Smallholder tree crop renovation and rehabilitation (R&R)

A Review of the State of the Emerging R&R Market and Opportunities to Scale Investment

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EXECUTIVE SUMMARY

This report, commissioned by IDH, the Sustainable Trade Initiative, focuses on renovation and rehabilitation of tree crops in smallholder farming (abbreviated hereafter as "R&R"). For the purposes of this report, we focus on four commodities – cocoa, coffee, palm oil and tea - and we define 'renovation' to include activities that involve addition of planting material, and 'rehabilitation' to include grafting, stumping or pruning. In both cases, packages typically include training on good agricultural practices and the application of fertilisers and pesticides. We focus on R&R programmes that include upfront investments that have a long-term impact on tree productivity, and not those that solely focus on training or supply of inputs with a shorter term perspective.

Smallholder farmers engaged in cultivation of 'tree crops' face particularly complex challenges related to maintaining productivity and their associated livelihoods. Tree crops are long-term assets that decline in productivity over time and require ongoing maintenance and periodic renewal to maintain yields. Such maintenance, and especially renewal, requires material upfront investments that can be followed by a period of reduced or no income from associated cash crops, and returns to such investments only arise after a period of several years. With little in the way of savings and a chronic lack of affordable finance for smallholder agriculture, especially for those without hard collateral, the majority of smallholder farmers focused on tree crops are often trapped in low and declining productivity systems.

Smallholder farmers[1] are an important part of global production for many agricultural commodities. Smallholders account for 30-40% of global palm oil supply, 60-70% of tea and coffee supply and 85-95% of global cocoa supply. Demand for these commodities is expected to grow materially over the medium term. As a result, industries dependent on these commodities will face substantial commercial pressure as prices rise against a backdrop of stagnant (and even possibly falling) supply. Beyond the commercial implications for directly impacted industries, there are substantial farmer livelihoods and environmental implications from a failure to undertake smallholder R&R at scale. For countries that currently or potentially play a significant role in the production of these commodities, there is a substantial export earnings opportunity to be captured from success in adopting smallholder R&R at scale.

Approximately 14m hectares of land harvested by smallholders for cocoa, coffee, palm oil and tea worldwide, or 6.5-7.0m smallholder farmers[2], would benefit from R&R if such services could be made affordably available to them; the current 'supply' of R&R is a fraction of this today. **$20bn of financing**

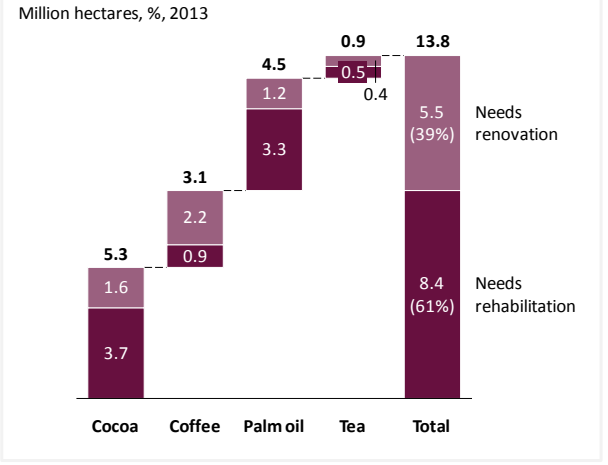
[1] For the purposes of this report, we define smallholder farmers as generally those farmers involved in cultivating plots up to 5 hectares in size. However, there are country and crop level differences in the way that Ministries of Agriculture and statistical offices define smallholders and numbers should therefore be taken as highly indicative at the global level.

[2] Our estimate of the number of smallholder farmers is a derived figure: we have estimated the amount of land harvested by smallholders that requires renovation or rehabilitation (based on the consensus opinion of sector participants and experts) and then adjusted this down to take into account the proportion of plots that are too small to warrant R&R, and for which farmers have better alternatives versus R&R. We have then divided this by the typical average plot size for smallholders to estimate the number of smallholders that are addressable. This is therefore a highly indicative figure that is best understood as providing a scalar (1m vs. 10m vs. 100m) than a target.

would be required to address the underlying demand for R&R[3] in these four crops today, rising to $100bn to fully fund these projects over the next 25 years. The investment case for renovation versus rehabilitation differs substantially between each approach (see Figure 1); the upfront renovation investment would be $12bn, and $65bn over 25 years, while rehabilitation costs would be $8bn in the first year and $44bn over 25 years[4,5].

Figure 1: Global Demand for R&R by Crop and Costs vs. Export Value of R&R by Crop

Underlying Demand for Renovation vs. Rehabilitation by Crop



Overview of Costs and Value of R&R by Crop

	Costs ($bn)		Export Value ($bn)	
	Year 0	Year 0-25	Year 0	Year 0-25
Coffee	**6.3**	**34.5**	**-7.0**	**55.6**
Renovation	5.7	28.6	-7.5	46.1
Rehabilitation	0.6	5.9	0.5	9.5
Cocoa	**8.4**	**52.7**	**1.2**	**137.7**
Renovation	4.4	27.9	-2.6	68.0
Rehabilitation	4.1	24.9	3.8	69.6
Palm oil	**5.1**	**17.6**	**-1.3**	**80.5**
Renovation	1.6	6.0	-2.4	67.8
Rehabilitation	3.4	11.6	1.2	12.7
Tea	**0.8**	**3.8**	**-1.0**	**29.9**
Renovation	0.6	2.7	-1.5	20.6
Rehabilitation	0.2	1.2	0.5	9.2
4 crops	**20.6**	**108.7**	**-8.1**	**303.6**
Renovation	12.2	65.1	-14.1	202.6
Rehabilitation	8.3	43.5	5.9	101.0

R&R is not new; it is an established practice in commercial plantations and the methodologies and technologies required are well known and understood. The application of R&R to smallholder farmers is not altogether new either, although to the limited extent that smallholders are conducting R&R, it has predominantly been driven by the public sector. Historically governments have often played a significant role in driving large scale planting and replanting, often as part of a national asset and growth agenda.

However, in the last two to three years there has been substantial innovation in R&R program design and smallholder finance that is being brought together by a range of actors, and in ways that could attract new sources of capital to achieve scale. The combination of actors motivated by varying agendas including sustainability of supply, value chain development, farmer livelihoods, environmental sustainability or to

[3] We have focused on the financing gap to address total underlying R&R demand defined as smallholder land that can best benefit from renovation or rehabilitation (versus other approaches such as good agricultural practices), less plots that are too small to be viable for R&R, less land which could better be used for alternatives crops or where farmers are better off taking on wage labour.

[4] These figures are based on a broad set of assumptions and are for high-level guidance only; estimates of the land requiring R&R are based on analysis of ageing, disease incidence and poor condition incidence of the smallholder tree stock for the top 5 countries in each commodity and then extrapolated to the global level of smallholder production. The split between land requiring renovation versus rehabilitation is based on the collated perspectives of industry experts and R&R program developers. We have applied 'averaged' renovation and rehabilitation costs for each commodity across the total land required. Finally, we have not assumed any increase in the costs of inputs (especially labour, fertiliser, pesticides, planting material, processing and logistics) over the 25 year period, but do assume that there will be increased operating costs associated with harvesting and storing / transporting increased production.

[5] It should be noted that rehabilitation and renovation are not mutually exclusive: it can be possible to rehabilitate trees that could also be renovated; however, for the purposes of this analysis we assume that all land where trees are old enough to warrant renovation or are diseased are renovated, and remaining trees that could benefit from rehabilitation are rehabilitated. Therefore, the total R&R investment opportunity is the sum of these two figures.

extend the reach of social lending have developed a diversity of new R&R programmes. Much of this development is still nascent, but approaches are emerging that demonstrate the potential to be scaled. Across the current R&R program landscape, there are 3 main types of program, with multiple approaches within each.

Figure 2: Overview of main types of R&R programmes

		Description	Examples	Typical Crops
Co-Op R&R Service Delivery	Social Lender Driven	• Social lender selects scale co-operatives that offtake agreements and / or other collateral • Social lender invests in developing co-op capability to on-lend and administer / provide R&R services to farmers	• Some of loans extended by Coffee Farmer Resilience Initiative (Root Capital) (5 loans)	• Coffee
	Coop Creation & Development	• Farmers are aggregated into cooperative structures • R&R (plus other) services aggregated by and distributed through the coop; can also act as the channel for R&R finance	• Coffee Farmer Alliances Tanzania (HRNS / Neumann Kaffee)	• Coffee • Cocoa • Tea
Commercial R&R Service Delivery	Nucleus-estate-delivered	• Plantation operator takes over smallholder plots and undertakes R&R, finances the R&R, and returns land to farmers when R&R is complete and plantation is approaching commercial production • Farmers pay back operator with a share of increased production	• PT Hindoli Plantation Replanting Program, Indonesia (Cargill)	• Palm Oil
	R&R entrepreneurs creation	• Development of farmer service company structures that deliver R&R services (amongst other services), and potentially provide farmer finance	• Cocoa Sustainability Program (Mars) • Biopartenaire (Barry Callebaut)	• Cocoa
Integrated Direct-to-Farmer Models	Supply Chain Actor / Cert. Agency Provision	• Buyers or input providers provide technical assistance, planting material, inputs and finance • May be part of existing / added to value chain investments • Similar approaches also adopted by certification agency programs	• Ecom-Starbucks-IFC-IDB Coffee Rust Program	• Cocoa • Coffee • Palm Oil • Tea
	Landscape level agroforestry projects	• Development of landscape-level agroforestry projects that can include afforestation, timber, tree crop agriculture and intercropping with other products. • Capture carbon value (voluntary credits) as well as from R&R	• Shade Coffee and Cacao Restoration Project, Ecotierra	• Cocoa • Coffee • Palm Oil
	Public Sector Provision	• Typically leverage public sector bodies for planting material, technical assistance and provide grants or concessional loans to farmers to adopt R&R. May create govt. R&R service cos to integrate and deliver package of R&R inputs & finance to farmers	• National Replanting Program, FNC • Indian Tea Board 12th scheme	• Cocoa • Coffee • Palm Oil • Tea

