling 4,200 kg of biomass per day (6 batches of 700 kg), which can produce up to 9.2 L of oil. But this machine requires electricity to pump water and heat through the machine, and thus it currently sits idle for lack of electricity and sufficient quantities of biomass.



Sorana's dual-process extraction unit

Outside of geranium and patchouli oil production, another firm making forays into the sector is Sorana, a potential producer of essential oil of the flower, *Rosa centifolia*. Sorana's growing and processing site is located in Musanze. It consists of approximately 1 ha of cultivated land, and is equipped with a modern, high-volume processing unit capable of both common distillation as outlined above, and solvent extraction, to produce rose concrete and absolute (most commonly used in perfumes).<sup>v</sup> Sorana's intention is to focus solvent extraction to produce oil from *Rosa centifolia*. The site employs 7 people and the plant has a processing capacity of up to 1,800 kg of biomass per day, which can produce up to 1 L of

oil. However, Sorana is not currently producing any oil for the same reasons as Ikirezi's modern plant. Of note, however, is that Sorana's plant has built-in capacity to generate hydroelectricity. The actual facility is in disrepair, and would require rehabilitation, but the potential to utilize hydropower is a major advantage and should be a key factor in Sorana's operational goals.

## Knowledge Use

Given the current composition of the chain, there is little opportunity for inter-firm knowledge sharing. The most important knowledge sharing linkages at the moment are between the government and the firm, and between the firm and farmers, and they primarily revolve around crop production.

A close government-firm knowledge link is crucial for coordination and optimization of research and development efforts towards the selection of appropriate crops, dissemination of best growing practices, and the provision of expert extension services to new and developing firms. These services currently come from a number of sources: the firms themselves, local authorities, APDRWA, and (German NGO).

An effective knowledge link between government and firms will facilitate a more effective link between firms and farmers, which is as critical to the development of the chain as the material issues of land, electricity, and machinery discussed above. Farmers' lack of familiarity with essential oil crops and how to grow them, and the perceived and real risks inherent in the decision to not grow traditional staple crops, continue to comprise a major obstacle to increasing yields through greater participation of local growers. The success of the essential oils value chain depends in large part on the ability of firms to engender the confidence and commitment of farmers to grow the crops.



Ikirezi technician explaining the displacement process by which essential oil is separated from the floral water



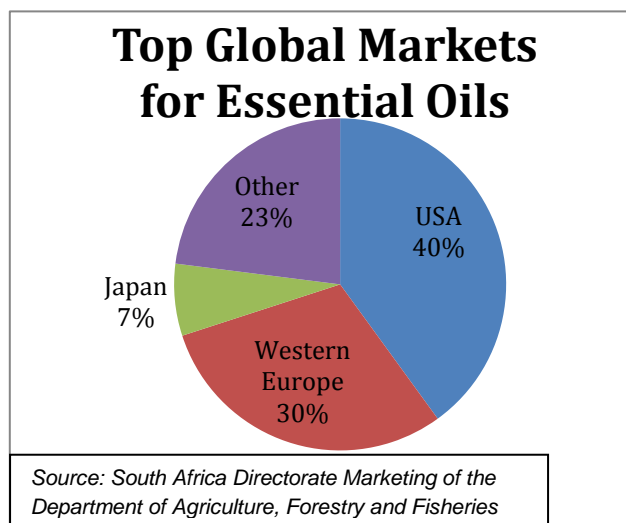
## END MARKETS AND TRADE

- The main challenge to evaluating opportunities and constraints for entry and/or expansion in various markets is the limited detailed market information available for essential oils
- Government support is needed for R&D and investment promotion of Rwandan essential oils

### Global Market

Essential oils are generally sold and used in their primary form without further processing into synthetic chemicals. They are used in high-end products in the flavors and fragrances industry, which is dominated by Europe, North America and Japan. In 2010, the international flavors and fragrances industry reached estimated sales of 22 billion USD.<sup>vi</sup> The EU leads in world trade of essential oils but is nevertheless not a major oil producer; most essential oils are re-exported.<sup>vii</sup>

The top ten crops used in essential oil production account for 80% of the world market for essential oils. Geranium, patchouli and rose are primarily used in the fragrances market where the whole oil is used.<sup>viii</sup> Eucalyptus, and lemon grass are lower value oils used as a source of specific compounds. Geranium, eucalyptus, and lemon grass are among the most highly demanded essential oils.<sup>ix</sup> Leading consumers of essential oils are the USA, followed by Western Europe and Japan.<sup>x</sup>



Little quantitative data exists on the international trade of individual oils. Different oils are generally grouped together in import data. Development of intermediary processing at the origin, namely in China, Indonesia, and India has changed the type and classification of products exported, making the scale and value of production of the basic essential oils difficult to assess.<sup>xi</sup> Moreover, the essential oils market is relatively fragmented among end-user industries, and end product manufacturers do not generally purchase essential oils directly from producers.

The global market for essential oils is expected to grow with increasing preferences toward natural, organic products with increasing consumer demand for aromatherapy, perfumes, flavoring, and cosmetics.

### Individual Essential Oil Markets

Each of the essential oil markets that are worth considering for Rwanda – geranium, patchouli, lemon grass, eucalyptus, and rose – have different demand levels, price points, and opportunities for Rwandan essential oil producers. Background on the markets for each of these oils is included in the tables below and in the Appendix.

