



Training Manual for Rural Resource Centres

**Making quality germplasm and inputs,
and bringing services closer to farmers
while creating green job opportunities
for rural youth and women**

Mulugeta Mokria, Niguse Hagazi, Kiros Hadgu, Abrham Abiyu, Gebrehiwot Hailemariam,
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Gergera Watershed, Tigray, Ethiopia

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List of Abbreviations & Acronyms

| | |
|-------|---|
| BESV | Breakeven Sale Value |
| CBA | Cost-benefit analysis |
| CIFOR | The Centre for International Forestry Research |
| CMR | Contribution Margin Ratio |
| CRS | Catholic Relief Society |
| DA | Development Agents |
| DQI | Dickson Quality Index |
| FAO | Food and Agriculture Organization of the United Nations |
| FC | Fixed Cost |
| FDRE | Federal Democratic Republic of Ethiopia |
| FTC | Farmer Training Centre |
| GDP | Gross Domestic Product |
| GIP | Galvanized Iron Pipe |
| ICRAF | World Agroforestry |
| IFAD | The International Fund for Agricultural Development |
| IFPRI | International Food Policy Research Institute |
| INGO | International Non-governmental Organization |
| IPCC | The Intergovernmental Panel on Climate Change |
| IRR | Internal Rate of Return |
| MoA | Ministry of Agriculture |
| MoALR | Ministry for Agriculture and Livestock Resources |
| MoANR | Ministry of Agriculture and Natural Resources |
| MSEP | Multi-Stakeholder Engagement Process |
| NGO | Non-governmental Organization |
| NPV | Net present value |
| OYWG | Organized Youth and Women Groups |
| PARM | The Platform for Agricultural Risk Management |
| PI | Profitability Index |
| PIR | Profit Investment Ratio |
| RCD | Root Collar Diameter |
| RRC | Rural Resource Centre |
| SH | Seedling Height |
| SQI | The Sturdiness Quotient Index |

| | |
|-------|---|
| SSA | Sub-Saharan Africa |
| TOM | Tree of Outstanding Merit |
| UNCCD | The United Nations Convention to Combat Desertification |
| UV | Ultraviolet |
| VIR | Value Investment Ratio |
| WV | World Vision |



About CIFOR-ICRAF

The Centre for International Forestry Research (CIFOR)-World Agroforestry (ICRAF) united in 2019 to conduct research-in-development on the most pressing challenges facing the world's forest and agroforestry landscapes. CIFOR and ICRAF are members of the CGIAR – a global research partnership for a food-secure future – and share its focus of poverty reduction, increased food and nutritional security and sustainable natural resource systems. The CIFOR-ICRAF work is aligned with the Sustainable Development Goals and the Paris Agreement, as well as the three Rio Conventions.

The CIFOR-ICRAF delivers actionable evidence and solutions to transform how land and renewable resources are used, and how food is produced. These include conserving and restoring ecosystems, supporting sustainable supply chains, and responding to the global climate, malnutrition, biodiversity, and desertification crises. *In short, improving people's lives while preserving the environment.*

The CIFOR-ICRAF provides actionable, game-changing solutions to five major global challenges including Deforestation and biodiversity loss; A climate in crisis; Transforming food systems; Unsustainable supply and value chains; and Extreme inequality. To deliver actionable, game-changing solutions to the five global challenges, the organization has divided its research teams into six themes including Trees and forest genetic resources & biodiversity; Livelihood systems; Sustainable value chains and investments; Governance, gender, justice and well-being; Climate change, energy and low carbon development; and Soil and land health.

In line with the above challenges and solutions, the CIFOR-ICRAF Ethiopia has been working on various research-in development programs for several decades. These include landscape restoration; agroforestry; climate-smart agriculture; forest conservation and development; forest policy and governance; food and nutrition security; integrated watershed management; drylands development; climate change; provision of adequate tree seed portfolios; rural job creation through agroforestry and tree-based value chains; women empowerment; development of innovative and learning platforms for enhanced economic opportunities and resilience; plus other associated programs. The key partners have been the Government of Ethiopia and other national and international development agencies supported by different donors.



SECTION I

1. Introduction

1.1. Background

Land is the main natural capital and decisive factor in producing food and ecosystem goods and services ¹. The livelihood and well-being of farmers depend upon and are intricately linked to the health and productivity of land ^{2,3}. However, land degradation is increasing. Global net primary productivity has been reduced by at least 5% due to land degradation, which is estimated at an economic value of between \$6.3-\$10.6 trillion per year (or 10-17% of global GDP) ⁴. The impact is particularly severe on the livelihoods of poor people who depend heavily on natural resources. Over time, land degradation can increase the vulnerability of rural communities to biological and environmental hazards and to the effects of climate change ^{5,6}.

The world's population, specifically Africa's youth population is growing rapidly, hence demand and competition for access to land and water resources are increasing, thus exacerbating land degradation ^{3,7}. The youth are Africa's greatest asset. If properly harnessed, this increase in the productive age population could support increased productivity and economic growth across the continent ⁸. However, today, most of the youth in Africa do not have access to stable economic and job opportunities ⁹. From the continent's total population, nearly 50% of youth aged 15-35 years live in rural areas, one-third are unemployed and discouraged, another third are vulnerably employed, and only one in six are in wage employment ⁹. Unemployment exacerbates poor living conditions and may contribute to conflict as well as the degradation of natural resources. Therefore, promoting national efforts that can provide new job opportunities is critical. Africa needs about 15 million new decent jobs every year to harness its demographic dividend, reflected by a booming young population¹⁰

Rural resource centre-based green job opportunities for rural youth and women are therefore becoming increasingly important to address both environmental problems and socio-economic concerns of youth and women, as well as increasing access to agricultural inputs. To this end, ICRAF, together with its partners, has been piloting the RRC business model since 2013 in Ethiopia. Based on the lessons and learnings, we believe that developing a comprehensive training manual is important. The publication can be utilized by various actors and stakeholders in their development efforts and initiatives to enhance economic opportunities and to build resilient communities.

1.2. Rationale for this training manual

The increasing number of unemployed youth and poverty are among the main constraining factors to attaining development, conservation and livelihood goals. It is important to develop comprehensive training to increase the capacity of rural youth and women groups, as well as agricultural extension to develop green job opportunities.

More importantly, Ethiopia has more than 24,000 government nurseries providing seedlings required for tree-planting programs ¹¹. However, most of these nurseries are not efficient and are usually active for a few months of the year. ICRAF has piloted and tested a business model known as the **Rural Resource Centre (RRC)** by privatizing some nurseries found in Ethiopia ¹² ^{1,2} and other parts of Africa ¹³. The main objectives of RRCs include: *1) making government nurseries more active and functional; 2) creating new employment opportunities for the rural landless and unemployed youth and women groups through privatizing public nurseries and establishing new ones; 3) producing demand-driven quality planting materials; 4) producing quality forestry, agroforestry and agricultural inputs, services and many other related issues, including bringing services closer to farmers and farming communities.* Across piloted areas, the RRC business approach proved to be feasible *in supporting the forest and degraded landscape restoration and greening initiatives.* Youth and women groups are now earning financial returns while in their localities and are hoping to grow further. Thus, it is important to develop a comprehensive training manual to scale up RRC business models and principles.

1.3. Target audience

This training manual is designed for youth and women groups participating in the production of planting materials, as well as practitioners at operational level (*i.e., nursery managers, agroforestry, farm conservation, agri-business, intensification and diversification extension workers and development agents, local communities and NGOs*).

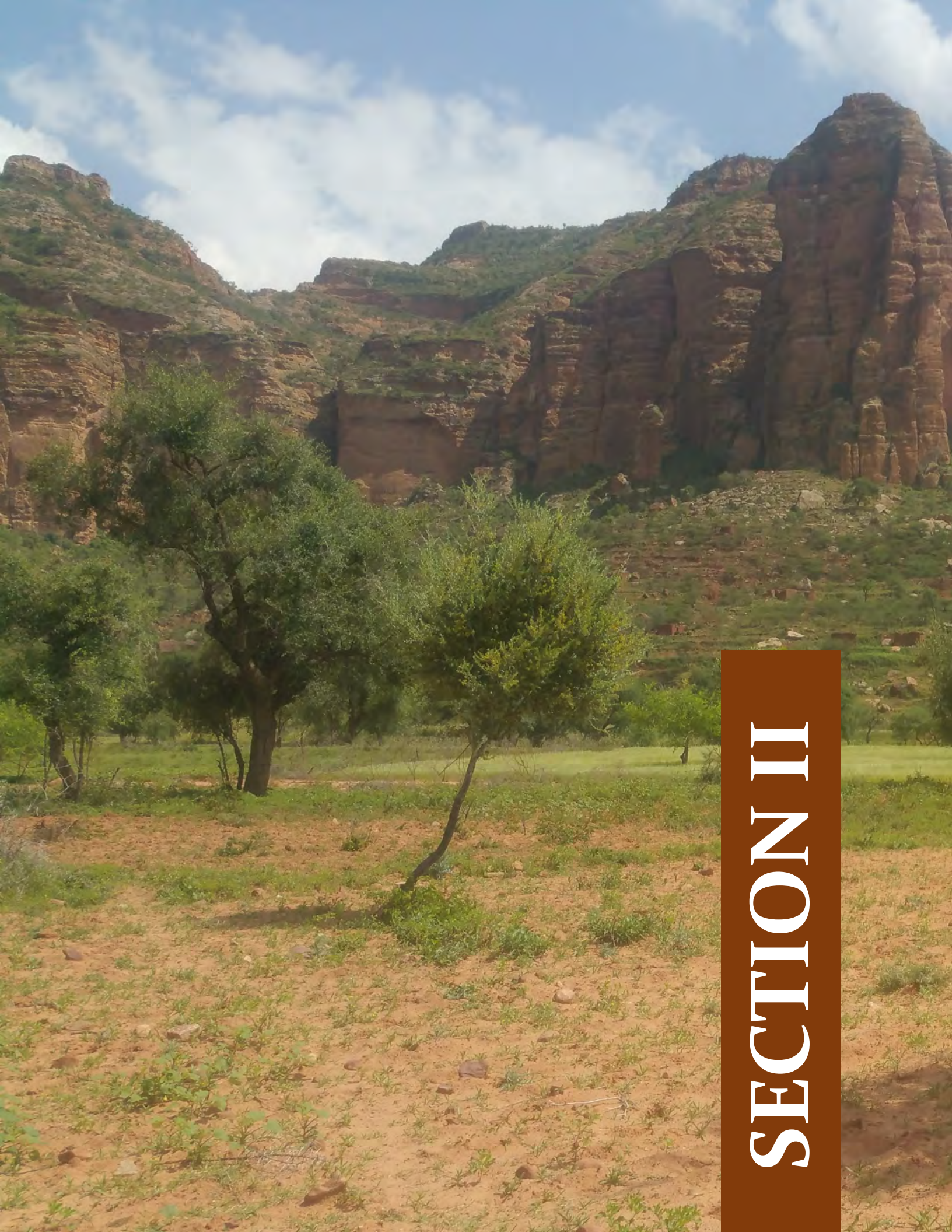
1.4. Structure of the training manual

This training manual comprises eight (8) chapters. The first chapter presents the general background, objectives and target groups. The second chapter highlights the scoping study and characterizing land use types, land resources, user rights and the existing

¹ <https://worldagroforestry.org/blog/2022/07/04/feature-bringing-bright-future-creating-green-jobs-ethiopia>

² <https://cqs-space.cgiar.org/handle/10568/102010?show=full>

extension system. The third chapter underscores the key components and principles of RRCs, the rationale of the RRC business, RRC ownership, RRCs vs the classical extension system, the importance of investing in RRCs, step-by-step engagements of stakeholders to identify and select women and youth groups, and services and inputs provided by RRCs. The fourth chapter discusses the steps and key activities needed to establish the RRC, design and construction of basic structural components and management. Chapter five presents key steps to create youth and women-oriented green jobs, gender considerations, RRC governance structure, ownership, organizing youth groups as cooperatives, and stakeholder engagement and support. Chapter six presents the type and importance of capacity building. It also provides information on grafting techniques. Chapter seven provides information and methods needed to assess seedling quality. The last chapter deals with a feasibility assessment and tree-based value chain based on previous evidence, lessons and experiences.



SECTION II

2. Scoping study in RRC establishment

2.1. Landscape and land use characterization

Scoping studies or reviews are a method used to build comprehensive evidence which may be used to inform future development programs, research practice and policy. Conducting scoping studies should aim to document information, experiences, opportunities and potential challenges on the economic feasibility of RRC development.