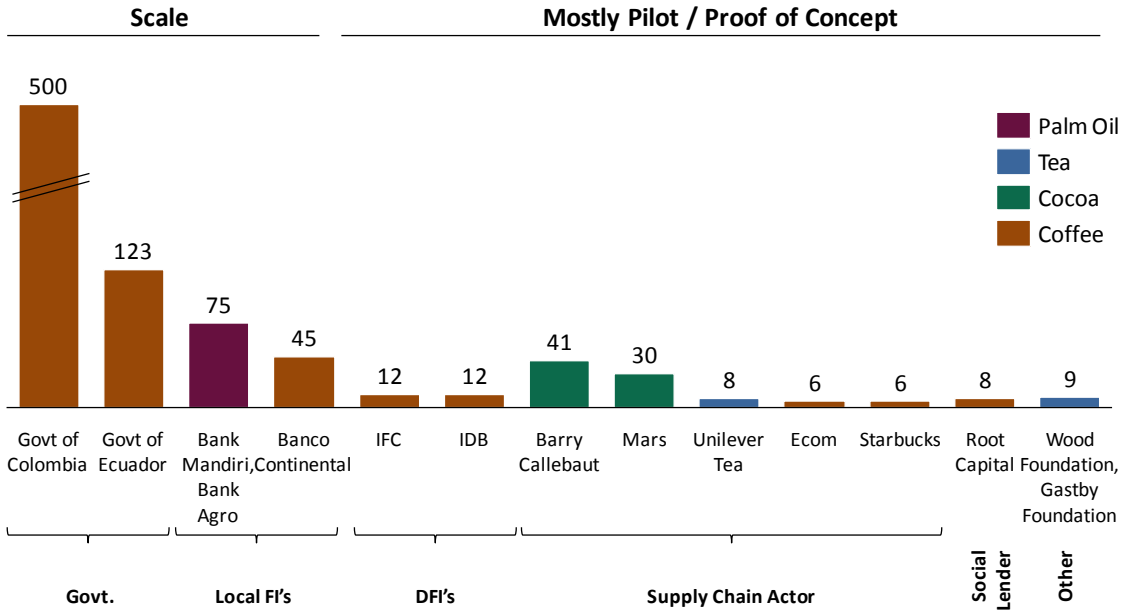
For prospective investors, renovation involves a long-term financing that may involve a grace period of several years, aligned to the period during which farmers need to invest in planting new trees and supporting sapling growth to maturity; loan repayments may commence several years after the initial loan, and can require several years to pay back (it should be noted that the grace period can be highly variable, and depends on crop fundamentals, and also whether renovation is done in conjunction with rehabilitation, and whether renovation is performed on only part of the plot or the whole plot in one go). During the upfront period of low income or negative cashflow, farmers may require income support finance. Overall, loan tenors may be in the region of 10 to 15 years, although in some cases could be shorter if a more gradual approach to renovation is adopted. Rehabilitation financing is shorter term than renovation financing, typically with a tenor of 5 years or less, and typically does not require a grace period.

While not universally evidenced yet, a significant number of programmes are showing promise in achieving financial viability at the smallholder farmer level, which is a key precondition for scalability, although it is important not to over-generalise from these findings, given that there are important country- and crop-specific factors that determine what activities are possible and what returns can be achieved. Many of these projects are also at pilot stage, with a lack of an established track record to confirm planned rates of return, especially regarding repayment rates.

There is a substantial financing gap for smallholder R&R, related to the overall challenges in smallholder finance in general. R&R finance outside large-scale productive plantations is largely absent, not least because of the problem of accessing tailored financial products that allow smallholders to uphold (and eventually improve) their livelihoods. Current global smallholder agricultural finance amounts to $9bn per year and global social lending into smallholder agriculture of USD 0.6 billion in 2014.[6]

Though total finance of R&R at a global scale is very limited, there are a number of actors currently engaged in financing renovation or rehabilitation. Government and local financial institutions are relatively established overall as lenders into smallholder R&R, with local financial institutions typically participating as part of a government-backed program[7]. Conversely, other actors currently participate at a much smaller level, reflecting a different type of intent and focus on newer innovations in terms of R&R program design. Supply chain actors that are trialling and piloting new programmes in the field – such as Mars and Barry Callebaut – have invested $30-$45m; Ecom and Starbucks are trialling a new transaction structure that involves a long-term off-take agreement, and roles for IFC and ADB, with the investments of all four actors reaching $30mln. Root Capital is investing in learning and refining its approach to delivering smallholder R&R finance through its Coffee Farmer Resilience Initiative and has made several loans to a combined total of approximately $8mln to date. **In all of these areas, investors are yet to reach scale and focus on attracting a step-up in capital.**

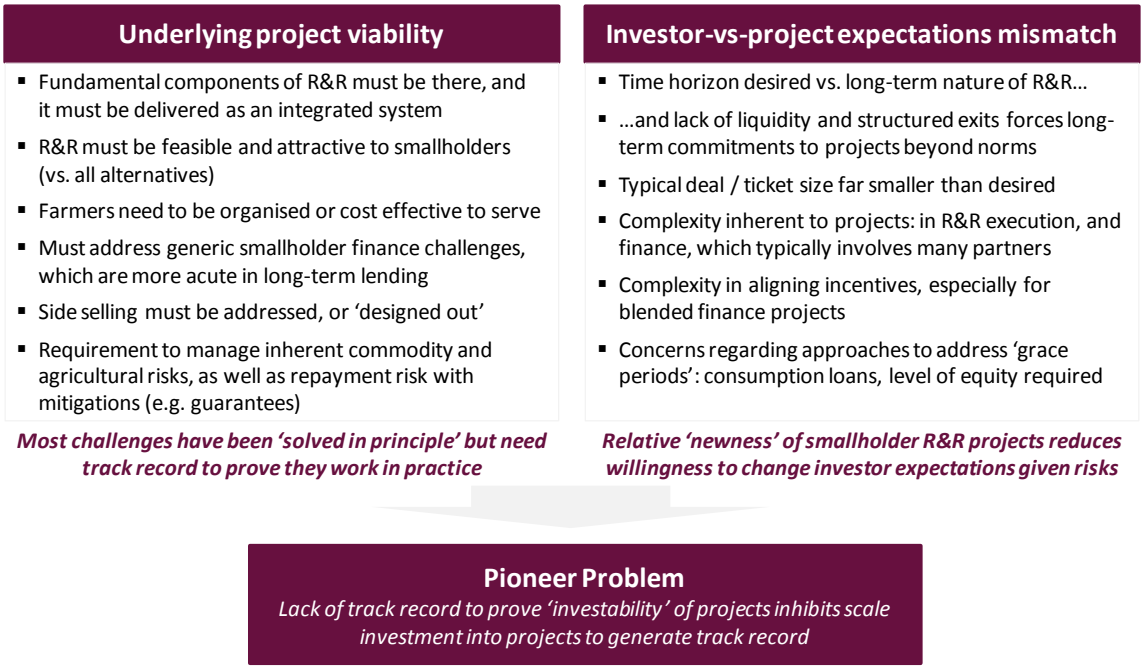
Figure 3: Examples of investments channelled into R&R by Institution Type
(USD million, historical and future publicised commitments)



[6] Institute for Smallholder Finance, 2015. Note that social lending has been growing rapidly. Total disbursements grew from $362m to $564m between 2013 to 2014, which is a 56% increase year on year, driven by rising disbursements from existing social lenders, plus new entrants into the space. However, closing the funding gap will require crowing in other sources of finance, especially commercial lenders, in the long run.
[7] Although this is to an extent driven by a relatively small number of scale programmes (e.g. Colombia's FNC program in coffee, India's investments in smallholder tea, and Indonesia's investments through government owned plantations into smallholder farmers via rural banks

Developers of R&R projects seeking finance to launch and scale up their activities, and prospective investors seeking attractive R&R programmes to support, both suffer the 'pioneer problem': there are several uncertainties regarding smallholder R&R for which there appear to be solutions in principle, but there are a lack of reference projects that can demonstrate that these solutions work in practice (or which of these solutions are best) and what returns may be achievable. This inhibits investment into projects that can scale up pilots and generate the track record that project developers and investors are looking for.

The challenges that are most typically referenced by actors and prospective investors in the R&R space typically fall into two areas – ensuring the underlying viability of R&R projects, and managing a mismatch between investors expectations and what R&R projects offer as an investment opportunity. Although there are country and crop specific nuances, most issues fall under these areas.



Overall, solutions to the challenges to achieving underlying project viability are emerging, from our review across projects in specific countries and crops in. Different R&R program archetypes have varying levels of exposure to different challenges, and overall there are multiple solutions and methodologies emerging. A selection of the most commonly found challenges and emerging solutions, include:

1. **Cost effective availability of the core components of R&R:** the fundamental components for a cost effective R&R program must exist. The operational building blocks of an R&R program are becoming established as a package of planting material (if replanting or grafting), training, inputs and financing for these components. Constraints and bottlenecks to R&R programmes' operational feasibility often have a country-specific dimension. Governments typically have a critical role to play in determining the conditions for the adequate supply of appropriate R&R inputs, but in cases where supply is insufficient in terms of quantity or quality, some project developers have developed their own sources of supply.

2. **Ensuring that R&R is attractive and feasible for smallholder farmers:** The combination of the scale of investment required in R&R and the extended period over which it delivers results can make smallholder farmers unwilling or unable to undertake R&R, especially given real or just perceived price risk and fundamental agricultural risks. The scale of upfront investment in renovation can be (at least partially) addressed in several ways: by taking a more gradual approach (such as renovating only 10% of the estate per year), by undertaking a blend of rehabilitation and renovation to aim to avoid material reductions in smallholder production over time.