**Table 1: Main Competitors in Each Market**

Geranium	Egypt, China, La Réunion, South Africa, Zimbabwe, Swaziland, Zambia, Mozambique, Malawi, Madagascar, Kenya, Morocco & Algeria, India, Indonesia
Patchouli	Indonesia (supplies 90% market), China, Brazil, India
Lemon Grass	Guatemala, China, India
Eucalyptus	Portugal, Spain, Brazil, Australia, South Africa
Rose	Bulgaria, Turkey, Morocco, India, Egypt

**Table 2: Global Production/Price v. Domestic Production/Price<sup>xii</sup>**

	World Production (MT/year)	Global Market Price (USD/kg)	Rwanda Production (kg/year)	Rwanda Price (USD/kg)
Geranium**	400	\$150/\$250*	350*	\$185*
Patchouli	1,500 – 2,000	\$68-108	210	
Lemon Grass**		\$9-17	400*	\$19/\$30*
Eucalyptus**				\$11 (projected)
Rose				

\*organic oil

\*\*Ikirezi figures are used as proxies for Rwandan figures

### *Geranium*

Geranium oil is one of the most marketed essential oils and is used for the synthesis and manufacturing of a large number of high grade and superior quality perfumes. In 2005, world production of geranium oil totaled more than 400 metric tons per year with a monetary value of more than 30 million USD. This figure was expected to reach 500 metric tons in 2011. Organic geranium oil accounts for around 7-10% of the market valued at an estimated 13 million USD.<sup>xiii</sup>



Geranium plant

Reunion Island has produced geranium oil for over a century and is said to make the highest quality oils, known as ‘Bourbon oils’.<sup>xiv</sup> Oils of Reunion origin therefore maintain a premium on the geranium oil market. Preferences for ‘Bourbon’ oils in the fragrance industry are due to a better aroma profile than those of Chinese and Egyptian origin. Some African exporters, like Rwanda, have been successful at producing oil of comparative quality to the ‘Bourbon’ variety.<sup>xv</sup>

Demand remains substantial and stable. Declines in exports from China, Reunion and Egypt suggest that there is an opportunity in the short and medium term for entry into the market and potential for Rwanda to expand its market share. Long-term price trends suggest a continued increase in market prices<sup>xvi</sup> and Rwanda’s current focus on organic production is a further advantage as consumer preferences and demand for natural products continues to grow.

### *Patchouli*

Patchouli is a medium volume essential oil mostly used in high-end, high quality fragrances. Indonesia accounts for upwards of 90% of world supply of patchouli oil, exporting an estimated 1,200 MT/ year, 25% of which goes to India. Approximately 900 tons go to western markets dominated by Europe, namely Switzerland and France, leaders in trade. The long-term average export price of patchouli oil ranges from 20 to 30 USD/ kg, although prices are historically highly volatile. Demand for patchouli oil is relatively inelastic and substitution for synthetics requires an exceptional rise in prices.<sup>xvii</sup> The market for patchouli oil has experienced a great deal of price variation due to unstable supply as growers often shift to other crops with higher return. Moreover, prices are expected to stabilize and new origins identified as the industry has recognized the need for secure supply required for the production of high-end fragrances.



### *Lemongrass*

Lemongrass essential oils are used in a wide range of household products and low-grade, inferior quality perfumes. Lemon Grass essential oil is also a primary source of citral, a raw material used in the production of Vitamins A and E and ionones. The two dominant species used on the market are *Cymbopogon Flexuosus* and *Cympogon Citratus* with little distinction between the two. In recent years, lemon grass oil has faced sharp competition from synthetic oils and also from *Litsea Cubeba*, a Chinese oil also found to be a raw material for citral.<sup>xviii</sup> The market suffers from a great deal of price fluctuation, largely a result of export quantities from India, the largest supplier of lemongrass oil on the international market.



## *Eucalyptus*

Eucalyptus essential oil is used in the pharmaceutical and fragrance industries. Species used to produce eucalyptus essential oil include *Eucalyptus Globulus* (currently grown in Rwanda), *E. Smithii* and *E. Australiana*, which are used in the pharmaceutical industry. *Eucalyptus Citrodora* is used in the fragrance industry as the main source of citronella. In 2005, *E. Citriodora* accounted for less than 10% of world production. However, increasing preferences for natural products instead of those that are chemically synthesized is expected to lead to increased demand for *Citriodora*. Demand for eucalyptus oil (and its constituent cineol) in pharmaceuticals is also believed to be steadily increasing.<sup>xix</sup>



Eucalyptus plant

## *Rose*

Rose oil, extracts and derivatives are used in products of the highest quality and are among the most important ingredients in natural perfumes. An average of 1 kg of oil is extracted from 3 to 5 tons of rose flower leaf.<sup>xx</sup> Of the two principal varieties used in rose oil production, *Rosa centifolia* is grown in Rwanda.<sup>xxi</sup> Together, Turkey and Bulgaria produce 80% of total supply with small volumes exported by Morocco, Iran and Mexico.<sup>xxii</sup> International trade volumes of rose oil are particularly low compared to other essential oils, totally just 4.5 tons in 2001.<sup>xxiii</sup>