In the context of the scoping study, “**land use**” is the term used to describe human use of land. Understanding the current major land use system across areas identified for RRC development is important. It helps to decide what kind of planting materials to produce and services required to improve the livelihoods of the farming community and restore degraded landscapes. In general, the benefits of conducting a scoping study are summarized in [Box 1](#).

Box 1.

- To document the farming system and farmers' preferred planting materials, inputs, and services
- To document agro-climatic characteristics of the area
- To document the existing public nursery site (size, governance, purpose, efficiency, accessibility to roads and markets)
- To identify the availability of existing public nurseries and land resources that can be transferred to organized youth and women groups (OYWG)
- To identify options for OYWG to secure land ownership (e.g., usufruct³ rights)
- To identify opportunities and options for OYWG tree-based value chains
- To evaluate land suitability for RRC establishment
- To identify inputs that are necessary to implement RRC establishment
- To evaluate the commercial viability or profitability of RRC seedling production
- To conduct seedling and input demand-supply analysis and identify the most required planting materials and forestry, agroforestry and agricultural inputs and services
- To understand the operating environment (i.e., policy and legal frameworks), as well as potential stakeholders at various levels
- To identify challenges and barriers associated with seedling production, marketing, access and women participation
- To identify potential risks in RRC development (conflict, safety and other related risks)

³A usufruct is a legal right accorded to a person or party that confers the temporary right to use and derive income or benefit from other's (e.g., government, community) property.

- To identify the inputs or supports required to improve the efficiency of selected public nurseries that can be owned by OYWG
- To identify the major types of seedling production and their price margins
- To identify highly preferred tree seedlings, vegetables and fruit crops

2.2. Access to land resources, ownership and land use rights in Ethiopia

In Sub-Saharan Africa (SSA), the land-holding system is highly intertwined with the population's source of livelihood, culture and identity. For most rural communities in the region, land is the primary means of production that is used to generate a livelihood for families. In line with this, the size of the land that they own potentially affects the household's income, plus their incentive to work and invest.

“Land is public property in Ethiopia ¹⁴. According to the current land policy, the right to ownership of rural and urban land, as well as of all natural resources, is exclusively vested in the State and the peoples of Ethiopia ^{14, 15}. Land is a common property of the Nations, Nationalities and Peoples of Ethiopia and shall not be subject to sale or to other means of exchange”.

The current land policy concealed earlier bans such as restrictions on land lease, labour hiring on a private farm, sharecropping and individuals holding more than 10 ha ¹⁶. Rural land can be accessed through government allocation, inheritance, gift and land leasing, but cannot be sold, exchanged or mortgaged. The fact that farmers have only **usufruct rights** to land has sparked a debate among Ethiopian and foreign scholars regarding the effect of the tenure system on land investment and management ¹⁴.

2.3. Public agricultural extension system of Ethiopia – the need to link with RRCs

Country-specific modernization and reform of national agricultural extension systems is a major undertaking requiring careful analysis of the situation. A quick review of various aspects of the existing extension system should be sufficient to start RRC-based green jobs and produce improved varieties of planting materials.

With approximately 21 development agents (DAs) per 10,000 farmers, Ethiopia has one of the largest agricultural extension systems in the world ^{17,18}. Moreover, the government has

been putting in an enormous amount of effort into modernizing the national extension system by establishing several farmer training centres (FTCs), which is one of the important entry points to improving access to extension services (Fig. 1). Currently, the government has established more than 12,000 FTCs; these provide agricultural extension services and contribute to agricultural development. While acknowledging these strengths, several efforts have been made to make the extension system more effective and efficient, but have not always produced the desired results¹⁹⁻²¹. Among others, the key bottlenecks leading to inadequate performance of FTCs include: (1) *Limited involvement of farmers in FTC management*, (2) *Insufficient resources for FTCs – critical for self-sustenance*, (3) *Most FTCs have no long-term plans for sustainability*, (4) *Inadequate incentives to motivate and retain DAs*, (5) *Limited knowledge and skills of DAs*, (6) *Limited training for farmers and* (7) *Inadequate incentives for model farmers who spend their time supporting resource-poor farmers*^{19,20}. Some of these challenging factors might be solved through the adoption and scaling up of RRCs to support and complement the activities of FTCs. Details on the RRC business model, concepts and principles are provided in the next chapters.

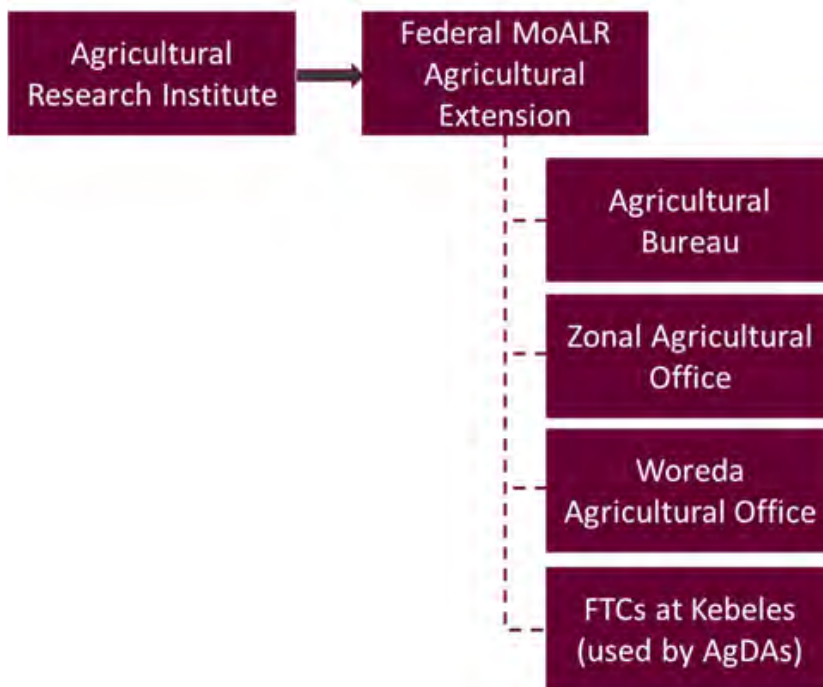


Figure 1. Hierarchical structure of agricultural extension system in Ethiopia. (Source modified from²²)

SECTION III



3. Rural Resource Centres – concept, principles and procedures

3.1. What is a Rural Resource Centre?

A rural resource centre (RRC) is a youth-centred knowledge-hub registered as a *farmers' association and/or agricultural cooperative*. Its functions are based on the principle of community, women and youth engagement. It is a business model and serves as a venue for farmers, youth and women groups to link with other actors including the private sector, non-governmental organizations (NGOs), government agencies and research institutes. It enhances access to agricultural information, training and quality planting materials. **Fig. 2.** highlights the general flow of process in the establishment of an RRC.

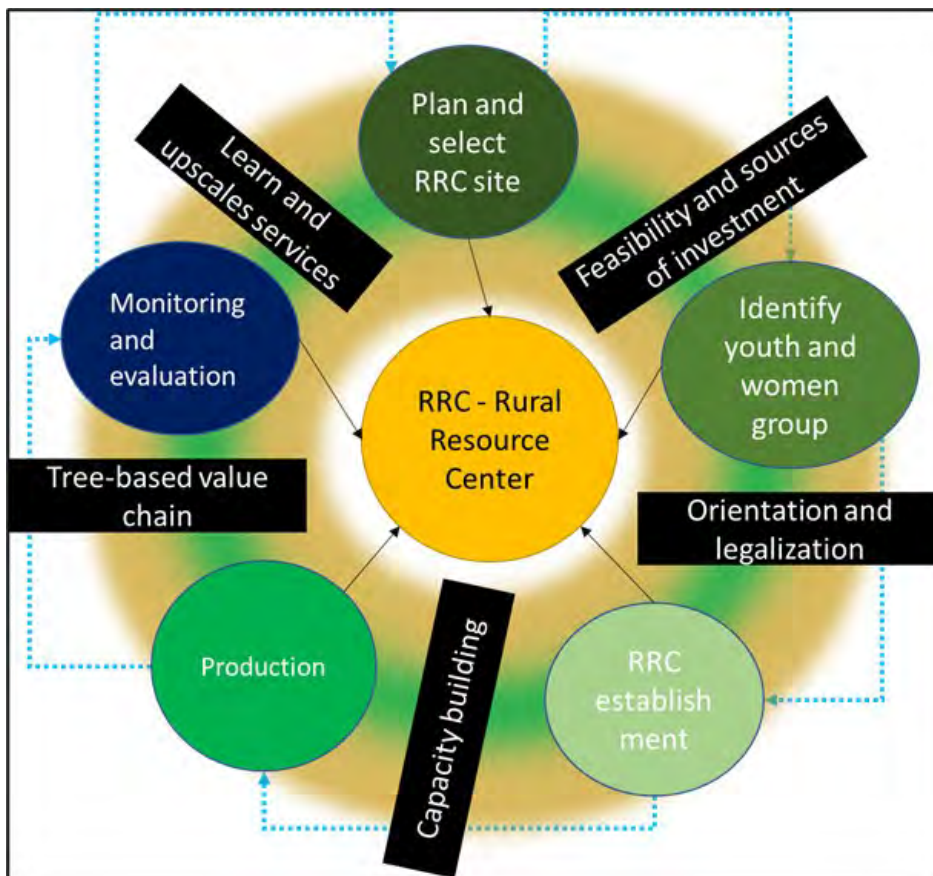


Figure 2. Flow of RRC establishment.

3.2. The rationale behind introducing the RRC business model in Ethiopia

There are a large number of nurseries in Ethiopia owned either by the government or communities. However, the nurseries are active and busy, on average, for only about six months in a year, thus performing sub-optimally. Moreover, seedling production in government nurseries put emphasis on quantity, and are subject to quota-based distribution. Thus, there is still an acute shortage of quality planting materials. The **RRC business model** has the potential to increase access to high-quality planting materials for farmers and investors.

RRC business enterprises were piloted by ICRAF together with its partners in different parts of the country from 2013 in Ethiopia. They have proven to be successful business models which could potentially be scaled up to national level to create dignified and fulfilling jobs for many unemployed youth across the country, while improving access to quality planting materials (Fig. 3).

Ethiopia has more than 24,000 nurseries supplying seedlings required for the national reforestation and local tree planting programs ¹¹. Taking this opportunity and with strong support from the national and local government, ICRAF has piloted and tested a business model dubbed the **Rural Resource Centre** through privatizing selected public nurseries in some parts of Ethiopia ¹² ^{4,5} and elsewhere in Africa ¹³. The main objectives of RRCs are: **1) to make nurseries active and functional throughout the year; 2) create new employment opportunities for the rural landless and unemployed youth and women groups to generate income and sustain their livelihoods; 3) produce demand-driven quality planting materials; 4) ensure quality forestry, agroforestry and agricultural inputs and services, including bringing quality planting materials closer to farmers and other end users.**

Across piloted areas, the organized youth and women groups under the RRC business model are now enjoying financial returns while in their locality, and are hoping to grow even more. Thus, it is important to develop a comprehensive training manual to increase awareness of the RRC business model and principles, and to increase the capacity of rural youth and women groups, as well as agricultural experts to develop green job opportunities. The manual will help agricultural officers (national, regional, district level), NGOs and other stakeholders to upscale the RRC business approach in different parts of Ethiopia.