3. **Aggregation of Farmers:** Farmers need to be cost effective to serve with smallholder R&R services, and this typically requires that they are organised, or that a process of organisation takes place. Only about a third of smallholder farmers in the four crops studied are currently organised in structured value chains yet most R&R programmes aim to work with these 'pre-organised' farmers for practical reasons. Serving independent smallholder farmers is logistically difficult and can create challenges in models that require deploying finance or on-lending. Farmer organisations can serve as distribution channels for training, inputs or planting material while at the same time strengthening farmer integration in the value chain and providing them with increased negotiating power. Multiple approaches for developing farmer organisations (faster, less selective methods versus slower approaches that upskill managerial, financial and technical competencies) are being trialled as ways to address this, while other approaches also include development of professional farmer service companies that act as aggregators.

4. **Ensuring that R&R financing is attractive and feasible for investors:** The long-term nature of R&R makes the existing challenges of smallholder finance more acute, and addressing these challenges is critical for the success of R&R programmes. The challenges of smallholder finance are well documented and understood[8] as well as emerging new approaches to resolving these challenges. For smallholder R&R, long loan tenors, combined with grace periods, lack of collateral and extended exposure to commodity and agricultural risk are a challenging proposition for prospective investors. The solutions emerging for such challenges are also similar to those for smallholder finance in general, and there are some differences in how these solutions are implemented across archetypes. For example, social lenders such as Root Capital have focused on cooperatives where some form of collateral may exist, including movable assets or leveraging off-take agreements; the Fairtrade Access Fund lend to producer groups without sufficient hard collateral if they have a strong business plan & sound financial records. Beyond this, the use of blended finance that combine non-returns seeking capital and guarantees are able to defray risk deliver risk adjusted returns that can crowd in returns-seeking capital, which is critical for scaling projects.

[8] Various reports documenting the current financing gap for smallholder farmers, and the challenges of upscaling smallholder finance exist, including "Catalyzing Smallholder Agricultural Finance" Dalberg (2012) (http://dalberg.com/documents/Catalyzing_Smallholder_Ag_Finance.pdf); "Investor and Funder Guide to the Agricultural Social Lending Sector" Institute for Smallholder Finance (2014) (http://www.globaldevincubator.org/wp-content/uploads/2014/06/Investor-and-Funder-Guide-to-the-Ag-Social-Lending-Sector.pdf) and "Direct-to-Farmer Finance Innovation Spaces Playbook" Institute for Smallholder Finance (2014) (http://www.globaldevincubator.org/wp-content/uploads/2014/10/Direct-to-Farmer-Finance-Innovation-Spaces-Playbook.pdf)

5. **Side Selling**: side selling challenges are often acknowledged as a key challenge for developing scalable projects in regions with low farmer organisation and loyalty; however, models have been developed that aim to 'design out' the challenge through means such as creating farmer service delivery entrepreneurs that can build direct farmer relationships and manage side selling better, while other models factor in premiums to be paid to farmers that are in R&R programmes. Many projects still factor in side selling, and ensure that their economics remain resilient to its effects within levels that are reasonable based on historical norms.

6. **Successful adoption and implementation of R&R practices**: the inputs for R&R and appropriate agronomic practices must be delivered in an integrated way over several years. A consensus is emerging that the separate components of an R&R package need to be delivered in a system to farmers if farmers are the ones to implement R&R. Other approaches have side-stepped the challenges of training and ensuring consistent application of new techniques by smallholder, by applying commercial models of R&R such as extending normal plasma plantation operations to smallholders on a temporary basis (temporarily taking over smallholder plots and undertaking the renovation for them, then returning plots) or by creating farmer services entrepreneurs that deliver R&R services and inputs for a fee.

Prospective investors into smallholder R&R projects typically find that there are several challenges regarding the investment proposition that arise frequently across the projects they assess; some of these challenges may require adapting expectations once the investment rationale behind R&R is more established, while some challenges should naturally become less binding as investments into smallholder R&R build momentum. Within this latter group are: concerns regarding the lack of market liquidity that locks investors into very long term projects; the lack of scale programmes seeking sizeable investments (and the resulting high transaction costs for small investments of $10m and below); the inherent complexity of R&R programmes that involve bringing together various operational and finance innovations that lack a track record; and the complexity in executing blended finance[9] project finance structures, which promise to bring together diverse sources of returns- and impact-seeking capital together, given the diversity in objectives and conditions.

Although we are broadly positive on the prognosis for the sector, the 'as is' scenario will involve a very long gestation period before the emerging 'R&R market' moves beyond fragmented pilots and demonstration projects towards an established sector that delivers scale investment opportunities, pooled projects with diversified indirect and direct routes for investors, and fact-based norms regarding returns.

To catalyze this process, we would recommend three sets of measures:

1. **A knowledge agenda and platform:** there is high potential value in accelerating the learning process across R&R project developers and investors by sharing project design thinking and

[9] Blended finance can be defined as the complementary use of grants (or grant-equivalent instruments) and non-grant financing from private and/or public sources to provide financing on terms that would make projects financially viable and/or financially sustainable.

identifying, disseminating and accelerating the adoption of emerging best practice. There is an allied critical need to accelerate the time to achieving a 'track record' for the R&R sector by incorporating and systematising learnings from a diverse range of programmes, including government programmes such as PTPN 13 and FNC[10].

2. **Creating standardised and agreed templates that make structuring and negotiating R&R projects faster, easier and cheaper:** high transaction costs exist in securing funding for projects, and especially for projects aiming to blend multiple types or sources of capital across investors with varying impact mandates and return expectations. In the short term there may be value in developing standards around renovation and rehabilitation costs by crop, fundamental investment terms and loan product components. There are also opportunities to develop template project finance structures that articulate some key generic project structures as a starting point for discussions to align multiple project stakeholders: the existence of agreed templates can avoid 're-creating the wheel' for new projects, by creating a point of reference for prospective investors and project developers to start discussions from.

3. **Creating a platform for collaboration across the different stakeholders that are needed to make R&R projects work at scale, to make identifying partners & investment opportunities easier:** In many cases, R&R projects in the same crop, or diverse crop-projects in the same location, may have similar needs in terms of suppliers and implementation partners. There are opportunities for such suppliers and partners to leverage their capabilities across multiple projects and in some cases to investigate how projects for different crops in the same region could collaborate and drive efficiencies in project delivery costs, and strengthen the financial case for R&R investments to both farmers and investors. Longer term opportunities may exist for multiple projects to collaborate and seek funding as a combined set of projects, offering opportunities for investors to diversify geographically and across crops, and potentially create larger scale investment opportunities. Some project developers are already pooling projects, and any collaboration platform development should aim to leverage (rather than replace or compete with) such approaches. Finally, given the high risks involved at the current pilot to proof-of-concept stage of development for smallholder R&R projects, there is currently a high need for concessional sources of investment (such as non-returns seeking & market building impact investment) and especially guarantees to mitigate investment risk.

[10] See the report produced by Rabo International Advisory Services "IDH Study Rehabilitation & Renovation of crop trees in cocoa, coffee and palm oil" for detailed case studies of these two programmes, as well as Mars' cocoa program in Indonesia.

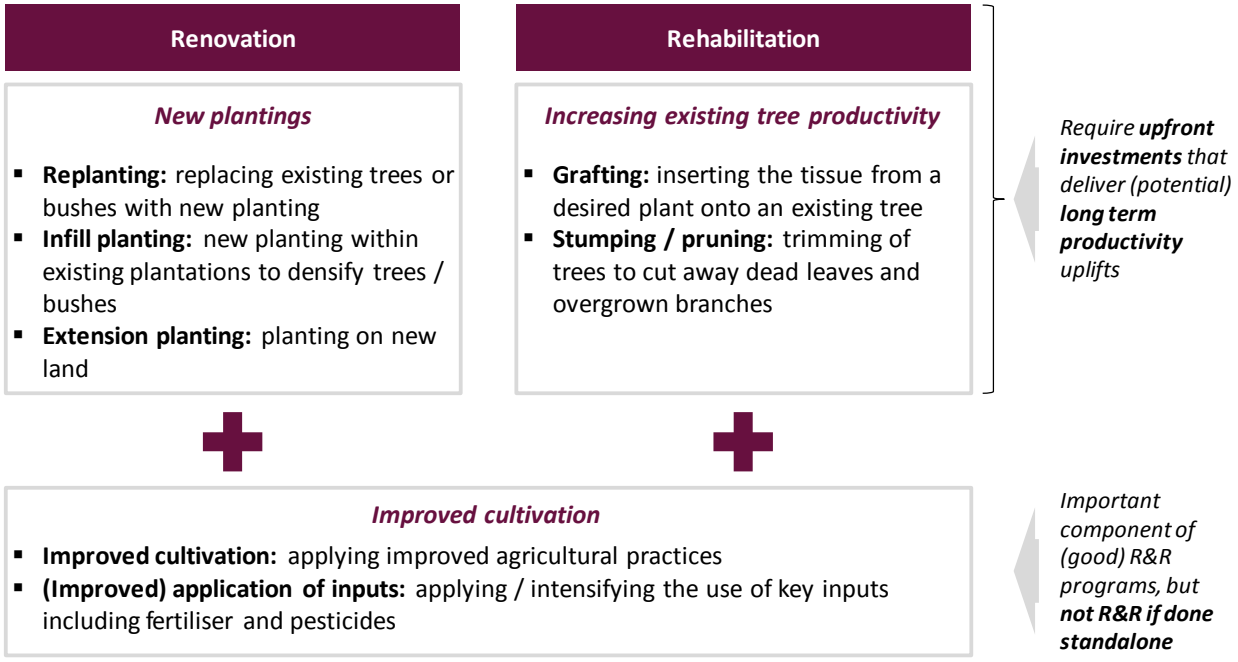
Contents

1. INTRODUCTION

1.1 Objectives and Scope of this Report

This report, commissioned by IDH, the Sustainable Trade Initiative, focuses on renovation and rehabilitation of tree crops in smallholder farming (abbreviated hereafter as "R&R"). While R&R is not a new practice – and in fact is a core element of commercial plantation management – its application to and adoption by smallholder farmers faces challenges related to executing R&R effectively and securing financing for investment into R&R programmes. However, substantial innovation in smallholder targeted R&R schemes is underway by a broad range of actors including industry participants, governments, social lenders and agroforestry project developers expanding beyond a historical focus on carbon sequestration. This report aims to share emerging best practice in R&R schemes, but also situate it within the context of the scale of the opportunity – both in terms of the scale of the investments required to service the industry need, as well as the potential value creation – and how bottlenecks to upscaling investments can be addressed.