Rosa centifolia plant

Limited and inconsistent data exists on the rose oil market but it is generally characterized by intense competition and consumption is reportedly much lower than total annual production, causing producers to carry over surplus stocks from year to year.<sup>xxiv</sup> Rose oil generally commands prices from 3000-5000 USD/kg. Aroma profile quality is the key factor in end market prices. Quality is said to depend on species used, cultivation protocols and distillation/extraction processes.<sup>xxv</sup> The cosmetics industry prefers to process organically produced rose oil as a result of growing consumer demand for organic products.<sup>xxvi</sup> Trade requirements are based almost entirely on the aroma profile and preferences of buyers indicating significant barriers to entry in the market. An IFAD working paper on Essential Oils Development in Rwanda suggests that trial quantities of rose oil be piloted on the market in order to assess the real potential for the successful export.<sup>xxvii</sup>

## Target Markets

In Rwanda, a small percentage of essential oil production is sold on the domestic market to hotels and boutiques while the bulk of output is sold to South Africa and EU importers for processing, value addition, and re-export. The core market sector for geranium and patchouli oils is the fragrance market. Currently, the demand for Rwandan essential oils outstrips supply, as production capacity is unable to meet the requirements of its small client base.

Karisimbi Business Partners identifies three categories of end markets for Rwandan essential oils: consumers, institutional, and industrial clients, each with distinct concerns. Consumer clients, who are more likely to be in the domestic market, are primarily concerned with quality, availability and affordability. Institutional clients are more interested in consistency of both quality and availability. Likewise, industrial clients are also concerned with consistent availability as well as quality certifications and mass volume.<sup>xxviii</sup> As the domestic market is limited in both size and potential for expansion, the Rwandan essential oils trade should be geared primarily toward institutional and industrial clientele.

Limited information is available on how many players there are in the institutional and industrial markets. There are, however, strong indicators that for at least some of the essential oil crops, there is a latent demand for Rwandan essential oils that is not being met by current production levels. Ikirezi, the dominant player in the Rwandan essential oils market, has confirmed contracts with three international companies and currently cannot match their supply with the requested demand for both patchouli and geranium oils.<sup>xxix</sup> The lemongrass and eucalyptus oils are not as well developed in Rwanda, but could also be promising opportunities for Rwanda. Due to high levels of competition in the global market, more research is needed on the potential for rose oil production before assessing its potential for Rwandan producers.

### **Niche Market Areas**

Within the essential oils market, there are three “trends” that IFAD identifies as important for determining standards and quality of the product: certification, sustainability, and traceability.<sup>xxx</sup> Certifications refer to the standard ISO certifications required for export but also organic, fair trade, and others. Organic oils command a higher premium, but in some cases are not worth the logistical efforts, particularly given the fact that the demand for both conventional and organic essential oils is on the rise.<sup>xxxi</sup> For oils that are used to make specific compounds like eucalyptus and lemongrass, organic certification may not be worthwhile, especially because of the lower price margin for these oils compared to geranium and patchouli. Fair trade certification is not currently offered for essential oils. However, given the social dimensions of Ikirezi, the sector’s leading firm, it may be worthwhile to pursue alternative certification methods for socially conscious companies, such as the Rainforest Alliance certification.<sup>xxxii</sup> The Rainforest Alliance certification also accounts for issues of environmental sustainability.<sup>xxxiii</sup>

More targeted research of potential opportunities and constraints concerning eucalyptus, lemon grass and especially rose oil is recommended to inform expansion of Rwandan production. End markets, standards and branding should thus be a priority consideration for R&D in the sector. Finally, government support is needed for exploring the potential of new markets as well as linking companies to markets via trade fairs and other industry-centered venues.

## VALUE CHAIN GOVERNANCE

The power dynamics of the essential oils value chain place specific constraints on upgrading:

- For upgrading to take place, the Rwandan government would need to support firms in obtaining sufficient land for cultivation and systems of irrigation
- Regular public-private consultations would be an effective way for private firms and local farmers to address needs like these with the relevant government ministries

### Dominant Actors

The first step to evaluate the power dynamics in the value chain is to study the leading firms. The following section will therefore focus on Ikirezi, and the source of and constraints on its prominent role.

Ikirezi is in a strong position as it is Rwanda's only competitive producer of geranium oil. It is also the dominant producer of patchouli oil, although Biolandes Rwanda also carries out some production. However, Biolandes purely sells to its French parent company and has a limited production area of only 10 Ha.<sup>xxxiv</sup> A similar picture emerges on the processing and packaging side, although APDRWA also takes part in the processing and packaging of patchouli. In the case of *Rosa centifolia*, Sorana has 1 Ha under cultivation but the company has yet to start processing, although tests have been carried out using eucalyptus.

In relation to farmers who grow geranium and patchouli crops, Ikirezi has significantly more market power. Ikirezi can sell the distilled essential oils at a considerable premium, as both types of crop can be bought from farmers at low prices. Indeed, geranium oil is currently sold at a gross margin of 80%. However, the company's mission as a community interest company (CIC) means that it strives to provide sustainable livelihoods for smallholder farmers, particularly targeting widows and orphans. Ikirezi could potentially pay even lower prices to farmers than it does, and extract higher revenues, but it chooses not to do so in order to support vulnerable communities.

On the retail side, Ikirezi benefits from strong market demand for essential oils on international markets. It has secured guaranteed supply contracts with three major international buyers: MANE (France), Teubes (South Africa) and S&D Aromas (UK).<sup>xxxv</sup> Despite the strong demand for its products, Ikirezi's low annual production means that it is not in a position to exert any meaningful market power in relation to its buyers. Furthermore, these international buyers subsequently blend and homogenize Ikirezi's products in order to turn them into products with a higher level of value-added. These products then sell at a considerable premium on international markets.