⁴ <https://worldagroforestry.org/blog/2022/07/04/feature-bringing-bright-future-creating-green-jobs-ethiopia>

⁵ <https://cqs-space.cgiar.org/handle/10568/102010?show=full>

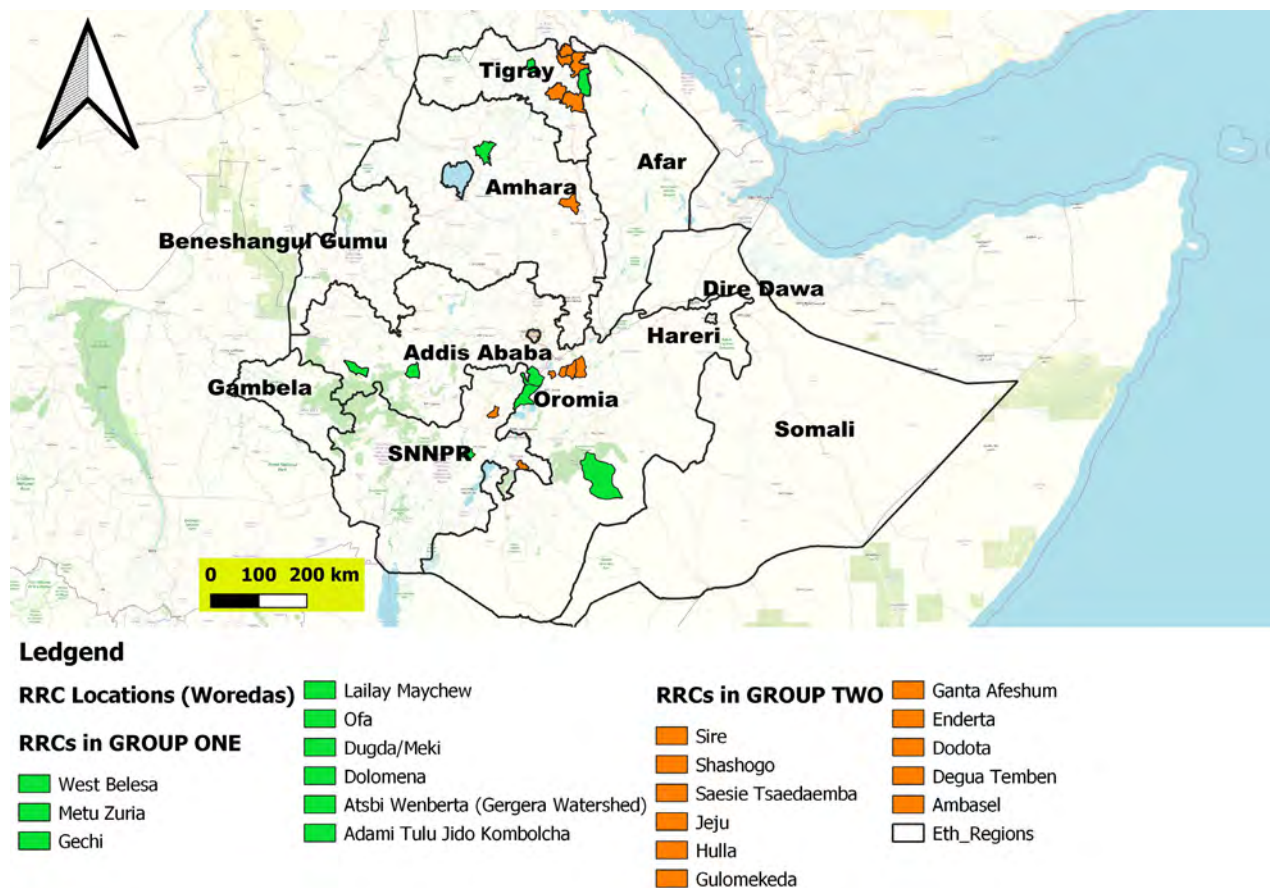


Figure 3. Location (Woreda) of RRCs. Group one refers to RRCs established by ICRAF in collaboration with the offices of Agriculture, Natural Resources, Land, and Cooperatives. RRCs in Group two refer to those established by CRS-Ethiopia, WV-Ethiopia, and other organizations through ICRAF’s guidance and technical support, as a way of scaling up the RRC business model.

3.3. Who owns and runs the RRC?

Rural resource centres are primarily owned and run by organized local women and youth groups. It is an effective paradigm shift from the notion that progress can only be attained through formal research and the extension approach. RRCs could also successfully address gender issues by working specifically with women’s groups through targeted engagement of women involvement in all activities. As a result, the youth (women and men) are often attracted to the RRC business because of the employment opportunities that they are able to secure. Therefore, the RRC business concept helps to address the issues of youth unemployment, and out-migration of youth and women. Most importantly, the RRC-based green job approach allows non-hierarchical stakeholder

interaction and serves as a platform and learning hub for various institutions and actors who can then work together to achieve a common goal (Fig. 4).

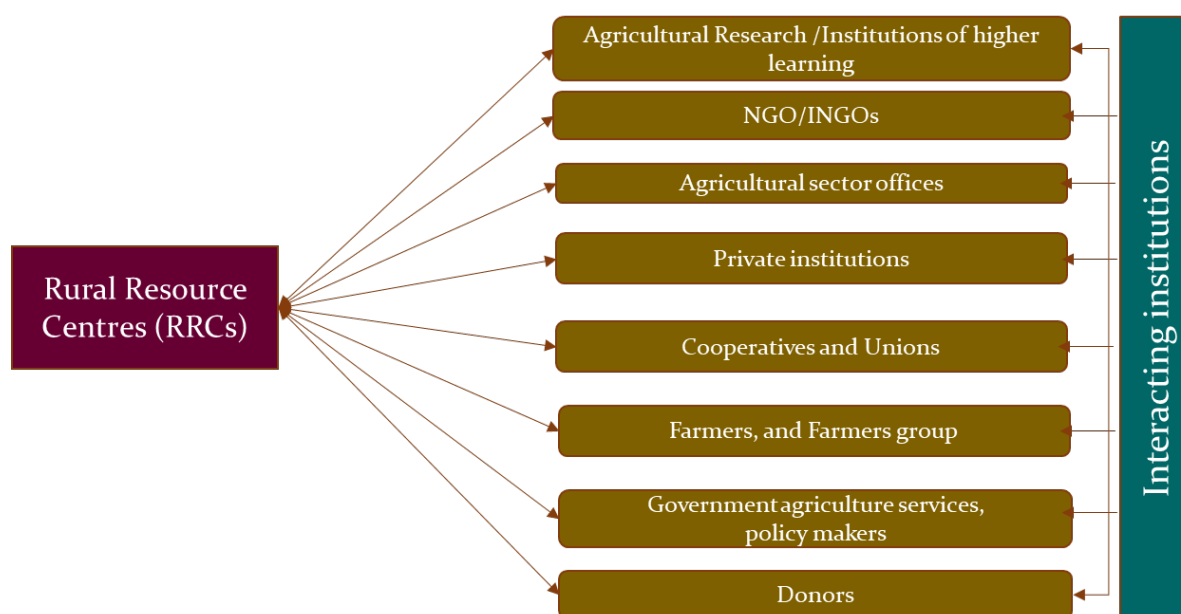


Figure 4. Non-hierarchical structure of RRC and linkages with potential stakeholders

3.4. Novelty of the RRC business model compared to other classical extension systems

How different is the RRC approach when compared to other extension approaches? Compared to public-run agricultural extension systems, RRCs have the following advantages: greater accessibility, increased adoption and evaluation of new technologies, better quality services, relatively high number of women and youth reached, and more effective networking with other rural actors and cooperatives. The key advantage of RRCs, however, is that they are rooted within a local context and have gained buy-in from farmers, women and youth. Therefore, they serve as reliable platforms that contribute to the creation of sustainable green job opportunities for rural youth and women groups. They also bring inputs and services closer to farmers and farming communities. Key features of RRCs are summarized in [Box 2](#).

Box 2. Key features of RRCs

- Complement other extension approaches (e.g., FTCs)
- High accountability (b/c the members of groups are legally recognized)
- Effective as a self-sustaining green business (because it is profit-oriented)
- Capacity to carry out activities when external funding stops or is reduced
- Cost-effective (ensure year-round functioning and effective use of the land)
- Gender-sensitive (allowing women and youth to participate and share benefits)
- Easy tracking of sources of planting materials purchased from the group
- Provide new opportunities for joint research, adaptation, training, experience-sharing, and diffusion of good practices and technologies
- Effective partnerships and easy to collaborate with other organizations (low level of bureaucracy)
- Subject to gradual development of the business and business approach
- More flexibility in activities, room for testing and adaptation
- Attractive to youth and women groups (b/c it is business-oriented)
- High opportunity of capacity development (b/c of diversified partnership and self-interests of RRC members)
- Scalability across regions and country

3.5. Why we need to invest in RRCs

Under the formal agricultural extension system, we have a limited number of well-trained extension officers or researchers struggling to reach a large number of farmers. Hence, RRCs offers a new opportunity to attain what was once considered impossible.

Furthermore, the centres also support local existing extension systems by strengthening and linking local institutions such as FTCs to farming communities, and providing a central location for demonstration of novel innovations to improve agricultural production and landscape restoration (Fig.5).

3.6. Key services provided by RRCs

Box 3.

- Seeds, seedlings and other inputs
- Training on quality seedling production, grafting techniques and financial skills
- Information on new technologies and innovations
- Links to market actors, particularly the private sector
- Access to market information and micro-finance opportunities
- Forum for exchange of information among farmers, youth groups and other stakeholders (Fig. 5)



Figure 5. Stakeholder field visit and experience-sharing.

3.7. Key issues to be addressed in establishment of a profitable RRC business

Box 4.

- Availability of sufficient land resources
- Type of plant and volume to propagate
- Identify and interact with key stakeholders (*Who are the main stakeholders?*)
- Identify seedling production approach (*How do I grow these plants/seedlings/cuttings?*)
- Identify potential markets and customers (*Where do I sell these plants/seedlings/cuttings?*)
- Resources required for full functioning of the RRC (*What resources do I need?*)
- Set affordable prices for each product (*What do I charge for the plants/seedlings/cuttings?*)
- Identify means to diversify RRC incomes sources (*What other forestry, agroforestry and agricultural inputs and services are needed?*)



SECTION IV

4. Establishing Rural Resource Centres

4.1. Site selection for RRC establishment

In general, sites for RRC establishment should be located close to a water source, and in areas with good access to a main road for easy transportation of products. In addition, it should be in a place where skilled labour is readily available. Nursery sites within the RRC should be established in gently sloping areas, with well-drained soil. An appropriate site must be selected for the most effective, efficient and economical design of a nursery. The RRC site selection will be dependent on the purpose and kind of plants to be produced. Careful observation of agroecological conditions and market potential are critical in the establishment of an RRC. If possible, it is advisable to visit several locations and make a list of potential nursery sites. These should then be compared and rated using several criteria and a decision matrix (Tables 1, 2).

Table 1. Site selection criteria and their description. *** can be considered as a critical criterion; *secondary criterion.

| Site selection criteria | Description {(Unsuitable (code = F, or 0), poorly suitable (D, or 1), Suitable (C or 2), Very suitable (B or 3) and Exceedingly suitable (A or 4)} |
|--|---|
| Accessibility and near to main road*** | Accessibility is important for RRCs; the product should be easily accessible to customers. Potential areas closer to main road can get the highest rating. |
| Water availability*** | An abundance of good-quality, sustainable water supply is critical for nursery and RRC establishment. Areas with direct access from perennial river, spring, ground water and lake can be given the maximum rating. Permanent source of water supply for irrigation. |
| Ease of use and upgrading /modernizing/* | Areas requiring the least cost for upgrade/modernizing might get the highest rating. These include areas which have fencing, are closer to materials required for construction, etc. |
| Easy access and proximity to staff* | Potential areas should be accessible and near a village where most RRC members live. This is critical because the activities in the site require day-to-day follow-up. |
| Adequate land availability*** | Potential area should have sufficient land for establishment and expansion. An area of about 1-2 ha, can get the highest rating. |
| Possibility of privatization*** | In the RRC business model, ownership plays a significant role in group development. Thus, potential areas that can be fully transferred to youth groups can get the highest rating, and areas which can be transferred to youth groups on the basis of usufruct for 5-10 years can get the second-best rating, and so on |
| Previous ownership and land uses *** | <p>Previous ownership and land use type is important:</p> <ul style="list-style-type: none"> • Government nursery sites that are not fully functional as per the total land area – this will be a prime choice • Potential areas with public ownership + grazing land or open areas (restoration sites) – can get the highest rating • Government ownership + nursery site – could also get the highest rating • Potential areas with undefined ownership can get the second best rating • Potential areas with private ownership can get the lowest rating (because it will be expensive) |
| Politics (conflicting land use zone) *** | Potential areas should be located far from conflict zones, as well as areas which have conflicting land use issues. |

| Site selection criteria | Description {(Unsuitable (code = F, or 0), poorly suitable (D, or 1), Suitable (C or 2), Very suitable (B or 3) and Exceedingly suitable (A or 4)} |
|----------------------------------|---|
| Proximity to markets *** | Proximity to markets include accessibility to farmers, horticultural investors (investment area), as well as local markets where RRC products can be supplied and sold. |
| Demand for planting materials*** | The potential area should be surrounded by people who require RRC products and services (like grafted planting materials, training, and other inputs). Areas with high demand for planting materials should be given the highest rating. |
| Climate/microclimate* | Potential areas with suitable agroecology and good rainfall are important for plant production. It also determines the type of tree/vegetable/fruit/herb to be grown. Thus, the area with suitable agroecology that is not a frost pocket should be given the highest rating. |
| Land cost* | Potential areas that can be accessed with either none or least cost should be highly rated. |
| Soil texture and fertility* | Potential areas with good soil properties are preferable, because an RRC should have a nursery site, a mother block, and demonstration plot. |
| Soil depth* | Potential areas with few rocks are preferable. |
| Topography* | The potential area for an RRC should be a gentle slope not exceeding 5°. The gradual slope allows for runoff, and prevents waterlogging and erosion. |
| Labour supply* | Since some of the RRC activities are seasonal, they may require casual labour, thus areas with high accessibility to labour should be given the highest rating. |
| Shipping distance * | Potential areas should be closer to shipping distance, such as a main city (to purchase nursery items and sell products, including scions, seeds, etc.). |