Figure 4: Definition of Renovation & Rehabilitation Used in this Report



R&R schemes combine a collection of activities focused on improving the performance of 'tree crop' systems that address the specific challenges that such long term assets pose to farmers. R&R 'packages' can vary widely, but almost universally need to address requirements for planting material, other key inputs, agronomic training, funding for these prior elements, organisation of farmers to make the delivery of services and funding feasible, and a solution for periods of low or no income. The model for the provision of each of these elements can vary widely, and we provide a landscaping of the major emerging models later in this report. A subset of the options available include 'funding' for the elements of R&R

through grants (financial or in-kind) to smallholder farmers, credit provided to smallholder farmers directly or credit provided to farmers organisations for on-lending.

What R&R means in practice varies significantly by crop and by country; we have focused on four agricultural commodities in this report, which inform our perspectives at the global-level, as well as the crop and country-specific level. We have focused on coffee, cocoa, palm oil and tea; our perspectives on the global-level challenges and scale of the need for R&R are framed by our focus on these crops, but the findings in this report are broadly applicable to smallholder tree crop systems overall. At the same time, specific country-level factors, especially in terms of agronomic conditions and institutional context, are typically critical factors in defining what practices are possible and the associated investment case for R&R; we therefore provide a series of country-level perspectives (for Indonesia, Cote d'Ivoire, Ghana, Tanzania and Malawi) after our overall findings to show how some of the global level factors identified play out in a specific country context.

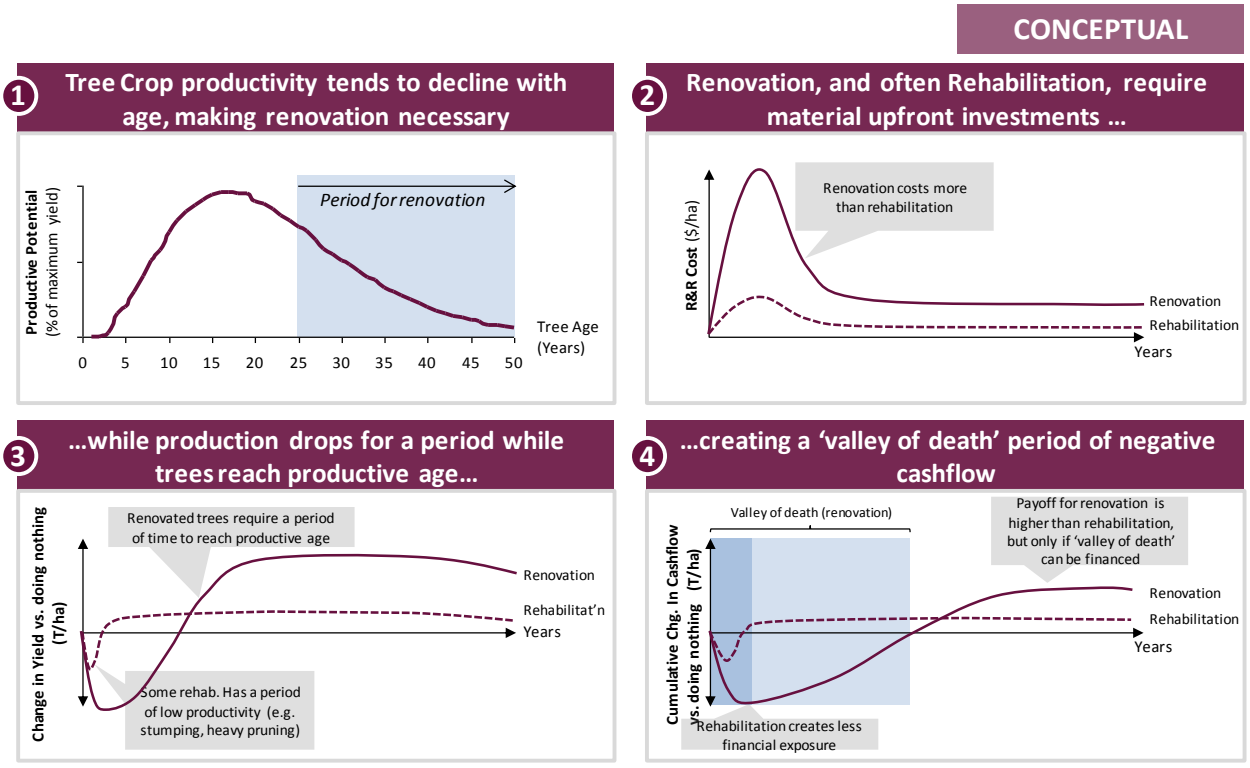
For the purposes of this report, we define 'renovation' to include activities that involve addition of planting material, and 'rehabilitation' to include grafting, stumping or pruning. In both cases, packages typically include training on good agricultural practices and the application of fertilisers and pesticides. We focus on R&R programmes that include upfront investments that have a long-term impact on tree productivity, and not those that solely focus on training or supply of inputs with a shorter term perspective. These shorter term interventions are often very important, and in some instances can make more sense for a smallholder to undertake than R&R, but they are not the focus of this report.

1.2 What is the fundamental challenge for smallholder R&R, and why is this important?

Smallholder farmers engaged in cultivation of 'tree crops' face particularly complex challenges related to maintaining productivity and their associated livelihoods. Tree crops are long-term assets that decline in productivity over time and require ongoing maintenance and periodic renewal to maintain yields. Trees can also be affected by disease and epidemics can crete a widespread (and hard to predict) need for large-scale replanting. Such maintenance, and especially renewal, requires material upfront investments that can be followed by a period of reduced or no income from associated cash crops, and returns to such investments only arise after a period of several years. With little in the way of savings and a chronic lack of affordable finance for smallholder agriculture, especially for those without hard collateral, the majority of smallholder farmers focused on tree crops are often trapped in low and declining productivity systems.

At the level of an individual smallholder, these challenges create a typically insurmountable barrier for the application of R&R; at the level of an R&R scheme or program, this often creates a 'valley of death' where upfront investments, followed by a low productivity period, are difficult to finance in the absence of financial products tailored to the needs of R&R. (See **Error! Reference source not found.**.) This 'valley of death' challenge mostly comes to bear on renovation, rather than rehabilitation investments, as rehabilitation activity typically leads to a more rapid uplift in production.

Figure 5: Overview of the 'Valley of Death' financing challenge for R&R schemes[11]



Smallholder farmers[12] **are an important part of global production for many agricultural commodities.** As shown in **Error! Reference source not found.Error! Reference source not found.**, smallholders account for 30-40% of global palm oil supply, 60-70% of tea and coffee supply and 85-95% of global cocoa supply. Demand for these commodities is expected to grow materially over the medium term. As a result, industries dependent on these commodities will face substantial commercial pressure as prices rise against a backdrop of stagnant (and even possibly falling) supply.

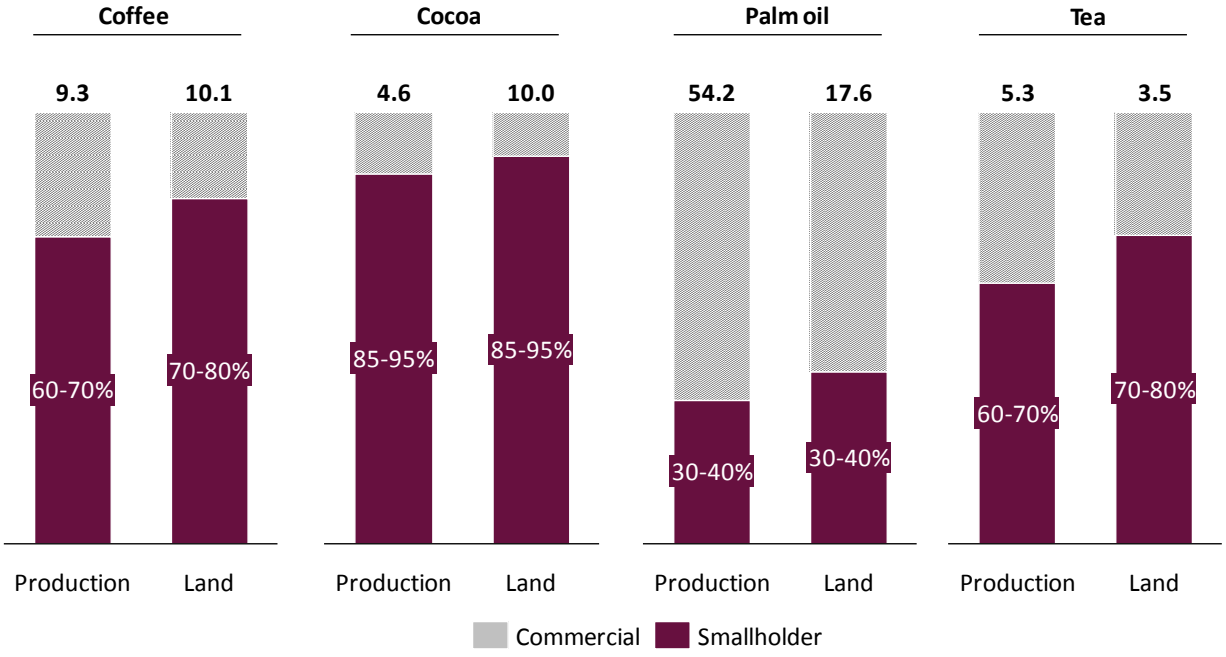
Beyond the commercial implications for directly impacted industries, there are substantial livelihoods and environmental implications from a failure to undertake smallholder R&R at scale. Farmers may face substantial pressure on incomes as productivity declines, especially if they are not diversified in production of other cash crops; alternatively this creates an imperative for farmers to clear additional forest to plant new trees rather than take the risk of replanting existing trees, and potentially sell the timber from newly cleared land. Often, for farmers that *do* undertake renovation, they typically do so in a gradual manner (if their plot size makes this feasible) and rotate across their entire plantation to renovate only a proportion at a time, which reduces the cash flow pressure, but leads to a longer period of sub-

