



## Developing value chains for *Ricinodendron heudelotii* and other indigenous tree species in West and Central Africa

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## 1. Introduction: Rationale/importance of the species

Humid forests in West and Central Africa are rich in biodiversity accounting for 95.3% of Africa's rainforest (Malhi et al. 2013). Despite this natural richness, poverty and malnutrition rates in these areas remain among the highest in the world (FAO, IFAD, UNICEF, WFP and WHO. 2018; USAID 2018). In the Congo Basin for example, 30 million people directly depend on the forest for several uses and services, such as food, medicine, wood for buildings and craft work. (FAO, 2017) However, forest resources are dwindling due to land clearing for agriculture, urbanisation, timber exploitation, unsustainable harvesting of forest products, and mining (Malhi et al. 2013). Furthermore, in some places, people's access to Non-Timber Forest Products (NTFPs) is constrained by the creation of protected areas (FAO, 2017).

It is therefore urgent to find solutions that reconcile livelihood improvement of rural populations and forest conservation. One such solution consists in enhancing households' participation in value chains of non-timber forest products, as well as in promoting agroforestry systems that integrate tree species that provide profitable products. The latter will allow producers to progressively move from wild harvesting to the cultivation of high-value tree species that supply rural and urban markets, but also to small- and medium-size processing enterprises. Interestingly, such agroforestry systems are multi-functional, simultaneously addressing issues of income generation and food security, but also soil fertility, water regulation, carbon sequestration and biodiversity restoration.

Many studies have demonstrated increasing demand for NTFPs in West and Central Africa (WCA) such as kola (*Cola spp.*), njansang/akpi (*Ricinodendron heudelotii*), bush mango (*Irvingia spp.*), bitter kola (*Garcinia kola*) and eru (*Gnetum spp.*), among others (Ndoye et al 1997). Unfortunately, smallholders have rarely been able to reap the full potential of NTFP commercialisation because of several constraints such as dispersed production, small volumes and poorly developed markets. Furthermore, there is usually a high degree of technological innovation required to achieve value addition, and product development generally takes a long time. There are stringent barriers to enter international markets, especially for food and herbal/medicinal products. The potential of certification certainly exists for some products but requires a high level of organisation from producers. In addition, more intensive harvesting may have serious ecological implications for the resource. And the risk that gains of increased commercialisation will not be captured by the intended beneficiaries is high because of reduced access to the resource through overexploitation and/or changing property rights.

Hence, intervening in NTFP commercialisation requires a long-term and multidisciplinary approach that ranges from providing support on both the technical and social aspects of natural resource management to understanding how markets function from the local to the international level. Yet, approaches have often focused on only one or a few stages in the value chain, such as production, processing or collective bargaining, and rarely adopted an integrated/holistic view, including the institutional and policy environment that governs the actors and the products in the value chain. World Agroforestry (ICRAF), the centre of scientific excellence in agroforestry, is well placed to take up such a holistic approach to the commercialisation of the products of agroforestry tree species with significant food and economic value to smallholder producers in WCA.

In its regional strategy for West and Central Africa, ICRAF has prioritised a few tree species for research on sustainable value chain development. Criteria for selection included: substantial contribution to GDP, employment of a significant number of people both in rural and urban areas, major export commodities for several countries, and opportunities for public-private partnerships at multiple scales. The tree species were then grouped in three categories: (i) major tree crop commodities with well-established value chains occupying high numbers of small-holders, but primarily export-oriented (cocoa, coffee, oil palm, rubber, timber); (ii) 'emerging' tree commodities that have been widely traded for centuries and for which the market is still expanding, but are mostly collected from the wild (shea, baobab, Arabic gum) or recently introduced (cashew) and (iii) indigenous tree species having important economic value to rural households, mainly traded in local and national markets, but with good prospects for market expansion and product development for culinary and cosmetic purposes (*Ricinodendron heudelotii*, *Irvingia gabonensis*, *Balanites aegyptica*, *Parkia biglobosa*).

*Ricinodendron heudelotii* was thus selected as a model species in the third category to develop a pathway for value chain development in WCA. Apart from the importance of *R. heudelotii* to household income overall, in Cameroon the revenues also come at a critical time when school re-opens. Moreover, *R. heudelotii* plays an important role in food security, as it is part of many traditional dishes and has a high nutritional value. As an upper-stratum species, *R. heudelotii* trees integrate well into cocoa plantations for shade. The species is also a preferred host for caterpillars, a delicacy in the DR Congo.