Table 2. Example: Decision matrix for evaluating potential RRC/nursery site. In this example, Nursery 1 has the highest score and is therefore considered the best choice for RRC establishment/nursery site. Adapted from ²³. *** critical factors; * secondary factors.

| | | Alternatives | | | | | | | | | | |
|--|---|---------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|
| | | Nursery 1 | | Nursery 2 | | Nursery 3 | | Nursery 4 | | Nursery n | | |
| | | Weight values | Rating | Weighted score | Rating | Weighted score | Rating | Weighted score | Rating | Weighted score | Rating | Weighted score |
| Site selection criteria | Accessibility and proximity to main road*** | 0.1 | 4 | 0.40 | 4 | 0.40 | 4 | 0.40 | 1 | 0.10 | 1 | 0.04 |
| | Water availability*** | 0.1 | 4 | 0.40 | 4 | 0.40 | 4 | 0.40 | 1 | 0.10 | 1 | 0.04 |
| | Ease of use and upgrading /modernizing/* | 0.05 | 4 | 0.20 | 4 | 0.20 | 4 | 0.20 | 1 | 0.05 | 1 | 0.01 |
| | Easy access and proximity to staff* | 0.05 | 4 | 0.20 | 4 | 0.20 | 4 | 0.20 | 3 | 0.15 | 4 | 0.01 |
| | Adequate land availability*** | 0.1 | 4 | 0.40 | 3 | 0.30 | 3 | 0.30 | 1 | 0.10 | 1 | 0.04 |
| | Possibility for privatization*** | 0.1 | 4 | 0.40 | 3 | 0.30 | 3 | 0.30 | 1 | 0.10 | 3 | 0.04 |
| | Previous ownership and land use type*** | 0.06 | 4 | 0.24 | 3 | 0.18 | 3 | 0.18 | 1 | 0.06 | 3 | 0.01 |
| | Politics (conflicting land use zone) *** | 0.06 | 4 | 0.24 | 3 | 0.18 | 3 | 0.18 | 2 | 0.12 | 3 | 0.01 |
| | Proximity to market *** | 0.07 | 4 | 0.28 | 2 | 0.14 | 2 | 0.14 | 3 | 0.21 | 4 | 0.02 |
| | Demand for planting materials*** | 0.1 | 4 | 0.40 | 2 | 0.20 | 4 | 0.40 | 3 | 0.30 | 4 | 0.04 |
| | Climate/microclimate* | 0.02 | 4 | 0.08 | 2 | 0.04 | 4 | 0.08 | 4 | 0.08 | 4 | 0.00 |
| | Cost of land * | 0.04 | 4 | 0.16 | 4 | 0.16 | 4 | 0.16 | 4 | 0.16 | 4 | 0.01 |
| | Soil texture and fertility* | 0.02 | 4 | 0.08 | 4 | 0.08 | 4 | 0.08 | 4 | 0.08 | 4 | 0.00 |
| | Soil depth* | 0.03 | 4 | 0.12 | 4 | 0.12 | 4 | 0.12 | 4 | 0.12 | 4 | 0.00 |
| | Topography* | 0.03 | 4 | 0.12 | 4 | 0.12 | 4 | 0.12 | 4 | 0.12 | 4 | 0.00 |
| | Labour supply* | 0.03 | 4 | 0.12 | 4 | 0.12 | 4 | 0.12 | 4 | 0.12 | 4 | 0.00 |
| Shipping distance* | 0.04 | 4 | 0.16 | 4 | 0.16 | 4 | 0.16 | 4 | 0.16 | 3 | 0.01 | |
| Total score | 1 | | 4 | | 3.3 | | 3.54 | | 2.13 | | 0.2952 | |
| Site suitability score/Rank score | | | Rank#1 | | Rank#2 | | Rank#3 | | Rank#4 | | Rank#5 | |

4.2. Key structural components of RRCs

Box 5. A ‘typical’ RRC comprises the following components:

- A tree nursery (bed, shade net)
- Demonstration plot/s
- Plot/s for practical training
- Mother block/s
- A training hall (if possible)
- A small office space (if possible)
- A store (if possible)
- Catering facilities (if possible)
- Agricultural processing units (if possible)

Note that the development of RRCs are progressive and could be achieved over time. The size for each component may vary depending on the total available size of the nursery and production objectives.

4.3. Nursery layout in the RRC

There is no single and globally accepted nursery design for plant seedling production. Thus, each nursery will have a unique design based on availability of space, distinct needs and resources. In general, a good nursery should consist of a water tank/pond, water pump, store, implement shed, open space for potting, seedling raising area/shade net area, office room, propagation structures and composting area. A nursery usually comprises a series of beds and pathways. It is also important to have a room/shelter for staff and the guard. In general, the layout should enable ease of operations and save running costs (Fig. 6). A shade net nursery can be constructed using various sizes and dimensions depending on the purposes and the amount of seedling. It is erected using locally available poles and/or galvanized iron pipes (GIPs) as supports. Ultraviolet (UV) light-stabilized green or black colour shade net of 50 to 75% shade intensity is used to cover the nursery area at a height of 2-3 m. However, the type and colour of the shade net varies depending on the climate conditions of a specific area (Fig. 7).



Figure 6. Example of basic RRC layout and required components.



Figure 7. Photograph of RRC nursery site and other facilities.

4.4. Establishment of mother blocks and demonstration plots

Improvement of the technology base and other recommended strategies will not have the desired impact unless quality planting material is made available. In most cases, the current planting material being supplied is poor, both in respect of genetic values and health standards, besides having high variations within the cultivar. There is also a

degeneration of varieties in certain cases. Variations are also observed in productivity and quality amongst trees of selected varieties. It is, therefore, necessary that the best tree or tree of outstanding merit (TOM) within each variety be selected, and used as the mother block.

4.5. Establishment and maintenance of mother blocks

With the objectives of making available enough number of propagation shoots/scions, it is always advisable to establish a new mother block by purchasing from reliable sources (Fig. 8). It should originate from plants of superior production, resistance and quality traits, thereby contributing to improved fruit production around the intervention sites connected to the RRCs.

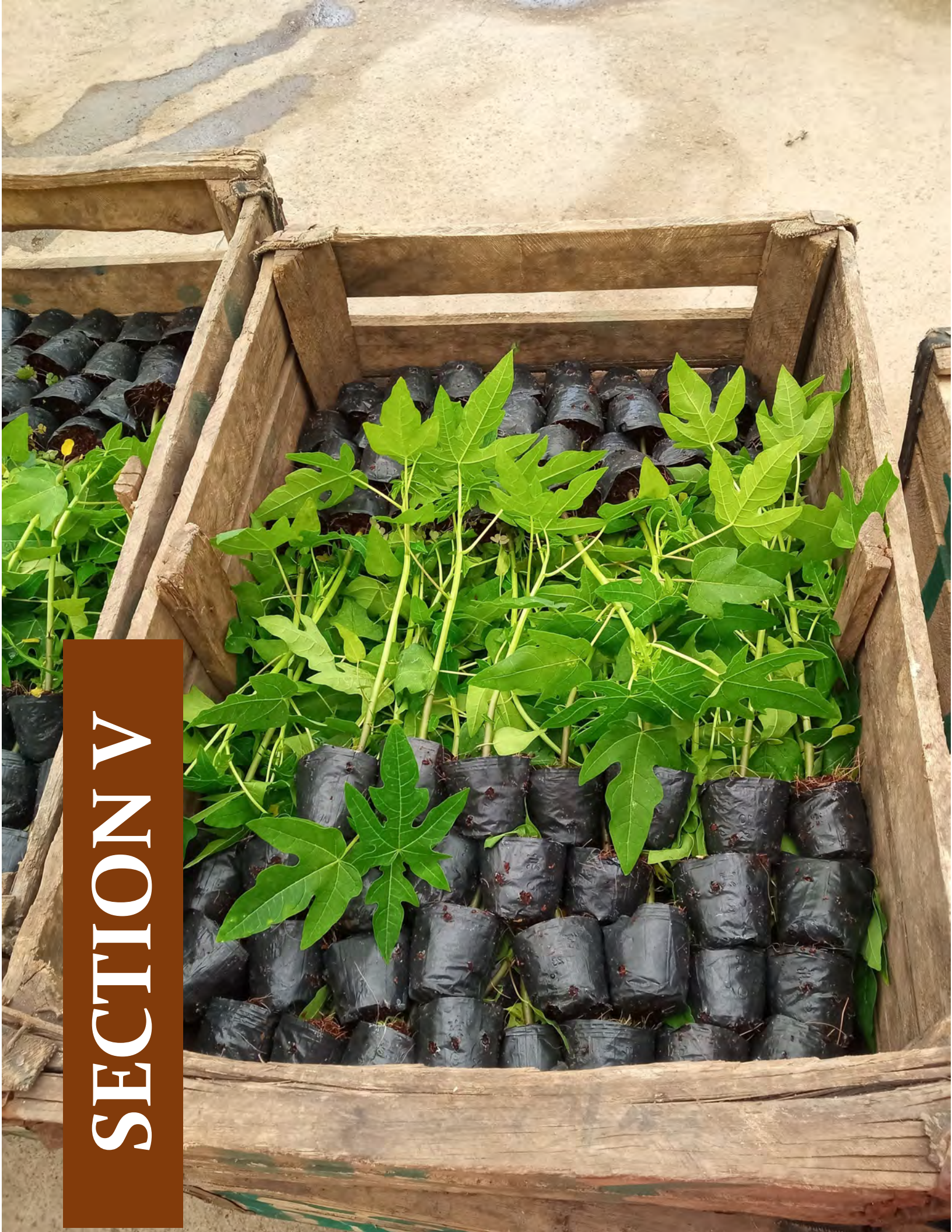
A separate space should be provided for establishment of the mother block with desirable characteristics of varieties within the premises of the nursery/RRC, especially for fruits which require scion for grafting. This is one of the most important inputs which decides the fate of production efficiency of fruit orchards. Therefore, high yielding propagules of recommended varieties from different locations should be selected in the development of a new mother block.

The selection of the elite mother plant **must be done** with the greatest care since the performance of the progeny depends entirely upon the characteristics of the mother plant. While selecting mother plants, the following basic characteristics have to be considered: (i) *consistently high performance and yield over several years* (ii) *healthy and free from diseases and pests* (iii) *plants with appropriate quality parameters* ²⁴. Trees selected for mother plants should be planted in a smaller space to ensure a continuous supply of scions. Mother trees should regularly be pruned to keep them in the vegetative phase and to produce enough shoots/scions for propagation throughout the year. A rigorously continuous maintenance and management of mother blocks is highly recommended to achieve the target of healthy, disease- and insect-free plants. The maintenance of mother plants, right from the time of planting to the stage of bearing and subsequent years, involves application of manure and fertilizer, weeding and inter-culture operations, trimming and pruning, and effective plant protection measures. To avoid overcrowding and the problem of light penetration, canopy management should be practised, depending on the situation and planting density. A proper record of each variety should be maintained by preparing a layout of maps in the nursery register.



Figure 8. Photographic depiction of a mother block (Avocado).

SECTION V



5. RRC-based green jobs

5.1. Steps to create youth and women-oriented RRC-based green job opportunities

Box 6 summarizes basic procedures to be followed during establishment of RRC-based green jobs. The growth of RRCs is gradual and driven by the capacities and resources available to the centre, but is also determined by the length of land ownership and needs of the farming community. Nevertheless, their ability to build strategic partnerships with other institutions such as government agencies, agricultural cooperatives, local councils, charity organizations, research centres, universities, NGOs and development programs, is a key element in ensuring the viability and sustainability of the centre. Therefore, continuous coaching and mentoring of organized youth/women/farmer groups is critical.