[11] Note that yield curves are very different for cocoa, coffee, tea and palm oil, both for rehabilitation and renovation, and these therefore drive very different investment and return profiles for each crop; these have an important role on shaping the types of financial products that are relevant to support R&R for each commodity area

[12] For the purposes of this report, we define smallholder farmers as generally those farmers involved in cultivating plots up to 5 hectares in size. However, there are country and crop level differences in the way that Ministries of Agriculture and statistical offices define smallholders – most notably in Latin America (and especially Brazil) there is solely a distinction between commercial and family owned farms, with many family owned farms not matching the definitions of other regions. Where possible some adjustments have been made to general values later in this report, but numbers of smallholders and their share in global production should be taken as highly indicative at the global level.

optimal production. There are broader opportunity costs for governments that face the dual challenges of lost potential economic output (and foreign exchange earnings) and increased rural-to-urban migration of farmers and labourers that abandon low-productivity agriculture for wage labour in cities.

Figure 6: Smallholder share of global land harvested and production, by crop (%, million hectares, million tonnes)



1.3 What this report covers

Although R&R presents challenges for smallholders, the combination of innovations in smallholder finance from actors such as the members of the Council on Smallholder Agricultural Finance[13], innovations in blended finance transactions that bring together sources of capital motivated by a mixture of commercial and impact objectives, and the underlying imperatives for making smallholder R&R successful has stimulated a fresh wave of experimentation in R&R scheme design over recent years. This report aims to take stock of where the emerging 'smallholder R&R market' is going, by:

- Chapter 2: The State of the Smallholder R&R 'Market'
  - *Sizing the scale of R&R need and opportunity* in terms of amount of land that could benefit from R&R, the scale of the financing gap, and the output and export value potential from engaging in R&R

[13] The Council on Smallholder Finance is an alliance of social lenders that includes Alterfin, Rabobank's Rabo Rural Fund, Oikocredit, Root Capital, responsibility Investments AG, Shared Interest Society and Triodos Investment Management. One of their stated aims is to stimulate lending to smallholder farmers, through both addressing a 'missing middle' of organisations and businesses requiring $25,000 - $2 mln in financing, and supporting the aggregation of independent smallholders into such businesses or organisations.

- *Surveying R&R schemes* (especially in the four target crops of cocoa, coffee, palm oil and tea) and identifying the emerging 'archetypes', how they have been evolving and the particular strengths or interesting innovations across each
- *Reviewing the overall[14] characteristics of the smallholder R&R 'investment proposition'* to potential investors into R&R schemes and the key features required for R&R lending products
- *Reviewing the state of smallholder R&R finance* including the types of investors, their relevance across different project archetypes, and a high-level (and selective) overview of recent smallholder R&R transactional activity

- Chapter 3: Emerging solutions and potential pathways to address bottlenecks for scaling R&R
  - *Assessing barriers and bottlenecks to R&R* both overall and how they apply to different R&R scheme archetypes, and also how they impact prospective investors decision-making
  - *Identifying solutions emerging amongst R&R schemes* that may form best practice
  - *Sharing considerations on broader pathways to address existing financing bottlenecks*, including approaches to address challenges around developing blended finance transaction structures, crowding in additional sources of finance, and developing platforms to manage collective action barriers that constrain incentives to invest in 'public good' R&R systems that deliver material industry-level spillovers

- Chapter 4: Country and Crop-Level Dynamics and Considerations for Developing R&R programmes
  - *Review of the general crop level factors* that define the market, scheme design and challenges for cocoa, coffee, palm oil and tea specifically
  - *2 country profiles for each crop* that outline the industry and institutional factors that define how R&R schemes need to be designed in order to be successful, and some indicative figures on potential investment schedules for selected country-crop combinations.[15]

[14] This report only provides a very high level assessment of the main features of R&R investments; the characteristics of R&R projects differ substantially depending on the archetypal model being used, the crop, the country situation and a number of other project design characteristics. Please refer to an accompanying report by Rabo Investment Advisory Services that provides a detailed assessment of three R&R projects as investment case studies.

[15] Indicative investment schedules and cash flow analyses are only provided for selected country-crop combinations; for those where no cash flow analysis is provided, please refer to the accompanying report by Rabo Investment Advisory Services

2. THE STATE OF THE SMALLHOLDER R&R 'MARKET'

2.1 What is the market size for R&R?

The size of the R&R market for smallholders is determined by a complex set of factors. It is essential to understand that beyond the number of trees that could produce more after an R&R intervention, the market for R&R is also determined by factors such as the potential of farmers to benefit from the yield uplift, the feasibility and attractiveness of R&R as compared to other options (which therefore includes the market price and any pricing support such as floor or guaranteed prices), the access to the necessary skills and inputs as well as the possibility of financing the up-front investment. There are four different levels, each of which is subsequently narrower than the last, to define the R&R market:

Underlying Need - **There must be a genuine 'need' for R&R**

The fundamental agronomics of specific crops determine typical yields over time, and when R&R may be required as a result of age – for example, tea bushes can provide high yields for an extended period of time if they are rehabilitated regularly while palm oil trees need to be replanted when they become too tall to harvest.[16] Legacies of different planting regimes, such as periods of extensive government-led planting campaigns, can also have critical bearing on R&R needs for each crop – these can create 'waves' of trees that reach the age that requires renovation and a sharp, concurrent drop in productivity for many smallholders at once if it is not addressed.

Other factors are also important in determining the 'need' for R&R at this level, in particular, the incidence of disease such as swollen shoot virus for cocoa and coffee rust. Over time, changing agronomic conditions that may be brought on by climate change can change whether or not conditions support current varieties of trees that are being used by smallholders, and may create a need for farmers to replant or graft new varieties. Beyond these factors, there must also be a market for any increased production by smallholders to ensure that it will deliver increased farmer revenues. This absorptive capacity must, at minimum, exist within local value chains and for R&R programmes to achieve substantial scale must also exist at national and international market levels.

Underlying R&R Demand - **R&R must be feasible and attractive for smallholder farmers**

There must be a positive investment case for smallholders to undertake long-run investments which may involve extended periods of reduced or no income. The business case must be feasible for a farmer to execute in terms of agronomic expertise, appropriate planting material and inputs but also provide an attractive investment compared to other alternatives. R&R must be a superior option versus alternatives such as switching to alternative crops, expanding their plots onto new land or

[16] Sector experts suggest that the productive life of tea bushes can be extended to as long as 100+ years if properly maintained from the outset, and that before this period, regular 'downpruning' at 25-year intervals are the main measure to enhance productivity.

moving to town to pursue a different livelihood. Long term risks need to be managed, especially for smallholders that have experienced or expect material farm gate price volatility.

Potential Serviceable R&R Market - Implementers must be able to bring together all the critical components of an R&R programme

An R&R programme must as a minimum combine planting material as required, training on requisite agronomic techniques, and the provision of necessary inputs (including fertiliser and pesticides). Implementers must both be capable of accessing and distributing these components.

The policy environment can have an impact on the availability of key R&R inputs such as planting material or fertiliser by controlling supply or price (or both). This can shape which R&R interventions are possible (such as whether grafting or planting of new varieties can be conducted) and establish incentives and barriers to farmer investments.

To deliver R&R programmes, the level of farmer organisation in a country can affect the complexity of scaling the intervention. For example, farmers organised into value-chains (e.g. in purchase agreements with traders or processors) or farmers organisations (e.g. cooperatives) are already part of an infrastructure through which R&R implementers can reach out or deliver training and monitoring. In many most countries and value chains the majority of farmers are not linked to formal value chains, which creates a significant challenge for high-level scaling of R&R beyond this 'serviceable' market size.

Potential Funded R&R Market - There must be a viable funding model

The provision of smallholder finance is generally challenging for commercial financial institutions, and can also be difficult even for social lenders that are willing to accept substantially below-market rates of return. These risks are generally well documented and well understood [17].

The long-term nature of investments required in R&R, plus the combination of elements required to create a viable R&R programme (planting material, training and inputs) amplify these challenges, especially given commodity price risk over long investment horizons, exposure to agricultural risks such as weather and disease, the requirement for grace periods and prospect of irregular payment schedules as well as the imperfect credit worthiness (and challenges in risk assessment) for smallholder farmers.