In addition, Ikirezi is highly dependent on decisions taken by the Rwandan government. Its production is constrained by the relative scarcity of available land, as Rwanda is the most densely populated country in Africa. To increase production to take a greater share of world markets, Ikirezi needs to receive larger allocations of land for cultivation. In addition, it needs more consistent water and efficient irrigation systems.

For these reasons, Ikirezi's position as a dominant producer of essential oils in Rwanda has not endowed it with a powerful position in the larger value chain. Its market power is limited by its being highly

dependent on three powerful international buyers and its possibilities to scale up production are limited by government decisions.

### **Type of Governance**

The governance of the value chain can be characterized as a quasi-hierarchy, which is typical of a set-up where buyers in developed countries are able to dictate conditions to their suppliers in developing nations.<sup>xxxvi</sup> In such situations, buyers are able to exert influence over the quantity, quality and price of the goods. Essential oils do not fit neatly under this rubric because buyers have a limited ability to determine quantity, as demand for geranium and patchouli outstrips supply.<sup>xxxvii</sup> However, this does not necessarily put Ikirezi in a more powerful position, as it is dependent on the government to scale-up production.

### **Upgrading Possibilities**

Ikirezi's position in the value chain is currently constrained by the lack of access to land.<sup>xxxviii</sup> In order to increase production it therefore needs to coordinate its interests more effectively with the government. The same holds true for the local farmers, who need to find effective means of making their needs known to the government, notably in the area of irrigation. An effective upgrading strategy therefore calls for a more extensive public-private dialogue to ensure that the Rwandan government responds to the needs of domestic producers. Such a dialogue should take place within an institutionalized framework with regular meetings between farmers, producers, processors, and government officials. These issues will be discussed in further detail in the Business Environment section.



## SUSTAINABLE PRODUCTION AND ENERGY USE

The main challenges in this dimension of the value chain are:

- A lack of availability of efficient and sustainable energy sources for fueling distillation units, which forces producers to use more environmentally harmful energy sources, like wood
- Limited irrigation infrastructure requiring expansion into the environmentally fragile marshlands in order to secure a sufficient supply of water
- Environmental stresses on the marshlands as a result of farming, e.g. destruction of the watershed, pollution, and erosion

Current production of geranium, *Rosa centifolia*, and patchouli in Rwanda does not utilize many inputs beyond land, water, and manure-based fertilizers, which limits the number of environmental issues facing essential oil production. Although the use of inorganic and chemical fertilizers is not widespread in the agricultural sector in Rwanda, precautions need to be taken to ensure that fertilizers do not contaminate the lands and water supply. The Rwandan government does have environmental protocols in place, but the degree to which agricultural byproducts are properly disposed of is uncertain.

A major challenge for sustainable energy use is the insufficient or complete lack of access to the electrical grid. For example, although Ikirezi does own high-volume, energy-efficient distillation equipment, it cannot use it due to an inadequate supply of power.<sup>xxxix</sup> Other distilleries are capable of being powered by solid-waste fuel, yet the companies do not have an adequate supply of agricultural waste products to use.<sup>xi</sup> Companies such as Ikirezi are then forced to use less efficient systems using more environmentally harmful fuel sources, such as wood and petroleum.<sup>xli</sup> There are efforts to make energy use for production companies more sustainable both by improving access to the more energy-efficient fuel sources mentioned above and by developing new or underutilized energy sources, such as hydropower.<sup>xlii</sup>

In order for the industry to expand, the essential oil producers will need to utilize more reliable and greater amounts of electricity, water, and land. Due to the water needs of essential oil plants, and constraints on domestic water delivery systems, industrial growth in the sector will require further transformation of marshlands into farmland. This will have widespread environmental impacts on water availability, contamination, biodiversity loss, and more.<sup>xliii</sup> These effects will be exacerbated if expansion is accompanied by an increase in the use of chemical fertilizers. Increasing the proportion of land dedicated for agricultural use can also lead to soil quality degradation and erosion. The Rwandan government, however, has had a great deal of success in mitigating erosion by means of various control measures, such as terracing and reforestation, which could indicate that the harmful effects of expansion on soil quality may be well mitigated by pre-existing systems of promoting environmentally sound agricultural practices.<sup>xliv</sup>

Negative environmental impacts can be further mitigated through appropriate planning and design as well as the adoption of appropriate technologies, good agriculture practices (GAP), and other standard procedures such as soil conservation techniques and integrated pest management.<sup>xlv</sup>



## VALUE CHAIN FINANCE

The availability of suitable types and volumes of financing will be critical to both innovations in and scale up of the essential oils value chain. Only then can it become an effective contributor to the government's export growth and diversification agenda, and to its development goals.

Three major bottlenecks to the development of essential oils value chain finance in Rwanda have been identified:

- Attractiveness: Land restrictions limit volumes and therefore the ability to cover fixed costs for machinery, land preparation, and working capital. Returns are also limited by low crop yields, mainly because of labor productivity issues but also potentially seeds and other inputs.
- Awareness: Commercial banks appear to be poorly informed about potential and existing business models in the essential oils sector, and are therefore reluctant to lend. Farmers have limited or non-existent knowledge about the benefits of growing essential oils crops. Potential investors lack information on the essential oils business in Rwanda.
- Upgrading and Diversification: Even if constraints are removed to the financing of existing essential oils businesses, upgrading and diversification efforts will still rely on the availability of grants and development finance.