Box 6. Key activities in the process of establishing RRC-based green jobs

- Discussions with woreda/district agricultural offices to plan for scoping study.
- Conduct a joint scoping study (*refer to chapter two for details on scoping study*).
- Following the study, conduct a series of consultations with woreda agricultural and land administration offices on possibilities of privatizing existing community-owned land, abandoned and/or partially-functioning government nurseries which can be transferred to organized youth groups, and grant “usufruct”⁶ rights for a period of 5-10 years.
- Conduct feasibility study: this is simply an assessment of the practicality of a proposed project plan or method. It is done by analysing technical, economic, legal, operational and time feasibility factors (*refer to chapter 8 for cost-benefit analysis*).
- Identify unemployed youth and women groups in collaboration with kebele⁷ and woreda/district agricultural and administrative offices.
- Select 10-20 unemployed youth/women as members of RRCs. This should be done in collaboration with the woreda agricultural office and kebele administration (*purely on a voluntary basis*).
- Raise awareness among youth groups about the principles of the RRC business, cooperatives, expectations and responsibilities.
- Facilitate registration of selected youth and women groups as an agricultural cooperative (primarily as quality seedling/cutting/producing cooperatives). This should be done following Regional/National Cooperative Proclamation²⁵.

⁶ A usufruct is a legal right accorded to a person or party that confers the temporary right to use and derive income or benefit from other’s (e.g., government, community) property.

⁷ The smallest administrative unit within a district

- Train the selected youth and women groups on the concepts of cooperative identity, values & principles, communication, marketing, saving and extension skills.
- Establish RRC consisting of nursery site, mother block, training and demonstration plots and other facilities (*refer to chapter three*).
- Built the capacity of RRC members through training (grafting techniques, nursery management, seedbed preparation, watering, composting).
- Facilitate and support field visits for peer-to-peer learning and experience-sharing.
- Help the group to set objectives (short-, medium-, and long-term) and to develop a business plan.
- Help the group to establish links and partnerships with other institutions and relevant stakeholders.
- Support the group to develop their own bylaws and help on its proper functioning.
- Support and help the group to build positive team spirit as this is key in such business models.
- Train and support the group on how they can diversify their business and income-generating schemes, including through supply of inputs and services to farmers and farming communities.

5.2. Governance structure of RRCs

Creating a sustainable RRC-based green job requires dedicated, visionary and dynamic leadership. RRCs are generally under the ownership of a grassroots organization, registered as a farmers' association, agricultural cooperative or micro enterprise. The simplest governance structure of an RRC includes chairman, secretary, accountant, treasury and members (Fig 9). The day-to-day management is generally delegated to a chairman. However, based on needs and available resources, all staff might be responsible for different activities – such as communication, production, marketing, public relations, partnerships and fundraising. In general, the members are responsible for all activities needed to produce seedlings and the services that are expected to be delivered by the RRC. More importantly, RRC members should understand the national/regional legal frameworks that are important for building legitimacy.

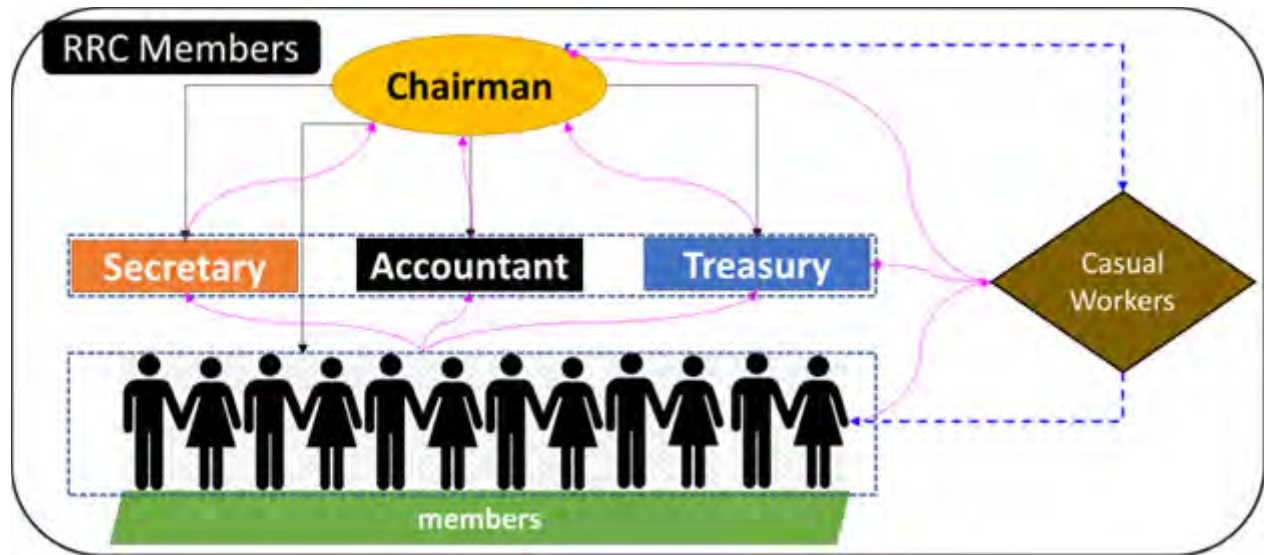


Figure 9. Simple organizational structure of RRC-based seedling-producing cooperative.

5.3. Business model canvas

The business model canvas is an important tool that helps to understand a business model in an easy and structured manner (Fig. 10). A specific canvas will give a comprehensive insight into the customers you serve, what value propositions are offered through what channels, and how institutions/companies/enterprises could make money²⁶.










| | | | |
|---|--|--|---|
| <h3>Key Partners </h3> <ul style="list-style-type: none"> Who are our main stakeholder/s? Who are our key supplier/s RRC? Which key resources are we acquiring from partner/s? – e.g., Land Which key activities do partners perform?– e.g., facilitation <p>e.g., Key RRC stakeholders</p> <ul style="list-style-type: none"> MOA, Regional and regional cooperative agencies Woreda and local land administration NGOs, Private investors (horticulture) | <h3>Key Activities </h3> <ul style="list-style-type: none"> What are the key activities required to provide proposed values? What is required to have cost-effective distribution channels? What activities are needed to have good customer's relationship? What activities are required to diversify RRC revenue streams? <p>e.g., key RRC activities</p> <ul style="list-style-type: none"> Privatizing and modernizing nurseries Continuously train members on – nursery management, grafting techniques Planting, management of seedlings at nurseries Documenting seed sources Training on accounting, business model Training on simple and important agronomic practices Establish linkages with different stakeholders | <h3>Value Proposition </h3> <ul style="list-style-type: none"> What value do RRC deliver? Which one of our customers problems are we helping to solve? What bundles of products and services are we offering to each customer's segment? <p>e.g., Key values of RRC</p> <ul style="list-style-type: none"> Provided new job opportunities rural/urban women/youth group/farmers Serves as a knowledge hub and experiences sharing Supply farmers preferred high-quality germplasm Demonstrate technologies | <h3>Customer Relationships </h3> <ul style="list-style-type: none"> What type of relationship do we and does our customers expect us to establish and maintain with them? How are they fit with our business model? Is there any cost implication to establish a relationship with our customers/stakeholders? <p>e.g., Customers of RRCs products</p> <ul style="list-style-type: none"> farmers, investors, NGOs, Government offices, etc |
| <h3>Key Resources </h3> <ul style="list-style-type: none"> What key resources do we require to establish the RRC and fully supply products and services (proposed values of RRC). Key resources could be: <ul style="list-style-type: none"> Members business knowledge /management skill/ Its physical assets (Land, shednet) Other equipment and machinery Financial | <h3>Distribution Channels </h3> <ul style="list-style-type: none"> Based on customer type and product, you may use multiple channels. For instance, you may opt to sell direct to end-users/farmers for some product lines, while using sales agents and distributors for others. Thus, important to ask: <ul style="list-style-type: none"> How are we reaching them now? Which channel works best for us? Which one are most cost effective? Etc. | <h3>Customer Segments </h3> <ul style="list-style-type: none"> For whom, are we creating value? Who are our most important customers? <p>e.g., customer segments:</p> <ul style="list-style-type: none"> Farmers, investors, NGOs, GOVs | |
| <h3>Cost Structure </h3> <ul style="list-style-type: none"> In this step you'll define RRCs cost structure relative to your value proposition. <ul style="list-style-type: none"> What costs are essential to deliver the maximum of proposed products? How best can we manage these costs in order to derive the greatest return? What are the most important costs inherent in the RRC business model? Which key resources are most expensive?– Land?, Seed? Which key activities are most expensive? – Nurseries operation?, initial investment?, Fixed cost (salaries, rents, utilities) Variable cost (economics of scale, economic of scope) | <h3>Revenue Streams </h3> <ul style="list-style-type: none"> Here, define RRCs revenue streams. <ul style="list-style-type: none"> Is that only derive revenue on sales of a given product/, e.g., seedlings? Plan to charge for essential services such as training? What other services/ products can the RRC deliver that our customers are willing to pay for it? For what do our potential customers are currently pay? How much does each revenue stream contribute to overall revenues of RRC? | | |

Figure 10. RRC business model canvas (example - modified from <https://www.businessmodelsinc.com/about-bmi/tools/business-model-canvas>)

5.4. Gender consideration and working environment

RRCs could target different groups, especially unemployed and landless rural youth and women groups (Fig. 11). In Ethiopia, ICRAF has been working specifically with women and youth groups. <https://worldagroforestry.org/blog/2022/07/04/feature-bringing-bright-future-creating-green-jobs-ethiopia>. They have been the key beneficiaries of the RRC business, and have enjoyed employment opportunities. It is also important to note that the concept of “one-size-fits-all” does not work in this scenario. To be effective, RRCs should be sensitive to the social-economic-environment realities in which they are going to operate and should aim to respond to context- and site-specific needs of the local community (farmers, government entities, private organizations, NGOs, etc).



Figure 11. Women and youth group working in an RRC they own. They are producing grafted avocado varieties.

5.5. Specialization and complementarity

RRCs should be established to achieve specialization and excellence in a few areas of agricultural production, or services that are highly relevant to the local community and that of the country. This distinguishes them from other public extension service-providing centres

RRCs promoted by ICRAF primarily focus on the production of quality planting materials needed to promote agroforestry and horticultural crops (Fig. 12). As a result, establishing demonstration plots within RRCs is important to convince farmers and get their buy-in. RRCs can play an important role where community needs are not met by traditional extension services. Moreover, they can be used to raise some important tree species based

on the demand of the locals so that the contribution to the government and community-led initiatives and programs can be also realised. Generally, they thrive where government extension systems are not fully functional. Even in areas where public extension is effective, RRCs can complement other rural advisory services because of their proximity to the community.



Figure 12. Production of grafted avocado by women and youth groups.

5.6. Stakeholder engagement, roles and responsibilities in the RRC business model

The Multi-Stakeholder Engagement Process (MSEP) is an important vehicle for capacity development and empowerment of youth and women groups. Thus, following the MSEP approach is important to ensure participation of women, men and youth groups on a specific issue based on a set of RRC business principles. This approach could help to ensure equity, gender-sensitivity, accountability, transparency, as well as to develop partnerships and networks among different stakeholders (cooperatives, unions, national/regional/district public institutions, NGOs, universities and research institutions).

5.7. Building ownership in RRCs – business

Ownership is an important factor for collective growth in the RRC business model (Fig. 13). It is important to encourage a culture of ownership and accountability amongst RRC members to attain excellence. In the RRC business approach, when youth and women

equally understand their responsibilities, achievement of their collective goals is possible in an efficient and effective manner. From an overall RRC business perspective, potential loopholes can be identified and appropriate action taken to prevent a recurrence. Hence, ownership is one of the key steps towards effective leadership and management of RRCs.

Therefore, developing an equal sense of ownership among groups is one of the most critical factors to success. This can be done through continuous engagement of all group members from day one of project implementation (Fig. 14). Finally, when the group of RRCs (cooperatives) actually take a step towards ownership, they enjoy several benefits (see Box 7).

Box 7.