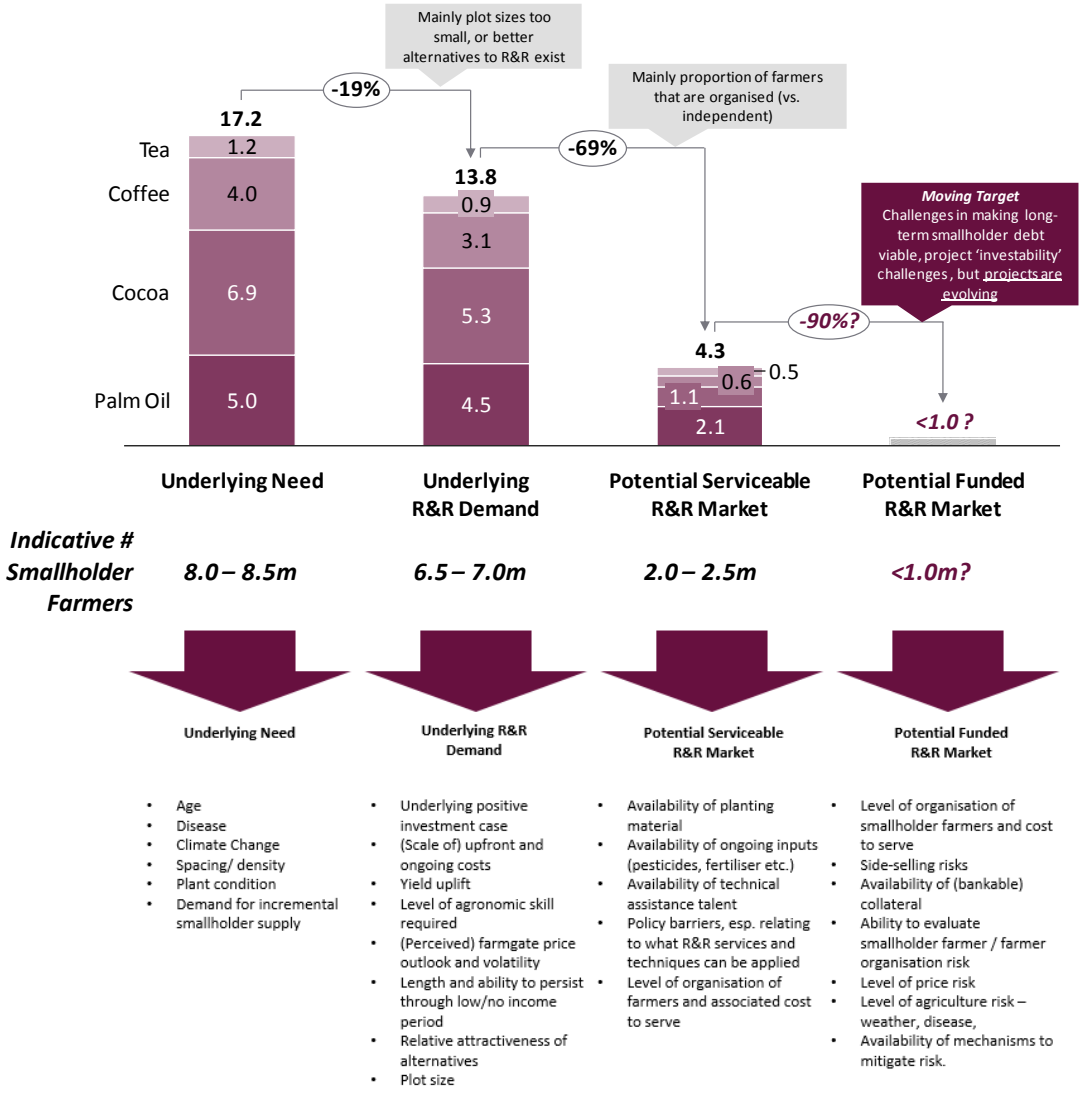
In many, if not almost all, cases an important role for non-commercial finance exists given the requirement to make investments in market infrastructure. For example, where side-selling[18] is a

[17] See for example: CSAF, 2014: "2014 year in review"; Initiative for smallholder finance, 2015; Dalberg: "Catalysing Smallholder Agricultural Finance", 2012

[18] In the context of R&R programmes, some aim to leverage increased productivity to recuperate the cost of the investment. If farmers divert the increased yields to other buyers than the investor, this is known as side-selling.

persistent issue non-commercial finance may need to create 'public good' productivity investment platforms that can circumvent collective action challenges. As such, layered financing approaches that combine public and private capital are likely to be required for R&R programmes that aim to reach significant scale.

Figure 7: Overview of the key Factors that Define the Scale of R&R Need and estimates of market size in terms of land area to renovate or rehabilitate (million hectares, 2013)



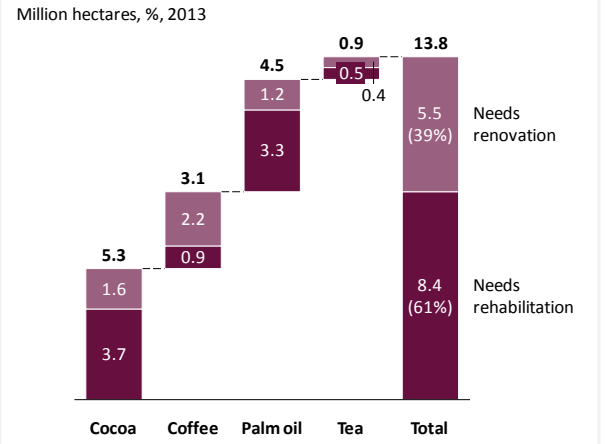
Approximately 14m hectares of land harvested for cocoa, coffee, palm oil and tea worldwide, or 6.5-7.0m smallholder farmers, would benefit from R&R if such services could be made affordably available to them; the current 'supply' of R&R is a fraction of this today. Figure 7 outlines the scale of the market, both in terms of the amount of land that could benefit from R&R as well as an indication of the number of smallholder farmers that would be reached at each 'level' of the market. The key levels for the purpose of this report are the 'underlying R&R demand of 13.8m hectares and 6.5m to 7.0m smallholders, and the 'potential funded R&R market' which is a small fraction of underlying demand. The funded market is

difficult to measure, but from a review of a broad cross section of major R&R programmes in our target crops (refer to appendix for a full list of projects covered) is below 1m hectares and less than 500k farmers. Ways in which the barriers and challenges that currently constrain the R&R market to this level can be addressed are focused on in the next chapter.

$20bn of financing would be required to address the underlying demand for R&R[19] in these four crops today, rising to $100bn to fully fund these projects over the next 25 years. The investment case for renovation versus rehabilitation differs substantially between each approach (see **Error! Reference source not found.**); the upfront renovation investment would be $12bn, and $65bn over 25 years, while rehabilitation costs would be $8bn in the first year and $44bn over 25 years[20,21].

Figure 8: Global Demand for R&R by Crop and Costs vs. Export Value of R&R by Crop

Underlying Demand for Renovation vs. Rehabilitation by Crop



Overview of Costs and Value of R&R by Crop

	Costs ($bn)		Export Value ($bn)	
	Year 0	Year 0-25	Year 0	Year 0-25
Coffee	**6.3**	**34.5**	**-7.0**	**55.6**
Renovation	5.7	28.6	-7.5	46.1
Rehabilitation	0.6	5.9	0.5	9.5
Cocoa	**8.4**	**52.7**	**1.2**	**137.7**
Renovation	4.4	27.9	-2.6	68.0
Rehabilitation	4.1	24.9	3.8	69.6
Palm oil	**5.1**	**17.6**	**-1.3**	**80.5**
Renovation	1.6	6.0	-2.4	67.8
Rehabilitation	3.4	11.6	1.2	12.7
Tea	**0.8**	**3.8**	**-1.0**	**29.9**
Renovation	0.6	2.7	-1.5	20.6
Rehabilitation	0.2	1.2	0.5	9.2
4 crops	**20.6**	**108.7**	**-8.1**	**303.6**
Renovation	12.2	65.1	-14.1	202.6
Rehabilitation	8.3	43.5	5.9	101.0

We estimate that if all underlying demand for R&R were met today, this would deliver cumulative increased export earnings of $300bn over 25 years, compared with the $100bn of total R&R costs arising over this period. Renovation is immediately cashflow negative but generates the highest long-term returns; rehabilitation involves a lower financial exposure and can typically deliver immediate uplifts in cashflow (except for the most severe rehabilitation activities such as stumping or coppicing).

[19] We have focused on the financing gap to address total underlying R&R demand, as the appropriate 'level' of the market; aiming to invest in R&R for the total 'underlying need' would ignore situations where undertaking R&R is a second-best investment option and overstates the financing opportunity; aiming to invest in the 'potential serviceable R&R market' would only focus on farmers that are organised, and would ignore the majority of farmers that are independent and for which some existing R&R schemes aim to address by aggregating.

[20] These figures are based on a broad set of assumptions and are for high-level guidance only; estimates of the land requiring R&R are based on analysis of ageing, disease incidence and poor condition incidence of the smallholder tree stock for the top 5 countries in each commodity and then extrapolated to the global level of smallholder production. The split between land requiring renovation versus rehabilitation is based on the collated perspectives of industry experts and R&R program developers. We have applied 'averaged' renovation and rehabilitation costs for each commodity across the total land required. Finally, we have not assumed any increase in the costs of inputs (especially labour, fertiliser, pesticides, planting material, processing and logistics) over the 25 year period, but do assume that there will be increased operating costs associated with harvesting and storing / transporting increased production.

[21] It should be noted that rehabilitation and renovation are not mutually exclusive: it can be possible to rehabilitate trees that could also be renovated; however, for the purposes of this analysis we assume that all land where trees are old enough to warrant renovation or are diseased are renovated, and remaining trees that could benefit from rehabilitation are rehabilitated. Therefore, the total R&R investment opportunity is the sum of these two figures.

Beyond the direct commercial value of additional production from tree crop systems that have been renovated or rehabilitated, there are significant social and environmental benefits. Although the share of final export prices that farmers realise in terms of farmgate prices vary substantially by country and by crop, assuming that farmers capture between 25-50% of the export value of additional output suggests that R&R at the level outlined above represents an opportunity to lift farmer incomes by $75bn - $150bn over period, with rehabilitation activity offering the potential to uplift smallholder farmer incomes in the first 12 months from undertaking the activity by up to $6bn. Environmental sustainability benefits also arise from both the prevention of deforestation and forest degradation, from additional carbon sequestration through additional tree planting, from activities incorporated into some R&R schemes that aim to improve soil conditions, amongst other benefits. These ecosystems benefits are, however, hard to capture in many cases unless there is a well-defined market: the existence of such mechanisms has made forestry projects that focus on carbon sequestration possible, and these can also be relevant for R&R.