Thus, the following strategies are recommended:

- Resolve land allocation and labor productivity issues: Decisions on land will decide the fate of the essential oils business, so discussions must be started to overcome difficulties (competing uses, risks of monopoly). The government should also facilitate the development of alternative labor models, so long as they increase yields and preserve farmers' interests.
- Involve banks in PPD and mobilize farmers and investors: A government-sponsored dialogue between commercial banks and producers could greatly facilitate lending. RDB could advertise the sector on its website.
- Institutionalize development finance for seed investment: RDB and BRD could partner to provide a systematized channel of seed investments for promising upgrading and diversification efforts

### Financial Attractiveness

Insufficient data has precluded the calculation of exact internal rates of return and typical tenors for investments along the different stages of the value chain. However, interviews with key stakeholders have offered a fair amount of qualitative information on the financial attractiveness of the chain.

Investment in the growing of crops for essential oils production is difficult as the wetland areas necessary for production are owned exclusively by the government and can only be leased – not sold.<sup>xlvi</sup> Returns on investments are relatively low in any case because both crop yields and farm-gate prices for leaves are themselves low, providing low marginal returns, while fixed costs are relatively high – especially because of necessary investments for land preparation. For farmers, there is still benefit from cultivating essential oil crops instead of food crops in terms of absolute returns, but attractiveness is reduced by a variety of risks, real and perceived. In particular farmers may simply not be aware of the potentially high returns from growing essential oil crops. They may fear for their food security, and lack adequate training to comfortably engage in essential oil crop growing.

Investment in processing would have very high marginal returns on investment (in the order of 80% for geranium oil processing according to available figures<sup>xlvi</sup>), but high fixed costs (especially for land preparation and processing units) combined with low turnover make the investment unattractive for private investors at the moment. Indeed, major investments so far have come mainly from donors or development agencies. There is a clear need to increase private investment, which can happen only if volume constraints are removed, especially in terms of land.

Trade and wholesale are done directly by the processing firms at the moment. These functions could be externalized if volumes were to increase and then generate low but positive net margins. Retail sale within Rwanda is limited to a few high-end hotels and boutiques for tourists. Margins are likely very high but sale volumes are likely to remain limited.

### **Financial Risks**

There are 3 main factors of financial risk around the supply of biomass for oil production: low productivity of labor, uncertainty about land allocation, and loss of organic certification (for most oils). The labor and land productivity issues have been addressed separately. Loss of organic certification could result from contamination by non-organic crops. Researching and organizing cross-crop production managed both at the government and firm level. However, it is not clear how these research and dissemination efforts are coordinated.

Oil processing risks center around inefficiencies due to older low-volume machines and under-utilization due to crop biomass and energy supply constraints. Maintenance and new machines can improve processing yields if development assistance is maintained and completed by private investment money as mentioned above. Crop biomass constraints have been mentioned above. Energy supply constraints could be reduced through better electricity infrastructure, which the government is investing in, as well as a clearer policy on tree farms – especially eucalyptus farms that are being pursued by Ikirezi.

Sales and market risks are almost non-existent at the moment for geranium and patchouli, given excess demand for these essential oils, but as pointed out in the End Markets section of this report, the markets for essential oils based on lemongrass, rose or eucalyptus appear to be more competitive.

Management risks could result from a scarcity of competent managers for processing sites as well as the management of input suppliers and farmers as businesses grow. The risk is relatively limited thanks to a well-recognized university for potential training and a large diaspora that has returned with good training in the industry.

Finally, increasingly stringent international standards on essential oil production could become a challenge to the value chain.

### **Norms and Practices**

Converging comments by relevant stakeholders (processing firms, social investors) point to a deficit of awareness, excessive conservatism and bureaucratic inertia at Rwandan commercial banks for agriculture-related loans. It seems that risks and business models specific to the sector are not well understood by mainstream banks, while some businesses have difficulties building a coherent business case. This latter

explanation is likely most relevant in the non-emergence of investors since the inception of the sector. The Rwandan Development Bank (BRD) could potentially compensate for these shortfalls to complement financial support by international development partners and donors. The government should consider organizing regular discussions between actors of the essential oils value chain with financial institutions, ideally as part of the overall public-private dialogue (PPD) already recommended.

Government focus on cooperatives for extension services and other support is also a constraint to the development of alternative models of labor management that could bring higher yields and help develop the value chain. As stressed elsewhere, there is a need to find a common ground to accommodate private sector demands for labor policies geared towards higher yields and the legitimate government concern for the risks associated with non-traditional models of labor management. Once again, organized and systematic PPD would be an effective way to resolve the issue.

### **Availability of Finance**

As stressed above, formal credit from commercial banks is hard to access, while microfinance and informal finance are irrelevant due to the large amounts of capital required (especially for distillation units, land preparation and working capital).

Value-chain financing is available thanks to the excess demand for the types of essential oils actually produced and sold at the moment. Final buyers are ready to provide financing for working capital to help ensure supply. For example, Clive Teubes of South Africa, Ikirezi's foremost buyer, has agreed to prepay half of the oil processing company's land preparation and manure purchase costs.<sup>xlviii</sup> However, value chain finance will be harder to secure if supply eventually meets demand worldwide for geranium and patchouli, or for other essential oils already facing competitive markets. Developing other sources of finance will become all the more critical.