*Ricinodendron heudelotii* (Baill.) Pierre ex Heckel, as per its full botanical name, from the Euphorbiaceae family is a fast-growing tree, reaching up to 50 m in height. The species is distributed from lower Senegal to West Cameroon, Democratic Republic of Congo, Angola and Tanzania and naturally occurs in fringing, deciduous and secondary forests. The species thrives best in areas with altitudes of 100-1200 m, 1400-3500 mm annual rainfall and mean annual temperatures of 18-32°C. Protection of wildings or planting is increasingly happening in cocoa farms as shade tree, in home gardens and on fallow lands. Fruits are green or yellow when ripe and contain one to three seeds. The commercial part of the njansang, as it is also known in Cameroon, is the yellow-brownish kernel that is extracted from the seed. Kernels are crushed and used as a flavouring and thickening agent in traditional dishes (soups and stews) and are a popular spice for fish. In terms of nutritional value, sauces made with njansang are richer in Calcium, Iron and Zinc compared to sauces from groundnut and melon seeds. *Ricinodendron heudelotii* contains more oil than many other oily plants such as cotton and soybean (49.25 % to 63.18 %) and is rich in carbohydrates (25%) and proteins (22%). Oil can be extracted from the kernels by cold pressure and is used for cooking and increasingly for cosmetics. The bark is traditionally used to cure a great number of diseases, such as gonorrhoea, cough, leprosy, hernia, dysentery, elephantiasis, syphilis, yellow fever, anaemia, toothache and malaria (Vivien and Faure 1994).

Njansang is traded on local, national, and to a lesser extent, international markets and provides cash income to many households in the humid forest zone of West and Central Africa. Regional commercialisation has increased significantly in recent years (Cosyns et al. 2011; Facheux et al. 2012) and export to Europe to supply the African diaspora is gaining importance as well.

## Problem Analysis

Despite the economic potential of *R. heudelotii*, increasing benefits of its production and commercialisation to smallholders through enhanced market participation is constrained by several bottlenecks throughout the value chain.

### Production

Successful development of the *R. heudelotii* value chain by creating better markets, improved infrastructure and higher product demand, and/or prices, provides a strong incentive for increased production. However, until now *R. heudelotii* is mostly collected from naturally grown trees in forest and on fallow land. Where *R. heudelotii* is gaining economic importance, farmers have started protecting the species in cocoa plantations, home gardens and on crop lands. Some farmers transplant wildings to

increase the number of trees on their farms. Nursing of seedlings however is rare, mainly discouraged by low germination rates. Another difficulty is the fact that it is a dioicous species, meaning that there are female and male trees. While an appropriate sex ratio between female and male trees is needed for normal fruit production, farmers want to keep the number of male trees on their farm low, because they are not productive. The issue is that one cannot determine the sex of the tree from the seeds. Moreover, assessment of genetic variation, characterisation and identification of plus genotypes, the establishment of genebanks for future selection and improvement work have just started. Therefore, improved planting material is not yet available. Consequently, value chain interventions should aim at ensuring the supply of quality products in sufficient quantities to increase farmers' revenues, meet consumer demand and sustain growing markets, without depleting the natural resource base. Cosyns (2013) found that current harvesting practices in Central Cameroon do not jeopardise the short-term survival of the species (70-75% of fruits are collected), but increased pressure because of better commercialisation prospects may threaten its long-term sustainability.

### Post-harvest cracking of the kernels

Another important component of value chain development is research of the harvest and post-harvest technology. *R. heudelotii* fruits are primarily dispersed through gravity and, when fallen on the ground, collected by farmers. Traditional processing involves collecting the fruit, piling it up and leaving it to decompose under shade for four to eight weeks. The rotten fruit pulp is washed off to obtain the stony endocarp. The seeds are then put through a boiling and cooling process that can take 8 to 48 hours to facilitate the appearance of small cracks on the shells. Finally, from the boiled seeds the kernels are manually extracted one by one, then dried and stored (Mbosso et al. 2013). Given the economic importance of the product, improving labour efficiency in post-harvest processing is necessary. *R. heudelotii* post-harvesting (collecting, processing and trading), typically done by women, is a long, tedious and labour-intensive process. The traditional method of extracting kernels is associated with risks to human health and wellbeing. For instance, the decaying fruit produces a dark liquid that stains the fingers and nails of handlers. It is also frequently infested with maggots, which can get under the skin of the processor. Manual extraction of kernels therefore presents a major constraint in the *R. heudelotii* value chain, creating a bottleneck to broader production and commercialisation of the product.