The market size of R&R is rendered difficult to precisely assess by the many interrelated factors that make investments feasible at the smallholder, R&R implementer and financier level. Although the above figures can be used as a high-level indication of global need, costs and value, the market size is going to be constrained by many country and crop-specific aspects that affect how feasible an investment in R&R is for the farmer and, therefore, how many hectares of land could benefit from either rehabilitation or renovation. Country and crop-specific analysis is needed to understand the varying picture of R&R feasibility and need, according to several factors that will be further discussed in Chapter 4.

2.2 The current state of development of R&R programmes

R&R is not new; it is an established practice in commercial plantations and the methodologies and technologies required are well known and understood. Gradual renovation and rehabilitation of tree crop systems is a long established practice for commercial plantations, and its practice is also adopted by relatively small-scale professional farmers, such as by many robusta growers in Vietnam [22]. In such cases, R&R is a purely commercial activity and finance is usually available on commercial terms.

The application of R&R to smallholder farmers is not altogether new either, although it has predominantly been driven by the public sector. Historically governments have often played a significant role in driving large scale planting and replanting, often as part of a national asset and growth agenda; examples include the large scale planting of cocoa in West Africa 60 years ago, two large scale waves of planting of palm oil in Indonesia in the 1970's and 1990's, and investments by governments of Brazil and Indonesia into cocoa. Such programmes have typically integrated tree crop research, and extension programmes to drive sensitisation and dissemination of planting materials and appropriate agronomic practices by smallholder farmers. The financing of such programmes has typically been heavily or entirely subsidised.

[22] In the case of Vietnam, the relatively young state of the coffee industry and the early establishment of renovation as a normal aspect of good plantation management have been important factors in making R&R a 'normal' smallholder activity that they can typically find access to finance for as necessary (or finance out of cashflow from existing operations by rotating a small proportion of their estate at any one time).

There have been some innovations recently in R&R program design and smallholder finance that indicate that some programmes may be able to attract new, more sustainable sources of finance, and achieve scale. There has in recent years been substantial innovation R&R program design and smallholder finance that is being brought together by a range of actors. The combination of actors motivated by varying agendas including sustainability of supply, value chain development, farmer livelihoods, environmental sustainability or to extend the reach of social lending, has led to a situation where many different types of R&R program exist today. Across the current R&R program landscape, there are 3 main types of program, with multiple approaches within each, as shown below in Figure 9.

Figure 9: Overview of main types of R&R programmes

		Description	Examples	Typical Crops
Co-Op R&R Service Delivery	Social Lender Driven	• Social lender selects scale co-operatives that offtake agreements and / or other collateral • Social lender invests in developing co-op capability to on-lend and administer / provide R&R services to farmers	• Some of loans extended by Coffee Farmer Resilience Initiative (Root Capital) (5 loans)	• Coffee
	Coop Creation & Development	• Farmers are aggregated into cooperative structures • R&R (plus other) services aggregated by and distributed through the coop; can also act as the channel for R&R finance	• Coffee Farmer Alliances Tanzania (HRNS / Neumann Kaffee)	• Coffee • Cocoa • Tea
Commercial R&R Service Delivery	Nucleus-estate-delivered	• Plantation operator takes over smallholder plots and undertakes R&R, finances the R&R, and returns land to farmers when R&R is complete and plantation is approaching commercial production • Farmers pay back operator with a share of increased production	• PT Hindoli Plantation Replanting Program, Indonesia (Cargill)	• Palm Oil
	R&R entrepreneurs creation	• Development of farmer service company structures that deliver R&R services (amongst other services), and potentially provide farmer finance	• Cocoa Sustainability Program (Mars) • Biopartenaire (Barry Callebaut)	• Cocoa
Integrated Direct-to-Farmer Models	Supply Chain Actor / Cert. Agency Provision	• Buyers or input providers provide technical assistance, planting material, inputs and finance • May be part of existing / added to value chain investments • Similar approaches also adopted by certification agency programs	• Ecom-Starbucks-IFC-IDB Coffee Rust Program	• Cocoa • Coffee • Palm Oil • Tea
	Landscape level agroforestry projects	• Development of landscape-level agroforestry projects that can include afforestation, timber, tree crop agriculture and intercropping with other products. • Capture carbon value (voluntary credits) as well as from R&R	• Shade Coffee and Cacao Restoration Project, Ecotierra	• Cocoa • Coffee • Palm Oil
	Public Sector Provision	• Typically leverage public sector bodies for planting material, technical assistance and provide grants or concessional loans to farmers to adopt R&R. May create govt. R&R service cos to integrate and deliver package of R&R inputs & finance to farmers	• National Replanting Program, FNC • Indian Tea Board 12th scheme	• Cocoa • Coffee • Palm Oil • Tea

Although there is a diversity in R&R program types, there is a consensus emerging around the overall architecture of viable R&R programmes. A 'minimum viable package' for R&R must include access to planting material, training, inputs, a solution to an initial low income period, and an affordable funding model (whether affordability is defined at the smallholder or programme level).

These programmes are at different stages of maturity: at a high-level, integrated direct-to-farmer models are the most established, followed by co-operative service development, while professionalised R&R service delivery models include a mix of very established and very new approaches.

2.2.1 Direct to Farmer Models

Models in this category aim to develop vertically integrated models for the sourcing of R&R program components, and deliver finance to farmers (in general) to conduct the R&R on their farms. The most established are public sector provided programmes such as those by the Indian Tea Board, or the relatively more recent Colombian Coffee Growers Association (Federacion Nacional de Cafeteros, "FNC")) driven coffee renovation program in Colombia.

Some R&R projects are either a continuation of, or are modelled upon, value-chain finance and development services provided by supply chain actors and certification agencies; while the overall approach is therefore less novel in terms of operational design, there have been some important developments in developing blended finance models and off-take guarantees. The newest approaches in this category involve the evolution of forestry projects that involve managing deforestation and forest degradation challenges, and capturing the value of this through (voluntary) carbon markets, to also include agroforestry, and the associated economic value from improved productivity.

Typically these models do not rely on the pre-existence of farmers organisations to work: they can indeed integrate existing organisations into their programmes, but they will often either include aggregation of farmers into their programmes. As such they can be the most scalable if they side-step the exercise of fully formalising value chains. However, such models also require that there is sufficient technical assistance and training to farmers in order for such programmes to be successfully executes, and this needs to be delivered consistently over several years to cover the replanting or rehabilitation period.

2.2.2 Co-operative R&R Service Delivery

These models leverage producer organisations as a means to aggregate farmers into groups that are 'economically viable' for the R&R project operators to service, and typically leverage co-ops to deliver R&R services, select eligible farmers and manage on-lending to them. A relatively established model in this category involves aggregation of farmers into cooperatives, and leveraging this structure to deliver R&R services to farmers, as well as deliver finance. Actors such as Hanns R. Neumann Stiftung have developed approaches that creating multiple tiers of farmer organisation, with a high degree of investment in developing farmer and co-operative capability.

Other models that are being piloted involve a much faster and less time intensive aggregation of farmers; the former approach takes greater upfront time and financial investment, but with a higher rate of success in implementing R&R, versus the latter model which may achieve faster time to implementation, but with poorer execution and associated repayment rates. The second key model in this category is led by social lenders, in particular pioneered by Root Capital through the Coffee Farmer Resilience Program, which targets lending to high-capability cooperatives that typically have some form of hard collateral and/or off-take agreements with major buyers, and develops the program to deliver R&R with them, as well as their capabilities to execute and manage farmer finance operations.

2.2.3 Commercial R&R Service Delivery

Models in this category aim to address the fact that R&R can be complicated to execute well, and the challenge of ensuring that R&R is commercially sustainable and scalable, by 'professionalising' the delivery of R&R.

The 'nucleus-estate-delivered' model, as typified by Cargill's approach in Indonesia in their PT Hindoli plantation, involves a temporary 'takeover' of smallholders' land to finance and undertake the R&R for a period of years; farmers are employed by the nucleus as wage labourers and also receive grants from the local government. Once farms are renovated, they are returned to smallholders, and typically achieve comparable yields to the commercial nucleus estate; farmers make repayments through a share of their output or the sale price to the processor.

An alternative model aims to create a commercial infrastructure of entrepreneurs that are incentivised to acquire smallholder farmers as customers for services that they can offer, including R&R. The former model has a substantial track record across a diversity of plantation sectors, while the latter model is currently being piloted by some supply chain actors that are aiming to develop sustainable and scalable approaches to driving up farmer productivity.

While not universally evidenced yet, a significant number of programmes are showing promise in achieving financial viability at the smallholder farmer level, which is a key precondition for scalability. Some programmes are indicating that costs of delivery and achieved yields are poised to deliver viable, and in some cases, material returns at the smallholder level (see country and crop specific sections in Chapter 4 of this report for examples of such programmes). Developments in coffee and palm oil are more advanced overall, partly driven by the imperative of the coffee rust crisis in Latin America and the high value of palm oil in recent years. On the other side, the long-run productivity of tea bushes and the very different emphasis in what R&R programmes in tea should focus on (in particular, infill and extension planting, versus the scale of worthwhile replanting) mean that tea-focused projects do not have to respond to the same level of challenge in terms of a sharp drop off in production. Cocoa, especially in West Africa, is more of a 'mid-case': there has been a significant push to develop sustainable intensification and long-run productivity enhancement projects over an extended period, with much of the industry brought together by the World Cocoa Foundation but R&R models are only just starting to emerge because of the lead-time that has been needed to resolve challenges in the local operating environment.