Development finance, government finance, and aid are currently the main means of financing for large capital investments as illustrated by the cases of Ikirezi and Sorana, the latter having acquired a processing unit financed by the EU and RHODA (Rwanda Horticulture Development Authority). These sources of finance are bound to remain predominant for the next few years (as shown by the business plan developed by Karisimbi Business Partners for Ikirezi for the next 5 years).

### **Financing Gaps**

Private equity financing is nonexistent for now but will be necessary in the future to maintain processing firms' ability to obtain loans for investment – a bank will not lend to a firm that has too little capital to support its lending given a defined business risk. Attracting such financing will therefore be critical in developing the value chain, and requires prior removal of constraints and uncertainties on land allocations, as well as the proper advertising of the sector's potential. Government policy regarding land allocation will be a critical input, as well as the involvement of a government investment agency. Once again, an effective PPD would help resolve land issues and define the structure (probably involving RDB and BRD) to provide seed investments and finance.

## **BUSINESS ENVIRONMENT AND SOCIO-POLITICAL CONTEXT**

The two main concerns that have been underlined throughout this value chain diagnostic are labor issues and lack of access to land. These are interrelated problems: allocation of land partially revolves around the lack of productivity exhibited by cooperatives.

- It is necessary that better business and agricultural extension services and knowledge sharing be developed. Accordingly, R&D strategy should include research not only into end uses of essential oils, but also into production inputs to ensure the maximization of yields.
- Most importantly, however, is the recurrent theme of enhanced Public-Private Dialogue (PPD). This is a vital element in the development of the chain and will help reconcile business needs and the government's development goals.

### **Business Environment**

The year 2011 showed continued progress in Rwanda's global business and competitiveness rankings as the country's ranking improved to 45<sup>th</sup> place in the Doing Business Report. Rwanda also now ranks eighth in the world in the "Starting a Business" category of the World Bank Group's global "Ease of Doing Business" index. Some of Rwanda's most notable improvements to the business environment have been to remove capital requirements for new businesses and to distribute credit information from retailers, trade creditors, and financial institutions.

Rwanda has done similarly well in the World Economic Forum's Competitiveness Index, where it has boosted its ranking by 10 spots since 2010/2011. Of the 12 pillars measured by the index, Rwanda has improved in infrastructure development, education, and liberalization of the labor market.

While these improvements all impact the essential oil value chain, Rwanda's lowest individual rankings are perhaps most relevant. Market size and technological readiness remain key areas of weakness. The tiny domestic market for essential oils in Rwanda is currently driven largely by tourism at high-end hotels and spas, which limits it to low volumes. International trade of essential oils should therefore be promoted in the short to medium term. The lack of constraints in customs procedures will be vital for the success of growth in exports.

### **Public and Private Sector Service Provision**

#### **Research and Development**

Research and development of plants used in the essential oils chain will be an important step in the development of the value chain. Currently, yields remain relatively low and highly variable, and patchouli production is impeded by its sub-standard growing conditions. To increase yields, it will be important not only to research optimal feasible growing conditions, but also fertilizer use and plant care. As planting conditions become less variable, farmers will be more likely to begin growing larger amounts of essential oil plants.

## Transportation and Infrastructure

While transportation networks in Rwanda remain largely underdeveloped, essential oils are a high value product that is transported in relatively small quantities. In the short term, therefore, this decreases the importance of transportation and infrastructure issues in the immediate upgrading of the value chain. However, as production increases, it will be important to formalize transportation methods in order to accommodate larger production capabilities and decrease variability.

Essential oils are currently exported by air. This is a viable option due the small size of the products. However, if export by air is to remain the main export method, transport and export networks should be developed to decrease costs and inefficiencies. It will be important to assess whether Rwanda's current airport will be able to sustain increasing exports for the short term, and whether the new Bugesera International Airport would present a viable option in the future.

## Electricity and water

Access to electricity is often cited as one of the largest impediments to business development in Rwanda, and it will be vital to the essential oil value chain as firms scale up production and increase their dependence on energy through use of modern, high-volume machinery. In the short to medium term, promotion of renewable sources of energy would ease the cost of energy use. In the long term, it will be essential to rapidly build access to affordable grid electricity.

## Market information services & Public-Private dialogue

SMEs in Rwanda face difficulties in accessing and utilizing pricing and general market information. SMEs also have few recourses with which to participate in the policy making process. While SME policy is promoted within the government, the lack of communication channels between the two sectors hinders the effectiveness of policies and negatively impacts the working environment for SMEs.

The lack of communication with the government is most palpable in terms of land allocation. Access to land is the leading difficulty cited by firms within the value chain. The disconnect between the industry's need for land and the amount of land being allocated lies primarily with the importance the government places on efficient uses of scarce land and management of risk associated with over-reliance on a single firm. It is thus vital for communication channels between the government and the private sector to be opened and developed, as the expansion of essential oils will be greatly impeded by inadequate public-private dialogue and mutually shared goals.