- It helps in building relationships (positive team spirit) among group members.
- It strengthens group relationships and increases a sense of mutual trust and confidence in the workplace.
- It helps to bring in more ideas to the forefront related to a specific task or project which might have been in a dormant stage due to lack of time and resources.
- It helps to build individual and group confidence and become more result-oriented.
- The groups become more productive, active and stronger.
- The groups develop a more proactive attitude in solving their challenges.
- Ownership directs the energies of youth and women groups towards a positive direction, even in challenging situations.

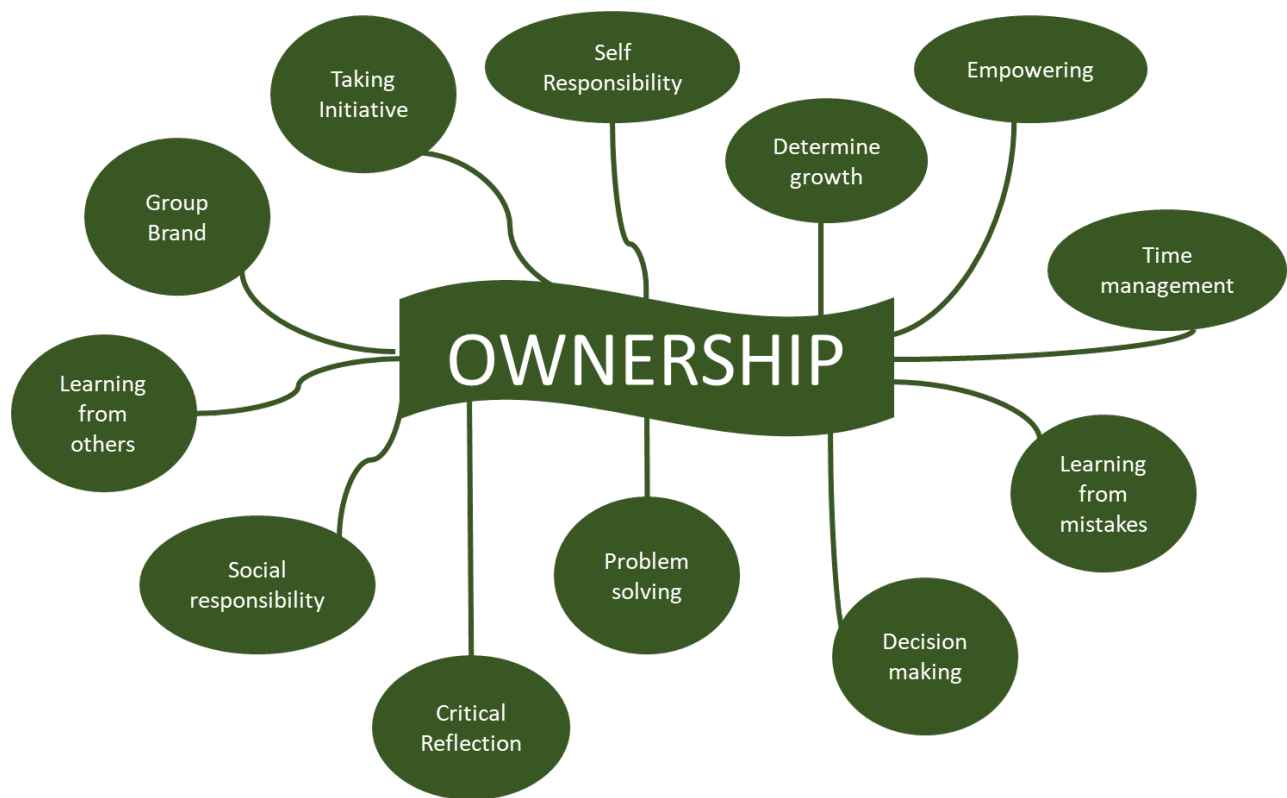


Figure 13. Importance of developing ownership in the RRC business approach.

We strongly recommend giving equal emphasis in developing ownership from the start of RRC business designing and implementation. Because a sense of equal ownership among RRC group members (youth and women) is critical for their growth, as well as that of the cooperative. When the group takes ownership of their work, they treat the business and its money as if it were their own. So, they make decisions responsibly, thoughtfully and with a lot of care. They will also be highly motivated, driven and take more initiative, thus seeking creative and innovative ideas to improve and develop on what they are doing in the RRC. In short, the RRC run by a group who have an equal ownership will maximize their financial benefits and contribution to livelihood development of the surrounding community.



Figure 14. Building ownership through engagement in the process of establishing RRCs and nurseries: an example.



SECTION VI



6. Capacity building of RRC members

6.1. Capacity building and support of RRC operators

The centre requires a well-trained and motivated technical team with a diverse skill set, including training and extension methods, agronomic practices, management and finance. Therefore, it is important to build the capacity of RRC members. Successful RRC operators must develop and maintain strong and diversified partnerships and linkages with various organizations and private sector entities, for example, connections with research organizations, universities, NGOs for capacity development and technical guidance. Continuous provision of technical training and business skills should be delivered to organized youth/women group/s. In addition to technical skills development, business skills are mandatory. Fig. 15 presents basic areas of capacity development in the RRC business. Here, knowledge that should be obtained during technical training is presented in detail.

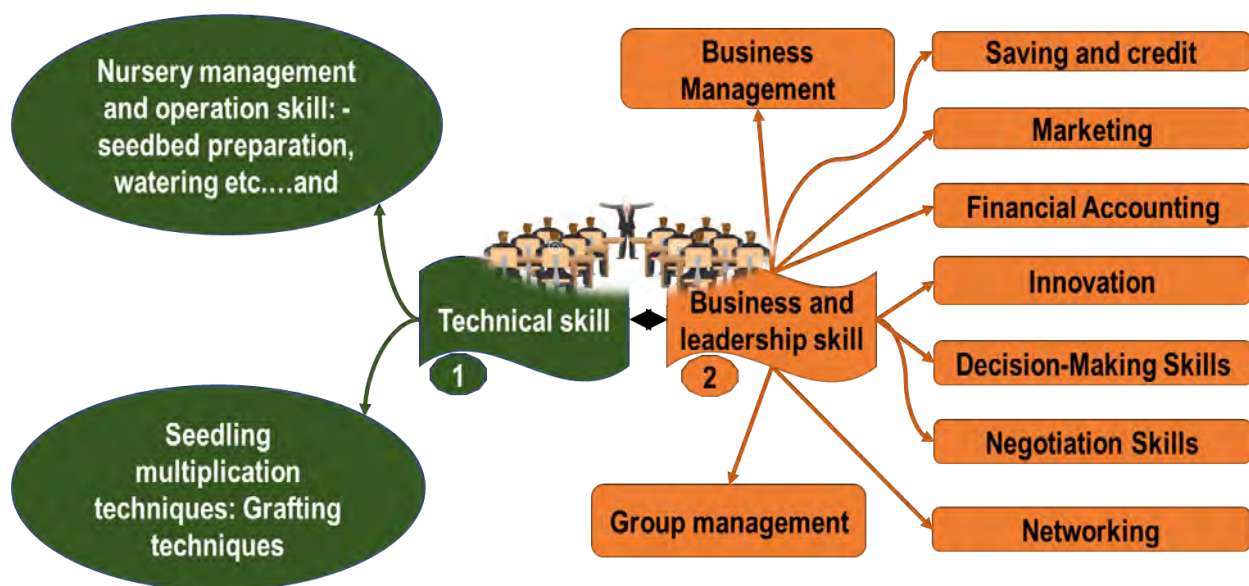


Figure 15. List of capacity development topics (technical and business skills).

6.2. Capacity development on grafting techniques focused on avocado and mango

Grafting is a rapid vegetative propagation technique used to multiply plants identical to the desired parent tree. Propagation is the process of raising new plants from a variety of sources: seeds, cuttings, bulbs and other plant parts.

6.2.1. Why grafting is important

Grafted trees, especially fruit trees, take a shorter time to start flowering and produce fruits²⁷ (Fig. 16). Given the availability of different varieties of fruit trees, farmers, organized youth and women groups, private nursery operators have good opportunities to graft desired varieties with great market and domestic consumption potential.



Figure 16. Grafted avocado – Fuerte (left) and Ettinger (right) varieties at age six, started fruiting from age three.

6.2.2. Grafting principles

- Involves joining or uniting two separate woody parts of a living plant tissue from different trees or plants to form one plant
- Parts used in grafting includes scion and rootstock
 - **A scion** refers to the bud or piece of stem that is to be attached to the rootstock
 - **Rootstock** refers to the seedling or tree upon which a scion is to be attached

6.2.3. Grafting methods

There are several grafting methods which differ depending on how the scion is attached to the rootstock (Fig. 17). The methods include top/wedge, whip/tongue and side/vener. Usually, mango seedlings are grafted using the top/wedge method.

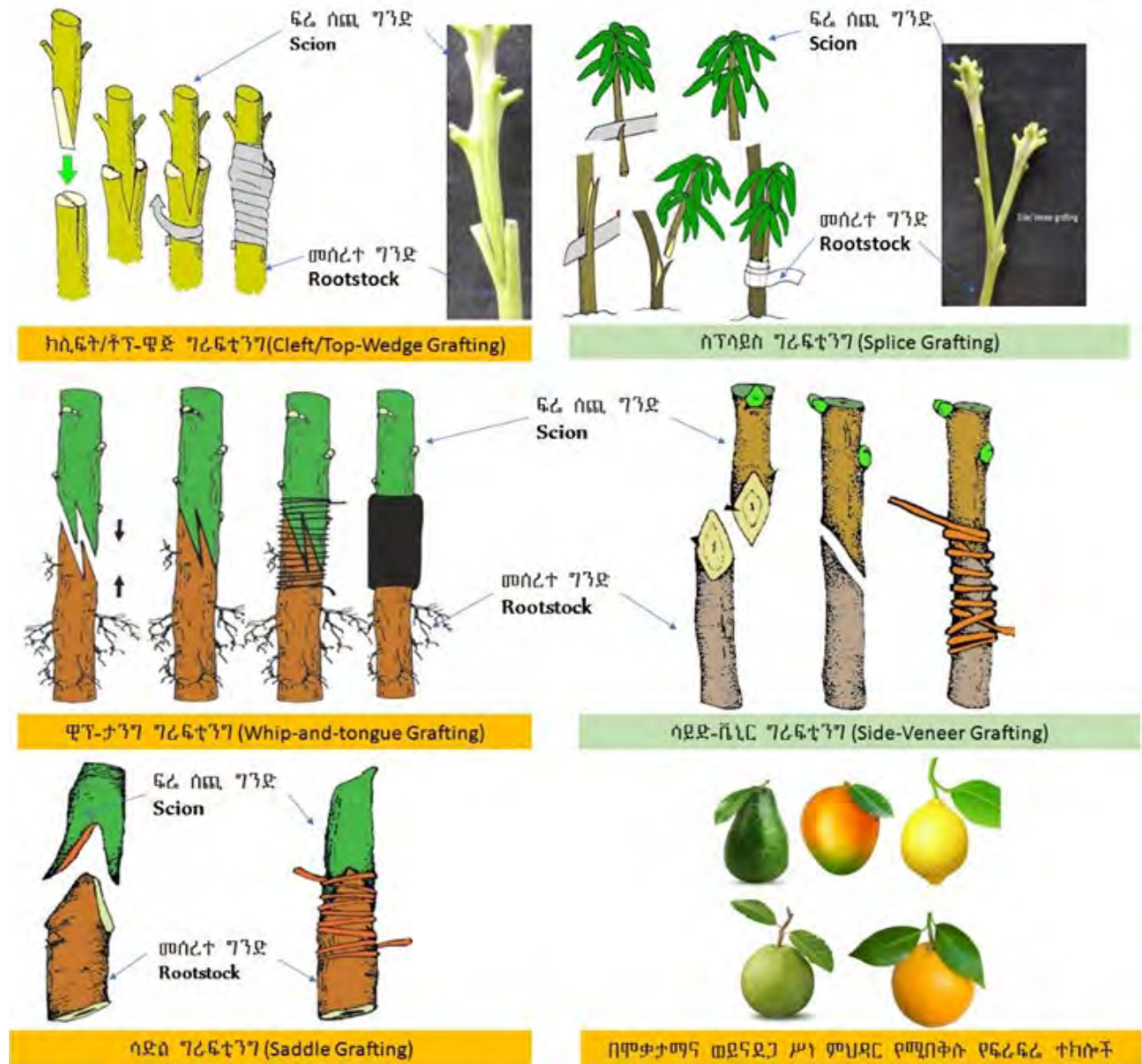


Figure 17. Examples of different methods of grafting

6.2.4. Step-by-step guide to grafting

Step 1: Prepare your propagation tools and materials

- Pruning scissors, scalpel or grafting knife (Fig. 18)
- Grafting tape or soft clear polythene strip that is water-proof and flexible
- Sterilizer such as spirit, but other alternatives could be used including rubbing isopropyl (alcohol - although it evaporates quite easily) or household bleach prepared by mixing one part with nine parts of water by volume
- Plastic bag to collect scion, a wet newspaper or cooler box (optional)



Figure 18. Grafting tools.