To overcome this difficulty, the World Agroforestry has developed a prototype extraction machine and evaluated it with producer groups within one of its research-for-development projects in Cameroon. Surveys with users and non-users of the machine suggested a shift towards



male and younger users. The advantages of rapid kernel extraction are partly offset by the requirement to sort out broken kernels. Mboosso et al. (2013) therefore concluded that the technology is promising but needs further improvement to deliver the expected increase in labour efficiency and economic advantages for rural women.

### **Post-harvest processing, collective action and other organisational mechanisms for marketing**

As for many of the non-timber forest products, predominantly collected from the wild, trade of *R. heudelotii* is hampered by local and dispersed production, small volumes, poorly developed markets and incomplete or asymmetric market information. Integrating poor farmers in more lucrative value chains would therefore require linking them up more efficiently with traders and the private sector. Producers would need to join marketing groups and engage in group sales to be able to increase their negotiation power, share production and market information and gain from capacity building programmes. Nevertheless, success of group sales seems to rely on the capacity of the groups to pay part of their members' production in advance to avoid side selling. Access to capital, however, remains a key constraint. This is not only the case for producers but also for traders and small-scale processing enterprises. Also, there is no system that collects and diffuses market information on *R. heudelotii*, even though better market information would enhance producers' power of negotiation and the flow of products for traders, as well as broaden choices for consumers.

### **Policies and Institutions**

External factors largely affect the outcomes of marketing efforts of smallholders in rural areas. Despite the social, economic and cultural importance of *R. heudelotii*, the species is poorly integrated in existing policies dealing with poverty reduction. Although most countries in WCA include NTFPs in their natural resources management and poverty reduction policies, the intentions do not materialise in specific programmes or strategies. This is partly due to the lack of statistics on production and insufficient evidence of the contribution of NTFPs to household income and overall economic growth. This is not different for *R. heudelotii*. Data on production, number of people involved, quantities traded domestically and exported, prices, etc. are not available. A few studies have collected data at household and market levels but these have often focused on specific sites

within a country and do not give a national, let alone a regional, perspective of the commercial importance of *R. heudelotii*. Moreover, *R. heudelotii* is presented as a fast-growing species occupying the upper layer of agroforestry systems, thereby limiting competition with other tree crops such as cocoa, which is an interesting feature in restoration initiatives. Yet, its contribution to carbon sequestration and other environmental services has not been well documented.

Forestry legislation governing trees in most WCA countries, designed with the good intentions of conserving natural resources, potentially limits farmers' economic rights to exploit NTFPs and de facto limits their rights to use the trees they plant on their farms. For example, in Cameroon, *R. heudelotii* is still considered a 'forest product' which requires a 'permit' from the Ministry of Forestry and Wildlife so that it can be exploited for commercial purposes. As the process is too onerous for individual producers, such permits are often obtained by wholesale traders who then dominate the market. From the moment farmers start planting *R. heudelotii* on their farms, the species' status should be revised from forest product to agricultural product with no need for special permits. An alternative would be the introduction of a new policy instrument such as certificate of origin to distinguish 'agroforestry products' that are cultivated on farm from 'non-timber forest products' that are harvested from the wild. In both cases, policy reforms are needed.

### **Equity**

Harvest, post-harvest and processing of *R. heudelotii* are usually done by women and children. Moreover, according to a study by Ndoeye et al. in 1998, the trade of *R. heudelotii* provided employment for about 1,120 Cameroonians most of whom were women. The growth of the *R. heudelotii* value chains thus presents huge opportunities for women's economic empowerment and rural employment. However, the increase in its economic value may also have negative effects on women because men get interested in the product and may take control over some activities that used to be in the women's domain, as has often been the case with other products.

Also, interventions to enhance value chain activities in communities may not benefit all households equally, as richer households often benefit more because the very poor households often lack a minimum asset base which would enable them to take advantage of the opportunities.