## Social and Cultural Context

The important role that the Rwandan government plays in the country's social and cultural spheres has important consequences for firms' operations. The government seeks to ensure that firms operating within the country are contributing to the country's development. For example, Ikirezi is a for-profit business, but an integral part of its mission is to work with widows and orphans. To maintain profitability as a business while serving its community oriented mission, determining the best model of labor management to employ is a complex and critical calculation. A comparison of crop yields between a labor association model and a cooperative model makes the increased use of the labor association model the favored strategy for Ikirezi, who has also found the model to be attractive to their laborers due to the relatively high and consistent daily wage they receive, as well as the decreased risk they face in investing their labor in growing essential oil crops.



Ikirezi farmers weekly meeting  
(from website of USAID's Partnership for Food Industry Development)

The cooperative model that is typically favored by the government has shown limitations in the essential oil value chain. Farmers are generally hesitant to grow a crop that they are unfamiliar with, and cooperatives have shown very low yields, making them unprofitable and thus an unattractive livelihood basis for most farmers. A diagnosis will have to be undertaken to address not only the problems faced by cooperatives, but also the problems associated with dialogue with the private sector. Increased education, extension services, and risk management will be important measures for determining and promoting the most appropriate promote the labor models and incentive structures for particular contexts.

## APPENDIX

## Essential Oils World Market Summary

Essential Oils	Components	Segments	Largest Producers / Exporters (MT/ year)	Largest Importers (MT/ year)	World Production (MT/ year)	Price (USD/ kg)	Issues Related to Market Access
Geranium	Citronellol and geraniol	High grade superior quality perfumes	Egypt (70), La Réunion (50-60), Morocco & Algeria (10-20), China (100-150)	France (95), USA (65), UK (20), Japan (20), Germany (15)	400	\$150-250*	<ul style="list-style-type: none"> <li>• Preferences toward organic product at twice the price of conventional, although constraints on production are substantial</li> <li>• Egypt, Reunion, and China are expected to decrease supply, suggesting increased market opportunity</li> <li>• Demand is strong and stable, but total consumption volumes much lower than patchouli</li> <li>• Competition from other African producers exporting high quality oil</li> </ul>
Patchouli	Patchouli	Medicinal, health, fragrance	Indonesia (supplies 90% market), China, Brazil, India	Europe, USA (500), India (290)	1,500- 2000	\$68-108*	<ul style="list-style-type: none"> <li>• High price fluctuation, but expected to stabilize</li> <li>• Broad interest in developing alternative origins/ suppliers other than Indonesia</li> </ul>
Lemon Grass	Cymbopogon Fexnosus and Cymbopogon Citratus, main source for citral	Low-grade, inferior quality perfume, household products, vitamins A & E	Guatemala (250), China (80-100), India (750)	USA (70), Russia (70), UK (65), France (35), Japan (35), Germany (20)		\$9-17	<ul style="list-style-type: none"> <li>• Competition from synthetic oils</li> <li>• Low market price (but likely to increase)</li> <li>• Supply is dominated by two origins but potential exists for new origins to enter market</li> </ul>

Eucalyptus	Eucalyptus Globulus & E. Australiana; Eucalyptus Citriodora	Pharmaceuticals and frangrances	Portugal (400), Spain (200), Brazil, Austrailia, South Africa	France (600 ), USA (300), Germany (230), UK (150)	2000		<ul style="list-style-type: none"> <li>• Low market prices but expected to rise</li> <li>• Demand is increasing based on consumer preferences toward natural products</li> </ul>
Rose	Rosa damascenta or R. centifolia	Highest end/ quality natural perfumes and cosmetics	Bulgaria, Turkey, Morocco, India, Egypt	France/ US	4.5**	\$2000-5000	<ul style="list-style-type: none"> <li>• Market is highly competitive and supply exceeds demand</li> <li>• Quality standards are extremely specific and depend on a range of variables</li> <li>• Oil production requires large volume of plant inputs requiring large land areas</li> </ul>
Reflects 2005 data unless otherwise indicated							
* Denotes 2011 data							
** Denotes 2001 data							



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<sup>i</sup> [ftp://ftp.fao.org/agl/aglw/docs/wr29\\_eng.pdf](ftp://ftp.fao.org/agl/aglw/docs/wr29_eng.pdf)

<sup>ii</sup> Solvent extraction involves the application of a solvent to plants to extract their essential oil, as well as other soluble materials like wax and pigments. It is often used on plants that yield particularly small amounts of oil, like roses.

<sup>iii</sup> Ikirezi Business Turnaround Plan, 2011. Karisimbi Business Partners

<sup>iv</sup> Certified since 2005.

<sup>v</sup> Akgül, Attila and Bayrak, Ali, 1993. Volatile Oil Composition of Turkish Rose (*Rosa damascena*). Departments of Food and Science Technology, Faculties of Agriculture, Selçuk and Ankara Universities. Konya and Ankara, Turkey.

<sup>vi</sup> (Oct 2011) 2006-2010 Flavor & Fragrance Industry Leaders, Leffingwell & Associates, as cited in Ikirezi Business Turnaround Plan.