Step 2: Select the rootstock

A good rootstock is very important for future production of high-quality fruit trees. The rootstock provides the rooting system and part of the stem of the future tree (Fig. 19).

Select the rootstock based on these criteria:

- Suitable varieties: select a seedling from a local avocado, mango tree that grows well in your area
- It should be healthy, strong, and free of pests

- It should be about 6 months old (which should be at least 25 cm tall) with a stem as thick as a pencil



Figure 19. Rootstock selection.

Step 3: Cut the scions

Materials selected as scions should be taken from terminal buds (end of a branch) of a tree or plant, at the ‘tight bud stage’ or before a new flush with buds which are swollen but have not opened (Fig. 20). It is very important to get quality scions for grafting, as this will develop into the productive crown of your future tree.

To get quality scions follow these steps:

- Identify a highly productive, healthy mother tree of the desired variety and quality
- Select scions from the end of the branches which are as thick as a pencil and have an active, healthy terminal bud
- Cut the scion at 10 cm length with pruning scissors, secateurs or a very sharp knife
- Remove the leaves from the scion using a clean sharp knife or secateurs
- Wrap the freshly cut scions in a wet newspaper and put the package in a plastic bag

- Transport your scions to the grafting location as soon as possible. Store the package in a cool place during transportation and use a cooling box if you will be travelling for long



Figure 20. Scion sourcing and preparation.

When to collect scions: *It is advisable to collect scions during warm and humid weather, just before the production of new leaves (also called flushing).*

What to avoid when harvesting scions: *Harvesting from diseased branches; low lying or crowded branches; bigger or smaller sized scions that don't match the rootstock; scions not at 'tight bud stage'; woody or matured stems; avoid collecting scions between the flowering and harvesting seasons.*

Important: *Scions should be stored in a zip-lock plastic bag in a cool dark place for not more than seven days. The sooner you perform the grafting with the cut scions, the better and the higher the success rate. To ensure successful grafting, it is recommended that you carry out the activity on the same day, whenever possible.*

Step 4: Preparing rootstock for top or wedge grafting

- Ensure that you pair scions to the rootstock of the same thickness
- Cut the rootstock seedling horizontally at a height of about 20 -40 cm above soil level by using pruning scissors or a sharp knife. Split the cut upper end of the rootstock through to a depth of about 3 cm using a very sharp knife



Figure 21. Rootstalk preparation for grafting.

Step 5: Preparing the scion for top or wedge grafting

- Cut the scion to a final length of about 10 cm using a pair of pruning scissors or a sharp knife
- Use the scalpel or razor blade to sharpen the cut lower end of the scion to a V-shape by removing the wood on both sides of the scion
- Try to make the V-shape as deep as possible (about 2-3 cm) as this will increase the survival rate of your grafted scion



Figure 22. Scion preparation for grafting.

Step 6: Join rootstock and scion

- Slide the sharpened end of the scion into the slot you have cut on the rootstock
- Insert the scion as deep as possible into the cut of the rootstock and align the *two parts*



Figure 23. Joining the rootstock and scion.

Important: Make sure the cambium parts (these are the white greenish layers just under the bark) of the scion and the rootstock are in close contact and quite firm. It is important that both the scion and rootstock have the same thickness at the contact location. If this is not the case, it is advisable that you remove the scion and repeat the sharpening at a thinner end or cut the rootstock at a thicker part of its stem. Then repeat the joining and check if the two match.

Step 7: Enclose (bandage) the union

Fix both the scion and rootstock in place by covering the point of union until it is healed. To do this:

- Hold the union carefully with one hand
- With the other hand, wrap the grafting tape or the polythene strip tightly around the union and knot or inter-loop the two ends of the tape/strip
- Make sure that the wrapping is tight enough and that the scion does not move out of the union while wrapping



Figure 24. Enclosing the location of the union.

Step 8: Cover the scion

- This is done to increase the temperature and humidity around the graft, hence improving the chances of a successful graft union
- Wrap another grafting tape or polythene strip around the scion, but a bit more loosely than the one bandaging the union
- Knot or inter-loop the two ends of the tape/strip
- Don't cover the upper part of the scion which is the terminal bud so that it can grow and produce new leaves. Keep grafted seedling under the shade
-



Figure 25. Enclosing the location of the union.

Step 9: Let the wounds heal and remove the bandage

- Label the grafted seedling with the name of the scion variety
- Keep the grafted seedling in the shade and water it well
- After about 14-21 days the scion should have developed new leaves and the wound should have healed
- Remove the grafting tape or polythene strip when the wound is fully healed



Figure 26. Removing the bandage.

Step 10: Post grafting care: hardening, transplanting and removal of terminal bud

- Harden your grafted seedlings to avoid shock by placing them in a shade house or a shaded area for 6-8 weeks before transplanting
- Transplant the grafted seedling into a well-prepared planting hole
- About six months after transplanting, you can remove the terminal bud of the stem to initiate branching at the desired height of the tree

Important: Overwatering of recently grafted plants is a common mistake encountered as there is minimal loss of water through leaves. Please do not overwater the grafted plant.



SECTION VII

7. Seedling quality assessment

7.1. Determination of seedling quality

Quality is more important than quantity, thus it is better to produce a few good trees, than many poor ones. On the contrary, a common mistake in nurseries is to focus on the total number of trees produced and disregard their morphological and genetic quality. Therefore, a nursery manager in the RRC should favour quality over quantity while producing seedlings. Improving plant quality may mean that the farmer plants fewer trees, but the growth and survival rate of these trees will be superior.

The main purpose of producing quality seedling is to improve people's livelihoods while creating a healthy environment. Good plant quality is the basis for achieving tree planting objectives; high quality trees have a higher survival and faster growth rate in the field than poor quality trees. The fast-growing nature of quality seedlings is an important factor as it out-competes weeds and reduces the initial labour costs of establishment. More importantly, fast growth also enables a farmer to harvest wood or tree products sooner, thus reducing the payback period of investment (i.e., increasing the return on the farmer's investment). On the other hand, a poor-quality tree will always be a poor quality tree even if planted on a well-prepared and fertile farmland. In the field, every poor-quality tree wastes space and resources leading to low land productivity and discourages farmers from engaging in planting activities. It is not worth a farmer's effort to transport plants to the field, prepare an area, plant and maintain trees unless they are of good quality. Therefore, your nursery customer/farmers deserve only the best quality seedlings.

7.2. Sources of quality seed and seedling

Seedling quality has two major characteristics: the genetic make-up of the parent trees and its physical condition when it leaves the nursery. Enhancing genetic quality of seedlings requires a long time than improving the physical quality of seedlings which can be accomplished in a year, even in one season. In general, quality seedling production starts from the collection of quality seed/scion/cuttings, nursery establishment and tree-care and management practices.

7.3. Assessing seedling quality

7.3.1. Dickson Quality Index

Seedling quality is a qualitative gradable trait, that can be measured indirectly by its relationship with growth, vigour and quality index. Dickson Quality Index (DQI) is one of the methods used in seedling quality assessment (Eq.1). However, this quality test approach has its own drawback, because it can only be used to compare even aged seedling and derived after destructive sampling. The Dickson Quality Index reflects the plants' ability to survive and grow in the field, with performance increasing as the index values rise ^{28,29}. It was calculated based on the formula below. Plants with an index greater than or equal to 0.2 are considered to be of good quality ^{29,30}

$$DQI = \frac{\text{Total seedling dry weight (g)}}{\left\{ \frac{\text{height (cm)}}{\text{stem diameter (mm)}} \right\} + \left\{ \frac{\text{shoot dry weight (g)}}{\text{root dry weight (g)}} \right\}} \dots \dots \dots \text{Eq. 1}$$

7.3.2. Sturdiness Quotient Index

The Sturdiness Quotient Index (SQI) is a non-destructive method used to assess seedling quality. This method is less rigorous, but non-destructive and uses easily measurable seedling dendrometric parameters including seedling height (in cm), root collar diameter (in mm). It compares height (in cm) over root collar diameter (in mm) (Eq. 2). SQI – the ratio of the height of the seedling to the root collar diameter – expresses the vigour and robustness of the seedling. The ideal value for a seedling to be considered sturdy is less than six³¹.

$$SQI = \frac{\text{Seedling height (SH in cm)}}{\text{Root collar diameter (RCD in mm)}} \dots \dots \dots \text{Eq. 2}$$

7.3.3. Morphological characteristics of quality seedlings

Box 8.

- Healthy, vigorously growing and free of disease
- Lignified, woody, single and strait stem
- Has a large root collar diameter and dense and symmetrical crown
- Under-formed and dense root system with many fine, fibrous hairs with white root tips
- A balanced shoot-to-root mass ratio (Fig. 27)
- Dark green leaves
- Well hardened (exposed to full sunlight) – able to survive a short period without water



Figure 27. Photographic representation of quality seedlings.

7.3.4. Important nursery practices to improve seedling quality

Box 9.

- Consult subject matter experts and farmers when selecting the seed/scion sources for seedling production
- Identify the parent trees well in advance to ensure sufficient seed collection
- Collect seed from different parent trees (30-50 individual trees)
- Frequently examine seedling quality using several morphological traits and correct problems through appropriate nursery practices
- Sacrifice a few seedlings to improve total nursery production quality
- Remove poor quality seedlings as soon as possible



SECTION VIII

8. Investment cost of RRC establishment and value chains

8.1. The cost of running RRCs

The running costs of RRCs vary from place to place and thus it is difficult to estimate the exact investment costs as it depends on specific site conditions and investment required for land resources and purchasing of nursery operational materials. Among others, staff salaries are usually the most expensive line item in an RRC's operational costs. Therefore, RRC members should work hard and recommended looking for alternative ways to cover their salaries, especially for the first 10-12 months (e.g., part time working in another place). RRCs also need operational funds to run their activities, thus different organizations could support operational activities of organized youth groups running the RRC. The centres often focus on production of quality-planting materials, farm input supplies, on-farm demonstrations and centre-based training. Therefore, to remain relevant, the RRC business should also increase its scope of production and services required beyond the specific community in the face of evolving needs.

8.2. Sources of investment for establishment of RRCs

The initial investment for RRC establishment is generally financed by a combination of supporting organizations (NGOs, development programs, charity organizations, government – primarily by availing land for RRC establishment). Based on ICRAF-Ethiopia's experiences, different projects cover most of the start-up costs through providing nursery equipment, seed and scions. Most importantly, ICRAF usually provides continuous technical/practical training, coaching and mentoring. However, organized youth groups could also start RRC businesses using their own financial resources, or by borrowing from banks and/or from micro-finance institutions including from locally established savings and credit cooperatives/associations. RRC members usually prioritise increasing sale of seedlings and farm inputs, hence less effort is put into providing training and extension services. This approach is also among the core strategies of RRCs being self-sustaining, which makes it a unique approach that is able to solve some of the identified shortcomings of FTCs which are fully government-dependent extensions systems.

8.3. Value chains for seedling production

Different stakeholders can be involved in the value chain of RRC products. They comprise: Government offices (mainly office of agriculture, natural resources, cooperatives); Farmers within the locality and outside the village, kebele and districts; NGOs; Nearby emerging towns and cities; Investors, and private seed suppliers; Brokers; Input suppliers (Fig. 28).