## Main Interventions

Rationale	Interventions		Outputs	Outcomes	Impact
<b>LOW PRODUCTION</b> <ul style="list-style-type: none"> <li>- Mostly collected from wild or natural regenerated trees, few people plant</li> <li>- Deforestation threatens sustainability</li> <li>- Dioicous species</li> <li>- Lack of improved planting material</li> <li>- Difficult kernel extraction process limiting production</li> <li>- Unfavourable forest policies governing harvest and trade</li> </ul>	<b>PRODUCTION</b> <ul style="list-style-type: none"> <li>- Organise sensitisation campaigns</li> <li>- Identify and propagate superior planting material</li> <li>- Develop gemplasm distribution systems</li> <li>- Develop best-fit agroforestry models integrating Ricinodendron ...</li> </ul>	<b>VALUE ADDITION</b> <ul style="list-style-type: none"> <li>- Understand relationships between chemical and physical characteristics for nut cracking</li> <li>- Design extraction technologies</li> <li>- Understand consumer preferences and future market demands ...</li> </ul>	<b>PRODUCTION</b> <ul style="list-style-type: none"> <li>- Genebanks and mother blocks; vegetative propagation techniques; tree nurseries; guidelines for integration in LUS and agronomic practices</li> </ul>	<b>PRODUCTION</b> <ul style="list-style-type: none"> <li>- More trees planted</li> <li>- Quantities produced increased</li> </ul>	Income increased
<b>WEAK MARKET DEVELOPMENT</b> <ul style="list-style-type: none"> <li>- Dispersed production, individual sales</li> <li>- Lack of statistics to demonstrate importance</li> <li>- Lack of market information</li> <li>- Lack of value adding</li> <li>- Insufficient business support services</li> </ul>	<b>MARKET ACCESS</b> <ul style="list-style-type: none"> <li>- Design effective ways of organizing producers and traders</li> <li>- Strengthen organizational and entrepreneurial capacities of producers</li> <li>- Facilitate market linkages</li> <li>- Develop mechanisms for producers, traders and processors to facilitate access to credit</li> <li>- Develop tools to guarantee effective participation of women and minority groups in decision making</li> <li>- Design and implement MIS</li> <li>- ...</li> </ul>	<b>ENABLING ENVIRONMENT</b> <ul style="list-style-type: none"> <li>- Gather evidence on production, prices, income, contribution to GDP, demand</li> <li>- Gather evidence on environmental benefits of njansang</li> <li>- Design new instruments and institutional arrangements to facilitate Ricinodendron businesses</li> <li>- Design incentive options</li> <li>- Improve capacity of extension services to provide business and rural advisory services ...</li> </ul>	<b>VALUE ADDITION</b> <ul style="list-style-type: none"> <li>- Chemical and physical characteristics; technologies for kernel extraction and processing; consumer preferences</li> </ul>	<b>MARKET ACCESS &amp; VALUE ADDITION</b> <ul style="list-style-type: none"> <li>- Market actors offer more products with added value</li> <li>- More people engage in production and marketing</li> <li>- Women have more decision-making power related to production, marketing and use of revenues from Ricinodendron</li> </ul>	Value and size of market increased
			<b>MARKET ACCESS</b> <ul style="list-style-type: none"> <li>- Support tools for effective organising of producers and traders; entrepreneurial skill devlp; methods for linking producers to markets; business models; women empowerment training; MIS</li> </ul>	<b>ENABLING ENVIRONMENT</b> <ul style="list-style-type: none"> <li>- Policy makers more willing to develop policy incentives to promote Ricinodendron sector</li> <li>- Private sector investments improved</li> </ul>	Women and minority groups empowered
			<b>ENABLING ENVIRONMT</b> <ul style="list-style-type: none"> <li>- Econ and ecosystem data; feasibility of institutional arrangements; incentive options; business support capacity development</li> </ul>		Policy and institutional environment improved

### Intended Impact statement

The intended impact is the overall improvement of the well-being of *R. heudelotii* producers and traders. This will be achieved through:

- Increased income from *R. heudelotii* for producers and traders;
- Increase in overall value and size of *R. heudelotii* market;
- Empowerment of women and minority groups involved in the *R. heudelotii* business; and
- Improved policy and institutional environment for the promotion of the *R. heudelotii* sector.

### Outcomes

Several outcomes are expected after implementing the suggested actions to improve the value chain of *R. heudelotii*. They can be grouped in to short-term and long-term outcomes as presented below.

#### Short-term outcomes

- Producers are aware of the importance of growing *R. heudelotii* trees to ensure future supply
- More trees planted
- Quantities produced increased
- Kernel extraction facilitated
- New products and markets developed
- Price for producers increased

- Market access for producers increased
- Access to finance facilitated
- Transactions costs for traders reduced
- Quantities for traders increased
- Viable business cases established

### Long-term outcomes

- Market actors offer more products with added value
- More producers and other market actors actively engage in *R. heudelotii* production and marketing
- Women have more decision-making power related to production, marketing and use of revenues from *R. heudelotii*
- Policy makers are more knowledgeable and willing to develop policy incentives to promote *R. heudelotii* sector for poverty alleviation and environmental services
- Private sector increases investments in *R. heudelotii* business

### Outputs

To better exhibit achievements, several outputs have been planned to be delivered and can be presented as here below, along the different points of the chain:

In the domain of production:

- Genebanks and motherblocks with improved material developed;
- Technical note on vegetative propagation formulated;
- A network of tree nurseries producing improved tree planting material put in place;
- Guidelines for integration of *R. heudelotii* in different land-use systems developed; and
- Guidelines and training manual on context-specific agronomic practices for *R. heudelotii* cultivation published.