<sup>vii</sup> South Africa Directorate Marketing of the Department of Agriculture, Forestry and Fisheries. “Essential Oils Market Value Chain Profile” Retrieved from: <http://www.nda.agric.za/docs/AMCP/EssOilsMVCP2009-2010.pdf>

<sup>viii</sup> RWANDA: Project for Rural Income through Exports (PRICE) Final Design Report – Working Paper 6: Essential Oils Development, IFAD

<sup>ix</sup> (March 2003) AfricaBiz Vol. 1 – Issue 47

<sup>x</sup> South Africa Directorate Marketing of the Department of Agriculture, Forestry and Fisheries. “Essential Oils Market Value Chain Profile” Retrieved from: <http://www.nda.agric.za/docs/AMCP/EssOilsMVCP2009-2010.pdf>

<sup>xi</sup> IFAD. “Final Design Report – Working Paper 6: Essential Oils Development.” Rwanda: Project for Rural Income through Exports (PRICE). 10 October 2011. Page 11.

<sup>xii</sup> (March 2003) AfricaBiz Vol. 1 – Issue 47

<sup>xiii</sup> (May 2008) Export Diversification in Rwanda, UNCTD (as cited in Turnaround plan)

<sup>xiv</sup> Smadja, J. “Les Huiles Essentielles”. Laboratoire de Chimie des Substances Naturelles et des Sciences des Aliments (LCSNSA). Université de la Réunion.

<sup>xv</sup> RWANDA: Project for Rural Income through Exports (PRICE) Final Design Report – Working Paper 6: Essential Oils Development, IFAD.

<sup>xvi</sup> Idem.

<sup>xvii</sup> Idem.

<sup>xviii</sup> Introduction to the Essential Oils Industry and Trade. (2003, March). *Africabiz Monthly*. 1(47). Retrieved from: <http://businessafrica.net/africabiz/arcv011/is47front.php>

<sup>xix</sup> Africa biz

<sup>xx</sup> Gunes, Erdogan. 2005. Turkey Rose Oil Production and Marketing: A Review on Problems and Opportunities. Department of Agricultural Economics, Faculty of Ankara. Ankara, Turkey

<sup>xxi</sup> RWANDA: Project for Rural Income through Exports (PRICE) Final Design Report – Working Paper 6: Essential

Oils Development, IFAD.

<sup>xxii</sup> Gunes, Erdogan. 2005. Turkey Rose Oil Production and Marketing: A Review on Problems and Opportunities. Department of Agricultural Economics, Faculty of Ankara. Ankara, Turkey

<sup>xxiii</sup> Idem

<sup>xxiv</sup> Ikirezi Business Turnaround Plan, 2011. Karisimbi Business Partners. 61-62.

<sup>xxv</sup> RWANDA: Project for Rural Income through Exports (PRICE) Final Design Report – Working Paper 6: Essential Oils Development, IFAD.

<sup>xxvi</sup> Gunes, Erdogan. 2005. Turkey Rose Oil Production and Marketing: A Review on Problems and Opportunities. Department of Agricultural Economics, Faculty of Ankara. Ankara, Turkey

<sup>xxvii</sup> RWANDA: Project for Rural Income through Exports (PRICE) Final Design Report – Working Paper 6: Essential Oils Development, IFAD.

<sup>xxviii</sup> Ikirezi Business Turnaround Plan, 2011. Karisimbi Business Partners. 40.

<sup>xxix</sup> Ikirezi Business Turnaround Plan, 2011. Karisimbi Business Partners. 38.

<sup>xxx</sup> RWANDA: Project for Rural Income through Exports (PRICE) Final Design Report – Working Paper 6: Essential Oils Development, IFAD.

<sup>xxx</sup> Ikirezi Business Turnaround Plan, 2011. Karisimbi Business Partners. 38.

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- <sup>xxxii</sup> RWANDA: Project for Rural Income through Exports (PRICE) Final Design Report – Working Paper 6: Essential Oils Development, IFAD.
- <sup>xxxiii</sup> The Rainforest Alliance. <http://www.rainforest-alliance.org/agriculture/certification>
- <sup>xxxiv</sup> Ikirezi Business Turnaround Plan, 2011. Karisimbi Business Partners, 41.
- <sup>xxxv</sup> *Idem*, 39.
- <sup>xxxvi</sup> This is based on UNIDO’s definition of different types of governance, see UNIDO (2011), p. 53 for further details.
- <sup>xxxvii</sup> Karisimbi Business Partners (2011), p. 14 and 42. N.B. this is not the case for rose oil
- <sup>xxxviii</sup> This is also a problem faced by other actors, notably Sorana.
- <sup>xxxix</sup> Ikirezi Business Turnaround Plan, 2011. Karisimbi Business Partners. 11.
- <sup>xl</sup> *Idem*, 36.
- <sup>xli</sup> *Idem*, 11.
- <sup>xlii</sup> In the past, Sorana had used hydropower to meet some of their energy needs, but the technology was abandoned. There are efforts to rehabilitate the hydropower infrastructure and bring it back in use. (Source: Interviews with Sorana founder and Managing Director.)
- <sup>xliii</sup> Ikirezi Business Turnaround Plan, 2011. Karisimbi Business Partners. 61.
- <sup>xliv</sup> Government of Rwanda, Economic Development and Poverty Reduction Strategy (EDPRS), 2008-2012. 11.
- <sup>xlv</sup> Ikirezi Business Turnaround Plan, 2011. Karisimbi Business Partners. 61-62.
- <sup>xlvi</sup> *Idem*, 30
- <sup>xlvii</sup> Authors’ calculations using data from Ikirezi Business Turnaround Plan, 2011. Karisimbi Business Partners.
- <sup>xlviii</sup> Ikirezi Business Turnaround Plan, 2011. Karisimbi Business Partners. 53.