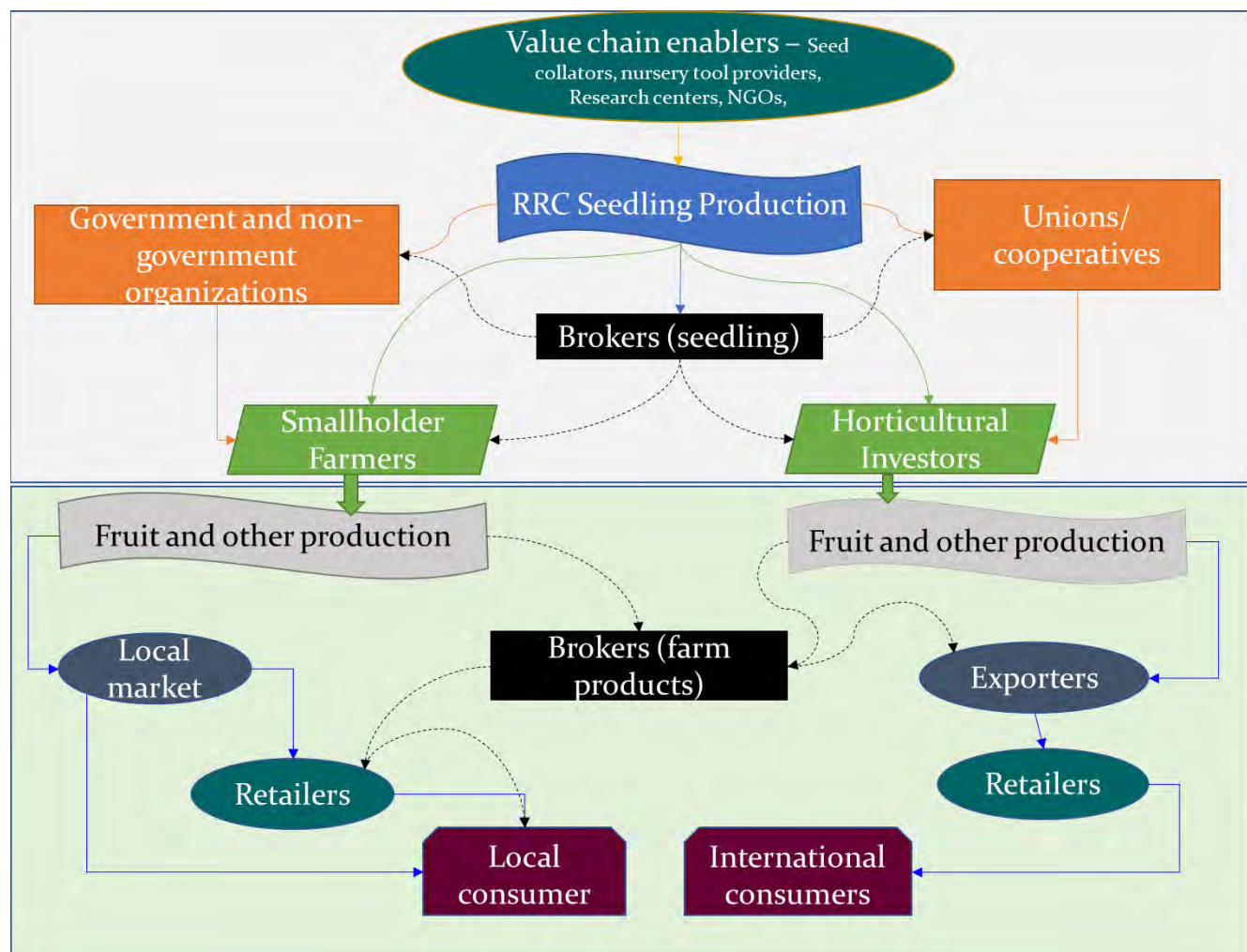


Figure 28. Simplified form of seedling production and distribution value chain as well as farm outputs.

8.4. Economics of RRC development and financial feasibility of RRC establishment in Ethiopia

8.4.1. Financial feasibility assessment

Currently seedling production is considered an activity for small-scale entrepreneurs, both in rural and urban areas. Thus, like any other investment, it is important to assess

good investment proposition if its IRR is greater than the rate of return that could be earned by an alternative investment or by putting the money in a bank.

Profitability Index (PI), alternatively referred to as value investment ratio (VIR) or profit investment ratio (PIR), describes an index that represents the relationship between the costs and benefits of a proposed project. It is calculated as the ratio between the present value of future expected cash flows and the initial amount invested in the project. Moreover, profitability index helps in ranking investments and deciding the best investment that should be made. PI greater than one ($PI > 1$) indicates that present value of future cash inflows from the investment is more than the initial investment, thereby indicating that it will earn profit. Thus, profitability index helps investors in making decisions about whether or not to make a particular investment.

Payback period refers to the amount of time it takes to recover the cost of an investment. Simply put, the payback period is the length of time an investment reaches a **break-even point (Eq. 4-6)**. The shorter the payback period, the more attractive the investment. Determining the payback period is useful for anyone (regardless of whether they're individual investors or cooperatives) and can be done by dividing the initial investment by the average net cash flows.⁸

$$\text{Breakeven sale value (BESV)} = \frac{\text{Fixed cost (FC)}}{\text{Contribution Margin Ratio (CMR)}} \times 100 \dots \text{Eq. 4}$$

$$\text{Contribution Margin Ratio} = \frac{\text{Sales} - \text{Variable cost}}{\text{Sales} \times 100} \dots \text{Eq. 5}$$

$$\text{Break even capacity utilization} = \frac{\text{Breakeven sales value}}{\text{Salesrevenue} \times 100\%} \dots \text{Eq. 6}$$

8.4.3. Basic assumptions of feasibility studies in the RRC business

Here we also make assumptions based on ICRAF's field experiences of establishing RRCs and delivering the centres to youth groups to operate. The assumptions highlighted here will help others to make decisions on financial feasibility when planning to start the RRC business. To conduct the feasibility study, there should be a detailed budget of the RRC project, including fixed and variable costs (see Tables 4-5).

Investment life: The feasibility assessment can be done for different lengths of project period (5, 10, 15, ... years).

Project support: The establishment of RRCs aiming to create new green job opportunities for rural youth and women groups is assumed to be

⁸ (<https://www.investopedia.com/terms/p/paybackperiod.asp#citation>)

supported by different stakeholders (government, NGOs). The support may include both financial and technical support, including provision of technical training and guidance, conducting demand analysis, promotion, and market linkage of RRC products. The support might continue until they generate their own income and run the RRC in full capacity.

Repair and maintenance costs: The annual repair and maintenance cost of the investment is estimated to be at a rate of 2% of the total cost of initial investment.

Discounting factor: The total investment and equity capital of the project is discounted at a rate of 18% over the lifetime of the project.

Income tax: According to the Ethiopian Investment Incentives Council of Minister Regulations No. 7/1996, cooperatives are exempted from income tax ³².

Sources of finance: The source of finance for the investment could be from own (cooperative) and/or from the project support (government, NGOs). The start-up capital required for RRC investment are land, office, store, shade and equipment.

Land: This will be provided free of charge by the kebele administration following the rules and regulations of land provision for youth groups in kebeles.

Manpower: The main activities that require labour are guarding, shade making, fencing, and soil preparation, raising seedlings, management practices for seedlings, grafting, seed collection and marketing. The sources of labour for most activities of the investment are the organized youth group members. The RRC may have two permanent guards who would be responsible for guarding and some inspection activities after receiving training.

Minimum wage: Ethiopia has no national minimum wage ³³. Some government institutions and public enterprises set their own minimum wages.

Operating costs: These are the running costs, such as raw materials, utilities and wages that are incurred on a daily basis. The total includes interest and principal payments on debt for start-up costs.

Raw materials: The principal raw materials required for the envisaged investment is tree seed, polyethylene bags, nursery materials, forest soil and scions. Some operational materials can be obtained with support from existing development projects.

Table 3. Estimated cost of establishing the RRC and equipment required (Fixed costs)

| No | Description | Estimated item cost in ETB | | | |
|---|--------------------------------------|----------------------------|----------|------------|-------------|
| | | Unit | Quantity | Unit price | Total Price |
| 1. Establishing the RRC and its basic components | | | | | |
| 1.1 | Shade house/nursery area preparation | | | | |
| 1.2 | Office and guard house | | | | |
| 1.3 | Store house | | | | |
| 1.4 | Fencing | | | | |
| 2. Nursery equipment | | | | | |
| 2.1 | Watering can | Pcs | | | |
| 2.2 | Rake | Pcs | | | |
| 2.3 | Shovel | Pcs | | | |
| 2.4 | Hammer | Pcs | | | |
| 2.5 | Forked hoe | Pcs | | | |
| 2.6 | Pruning and grafting equipment | Pcs | | | |
| 2.7 | Wheelbarrow | Pcs | | | |
| 2.8 | Measuring tape @ 30 metres | Pcs | | | |
| 2.9 | Nylon string | role | | | |
| 2.10 | Sickle | Pcs | | | |
| 2.11 | Water hose (3/4") | metre | | | |
| 2.n | etc | | | | |
| | Sub-total | | | | |

Table 4. Annual raw materials and casual labour requirements (Operating/variable costs)

| No | Description | Unit | Quantity | Unit price | Total cost |
|-----------------|---------------------------------|------------|----------|------------|------------|
| 1 | Seeds | kg | | | |
| 2 | Forest soil | Truck load | | | |
| 3 | Plastic pots of various sizes | Roll | | | |
| 4 | Purchase of inputs | LS | | | |
| 5 | Avocado and Mango Scion | pcs | | | |
| Subtotal | | | | | |
| 6 | Labour during soil preparation | Man days | | | |
| 7 | Labour for planting, watering | Man days | | | |
| 8 | Labour for grafting fruit trees | Man days | | | |
| 9 | Labour for seed collection | Man days | | | |
| 10 | Seedling preparation for sale | Man days | | | |
| 11 | Labour for salesperson | Man days | | | |
| 12 | Guarding | | | | |
| Subtotal | | | | | |
| Total | | | | | |
| | | | | | xxxx |

8.5. Revenue

During the first investment year, there may be no income for RRC members. It is important to note that the RRC will start to operate at its full capacity after the 2nd year and production will increase by 10-20% annually (Table 6, example of summary revenue record).

8.6. Core production activities using areas delineated for RRCs (shade net, nursery bed, demonstration plots, mother blocks)

8.6.1. From area put under shade net and nursery bed

- Grafted and non-grafted seedlings of fruit trees (e.g., grafted avocado, mango, lemon, guava, papaya, banana). The number of fruit tree seedlings depend on the agroecological condition of the surrounding area.
- Coffee seedlings (depends on agroecological condition of the surrounding area)
- Ornamental trees
- Timber trees (for construction and firewood)

8.6.2. From areas assigned for demonstration plots in the RRC

Usually, the RRC has a demonstration plot where different types of vegetables, fruits, spices, herbs, etc. are produced. This part of the RRC can also be used as a technology demonstration and training centre for farmers, and hence serve as a source of additional income.

8.6.3. From areas assigned for mother block establishment

Trees planted as mother trees will be sources of scion and fruit production will begin from years 3-4. This will be an additional source of income for RRC members.

8.6.4. Supply of agricultural products

The RRC will also be engaged in the sale of agricultural inputs on an on-demand basis. More importantly, after 4-5 years, the centre will start selling different scions from mother trees planted in the mother block.

Table 5. Summary of revenue records (example)

| Revenue sources | Quantity | Unit price | Revenue per production year | | | | | | | | | | |
|---|----------|------------|-----------------------------|----|----|----|----|----|----|----|----|-----|--|
| | | | Y1* | Y2 | Y3 | Y4 | Y5 | Y6 | Y7 | Y8 | Y9 | Y10 | |
| Sale of Avocado seedlings | x | \$ | | | | | | | | | | | |
| Sale of Mango seedlings | x | \$ | | | | | | | | | | | |
| Sale of Papaya seedlings | x | \$ | | | | | | | | | | | |
| Sale of potted coffee seedlings | x | \$ | | | | | | | | | | | |
| Sale of potted Grevillea seedlings | x | \$ | | | | | | | | | | | |
| Sale of potted Cupressus seedlings | x | \$ | | | | | | | | | | | |
| Sale of potted Pinus seedlings | x | \$ | | | | | | | | | | | |
| Sale of Eucalyptus seedlings | x | \$ | | | | | | | | | | | |
| Visitors' contributions | x | \$ | | | | | | | | | | | |
| Income from training to farmers/youth | x | \$ | | | | | | | | | | | |
| Income from sale of vegetables | | | | | | | | | | | | | |
| Income from sale of agricultural inputs | x | \$ | | | | | | | | | | | |
| Income from sale of dried tree seed | x | \$ | | | | | | | | | | | |
| Income from sale of scions | x | \$ | | | | | | | | | | | |
| etc | x | \$ | | | | | | | | | | | |
| Total | | | | | | | | | | | | | |

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