In the domain of value addition:

- Report on chemical and physical characteristics of *R. heudelotii* nuts finalised;
- Appropriate technologies for extraction of *R. heudelotii* kernels and processing developed; and
- Information on consumer preferences and market potential for kernels and processed products compiled.

With regards to market access:

- Support tools developed for producer and trader associations to decide on the most effective way of organising *R. heudelotii* production and marketing;
- Effective producers' and traders' organisations formed;
- Training material for entrepreneurial skill development published;
- Methodological approach for linking producers to other market actors developed;
- Models for viable business plans for private sector financing designed;
- Training material to empower women and minority groups in the *R. heudelotii* sector published; and
- Effective Market Information System in place.

Concerning the enabling environment:

- Evidence on production, prices, income, contribution to GDP, demand (official statistics) generated;
- Feasibility study on different instruments and institutional arrangements to facilitate *R. heudelotii* businesses produced;
- Assessment of effectiveness of different incentive options completed;
- Evidence on environmental benefits of *R. heudelotii* provided; and

- Training material to improve capacity of extension services to provide business and rural advisory services published.

## Activities

The research on development activities that can contribute to the outcomes are grouped into activities related to production, value addition, market access and enabling environment.

### • Production

1. Organise sensitisation campaigns
2. Identify and propagate superior planting material
3. Develop germplasm distribution systems
4. Develop appropriate agroforestry models integrating *R. heudelotii*

### • Value addition

1. Understand relationships between chemical and physical characteristics for nut cracking
2. Design extraction technologies
3. Understand consumer preferences and future market demands

### • Market access

1. Design effective ways of organising producers and traders
2. Strengthen organisational and entrepreneurial capacities of producers
3. Facilitate linkages between market actors
4. Develop mechanisms for producers, traders and processors to facilitate access to credit
5. Develop tools to guarantee effective participation of women and minority groups in decision-making
6. Design and implement Market Information System for national, regional and international markets

### • Policy and environment

1. Gather evidence on production, prices, income, contribution to GDP, demand
2. Design new instruments and institutional arrangements to facilitate *R. heudelotii* businesses
3. Design and evaluate different incentive options
4. Gather evidence on environmental benefits of *R. heudelotii*
5. Improve capacity of extension services to provide business and rural advisory services

## Partners and Roles

Partners	Roles
Scientists (ICRAF, universities, national and international research institutes)	Study value chain, identify/design and test options along the value chain (from production, harvest, processing and commercialisation)
Government (ministries, ...)	Create enabling business environment; set up technical and business support mechanisms and services
Civil society (NGOs, farmer organisations, traders /processor organisations)	Scale-up innovations along the value chain; lobby for enabling business environment; provide technical and business support to producers, traders and processors
Beneficiaries (farmers, traders, processors...)	Test and evaluate options (participatory research)

## Stakeholder Engagement

ICRAF engages with a wide range of stakeholders in the implementation of its activities and will issue a 'call to action' across sectors to effectively communicate and engage with all partners in its strategic approach.

ICRAF will leverage its reputation as a centre of scientific and development excellence that harnesses the benefits of trees for people and the environment. Leveraging the world's largest repository of agroforestry science and information, we develop knowledge practices at all levels, from farmers' fields to the global sphere, to ensure food security and environmental sustainability.

ICRAF will continue to support research on improved planting materials for *Ricinodendron heudelotii* to ensure the supply of quality products preventing the depletion of natural resource.

ICRAF will support inclusive and sustainable development of *Ricinodendron heudelotii* for its high potential to increase farmers' incomes and its contribution to restoring degraded lands in West and Central Africa, for

governments and policymakers, donors and regional and international development organizations, the private sector and farmers and others.

ICRAF will pursue its research on its promising prototype extraction machine to increase labour efficiency and economic advantages for rural women's groups engaged in ricinodendron post-harvest value chains.

ICRAF will promote long-term value chain sustainability by increasing collaboration between stakeholders, collective action, disseminating knowledge about processing and storage techniques, and promoting domestication and cultivation to enable trade to continue sustainably for the ricinodendron value chain.

The stakeholder engagement plan will communicate the above messages and also provide a platform for follow-up and tracking potential donors and investors to support the strategy for sustainable *Ricinodendron heudelotii* value chains in West and Central Africa.

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