It is important not to over-generalise from these emergent findings across very diverse contexts; we outline the experiences of a selection of programmes in specific country and crop contexts to demonstrate how they have aimed to address their specific challenges, before identifying the most important and unanswered challenges in the final section of the report, and what some emergent overall 'solutions' could look like for some location specific crop markets.

2.3 The State of R&R Financing

2.3.1 What does R&R Financing Entail?

Before assessing the state of R&R financing, it is important to outline the fundamentals regarding what R&R as an investment proposition entails. This section does not aim to provide a full and detailed account of R&R investments and associated investment schedules, which can be found in a report accompanying this series developed by Rabo International Advisory Services[23]. Below we outline the key components that R&R investment products need to address.

It should first be noted that renovation and rehabilitation are in general very different investment propositions. Renovation will typically involve replacing old trees, and involve upfront financing of planting material, lost income from the production that is foregone as the new trees mature, and finally after several years a superior level of output. Rehabilitation typically involves a far lower upfront investment in enhancing either tree or soil productivity and often results in productivity increases within the year that rehabilitation is undertaken. There are exceptions for each case. For example infill planting (to fill space where original planting was not as dense as it could be) is a form or renovation that does not involve an production losses from existing plants, while stumping or coppicing can require more than a year for a tree or bush to regrow from the remaining stump. However, for the most part, renovation involves high capex and higher long term return, while rehabilitation is a lower capex and lower long term return proposition. A final key fundamental to note is that, for trees that are either substantially damaged by disease, are very old, or are in very poor condition, rehabilitation may not be viable, and eventually all trees will need renovation.

For prospective investors, renovation involves a long-term financing that may involve a grace period of several years, aligned to the period during which farmers need to invest in planting new trees and supporting sapling growth to maturity; loan repayments may commence 5 or 6 years after the initial loan, and can require several years to pay back. During the upfront period of low income or negative cashflow, farmers may require income support finance. Overall, loan tenors may be in the region of 10 to 15 years (although some actors such as Root Capital structure shorter grace periods and tenors of 7 years). Rehabilitation financing is shorter term than renovation financing, typically with a tenor of 5 years or less, and typically does not require a grace period.

Gradual R&R decreases upfront investment costs. Current R&R programmes have a tendency to focus on one-off investments to see quick and higher returns. However, a more gradual approach with smaller parts of financing would de-risk R&R and also allow the smallholder to uphold a certain livelihood standard, while still bringing incremental improvements in productivity.[24] In some cases, the plot size will be too small for gradual replanting to make sense, whereas bigger SHF farms could replant 25 % of their land and still experience a noticeable uplift over a few years' time. By taking a gradual approach to

[23] "IDH Study Rehabilitation and Renovation of crop trees in cocoa, coffee, palm oil", Rabo Investment Advisory Services, 2015
[24] This gradual approach to replanting is advocated by Technoserve

replanting you avoid the long valley of death and adapt the replanting cash flow closer to a rehabilitation cash flow.

Figure 10: Overview of main features of financing required for renovation versus rehabilitation by crop

Crop	R&R	Age requiring R&R	Cost per hectare (USD/ha)		Grace period yrs	Time for NPV to become >0	Loan tenor	# productive yrs over which loan is repaid
			Upfront	Annual				
Cocoa	Renovation	25 yrs	2500	500	4-5	6	6-7	2-3
	Rehabilitation	20 yrs	1500	200	2	3	4-5	2-3
Coffee	Renovation	20 yrs	2750	750	4-5	9-11	10-11	4-7
	Rehabilitation	15 yrs	2000	250	-	1	5	5
Palm Oil	Renovation	25 yrs	1250	250	5-6	8	12-13	4-5
	Rehabilitation	10 yrs	2000	250	-	1	1-2	1-2
Tea	Renovation	>50 yrs	1500	250	5	7	11-12	4-5
	Rehabilitation	25 yrs**	1000	50	-	1	2-3	2-3

*** regular pruning on a bi-annual basis, but first stumping ('downpruning') at the age of 25*

R&R finance will have to engage with the trade-off between segmenting farmers and reaching sufficient scale to make operational sense from a financier perspective. There are several challenges involved in the design of R&R finance. One issue is scale, as most investors have a minimum project size and number of transactions to render the project cost-efficient. However, segmenting famers based on their loyalty or capacity to carry out R&R measures increases the likelihood of success, while also increasing the upfront costs of selection and making it more difficult to reach scale.

Different methods of farming entail different approaches to R&R and thereby different approaches to finance. There is no one-size-fits-all solution to R&R finance. Specific farming models create different challenges and opportunities for finance. When farmers operate as outgrowers or contract farmers, financiers can rely on estates to provide technical assistance and training. In these instances, local banks are also more likely to provide (part of) the financing. Independent farmers present a different challenge as they are harder to reach and other execution partners are needed, such as cooperatives or NGOs with strong local connections. Another model is to engage with farmers via purpose-built farmer organisations or demand-driven professional services as is the case in programmes run by Barry Callebaut and Nestle.

Innovations on risk-sharing will be needed for large-scale capital to enter the R&R space. Long-term agricultural investments expose investors to commodity price and agricultural risk, and prospective R&R investors therefore may require some form of risk mitigation measures both for the farmers (such as with flexible grace periods in the case of adverse weather temporarily impacting yields) and at the project level, such as through insurance markets or guarantees.

However, there is currently a lack of risk-sharing facilities for R&R. Facilities such as first-loss funds have been used to provide guarantees that allow organisations to take on high-risk lending. As an example, Root Capital have used this method to take on very risky loans in the coffee sector in Latin America.[25] However, such facilities need a certain size to be operationally cost-effective, and several attempts to create first loss funds have failed simply because of the minimum size requirement.[26] Mars' cocoa sustainability programme provides an innovative risk-management approach for financial institutions lending to smallholder farmers as the loan is provided on a gradual basis with a team of agronomists that can step in if farmers are underperforming and in risk of not repaying their loans. Although still in early stages, the approach has been launched in Cote d'Ivoire, and has a somewhat longer track record in Indonesia.

2.3.2 Key Actors in Smallholder R&R Finance and the State of R&R Finance Development

There is a substantial financing gap for smallholder R&R, related to the overall challenges in smallholder finance in general. R&R finance outside large-scale productive plantations is largely absent, not least because of the problem of accessing tailored financial products that allow smallholders to uphold (and eventually improve) their livelihoods. Current global smallholder agricultural finance amounts to $9bn per year and global social lending into smallholder agriculture of USD 0.6 billion in 2014.[27]

Though total finance of R&R at a global scale is very limited, there are a number of actors currently engaged in financing renovation or rehabilitation. Table 1 outlines the typical investor engaged in R&R at the moment, and the typical roles they have played. To date, the majority of R&R programmes have leveraged grant and donor finance, few programmes being financially (and commercially) sustainable. The current experience of other lenders, including social lenders and rural / agricultural banks is either very early stage or mixed at best – Root Capital and Rabobank Foundation being amongst the most advanced. Local banks are generally wary of lending large amounts to smallholders, if anything at all.

Government and local financial institutions are the most established overall as lenders into smallholder R&R, with local financial institutions typically participating as part of a government-backed program, such as the roles of Bank Mandiri and Bank Agro as part of the PTPN 13 Revitalasisi program in palm oil in Indonesia, or Banco Continental in the government of Ecuador's IHCAFE program. Investments have reached as high as $500m by the government of Colombia as part of its FNC program to combat coffee rust.

[25] Root Capital providers a thin layer of first-loss capital (5% of current capital committed, will be 3% versus the eventual target for funds disbursed); this is accompanied by a larger guarantee on a 50% pari passu The first loss fund is provided by USAID and Keurig Green Mountain on losses over and above the level covered by the first-loss guarantee.

[26] Dalberg interviews.

[27] Institute for Smallholder Finance, 2015. Note that social lending has been growing rapidly. Total disbursements grew from $362m to $564m between 2013 to 2014, which is a 56% increase year on year, driven by rising disbursements from existing social lenders, plus new entrants into the space. However, closing the funding gap will require crowing in other sources of finance, especially commercial lenders, in the long run.

Table 1 Overview of R&R Investors

Type of investor	Potential Role(s) as an R&R investor	Specific investor example
Development Finance Institutions & Multi-/Bi-Lateral Development Institutions	Can provide grants, finance with below-market returns and/or with concessional terms, mechanisms or guarantees to de-risk investments and attract other investors.	USAID shared loss fund against coffee rust in Latin America; IFC and Inter-American Development Bank investment into ECOM coffee R&R program.
Supply chain actor	Can finance the smallholder directly via replanting, act as guarantor for local banks to make SHF more credible.	Cargill's replanting programme in Indonesia.
Social lender	Provide long-term debt typically at substantially below market return levels; may or may not have any collateral; typically (not always) provided through farmers organisations that on-lend.	Root Capital Coffee Farmer Resilience Initiative .
Government	Public funding in terms of grants, subsidies or income support during valley of death.	Indian Tea Board offers 25 % grants and 50% loan scheme for replanting.
Foundation / Impact Investor	Grants as well as financing of specific parts of the R&R 'package' – e.g. capacity building in local community	Wood/Gatsby Foundation Chai programme in Tanzania.
Local finance institution	Typically able to finance smaller investments (through debt, typically at commercial rates unless other investors can insure or subsidise returns) if SHF is connected to coop or estate.	Local banks in Mars Triple Productivity package programme in Indonesia
Carbon finance Institution	Finance rehabilitation programmes with carbon credits earned from reforestation projects. Typically not big enough to finance replanting.	Ecotierra or Livelihoods Fund both make use of carbon credits.

Conversely, other actors currently participate at a much smaller level, reflecting a different type of intent and focus on newer innovations in terms of R&R program design. Supply chain actors that are trialling and piloting new programmes in the field – such as Nestle and Barry Callebaut – have invested amounts that are typically in the range of $30-$45m; Ecom and Starbucks are trialling a new transaction structure that involves a long-term off-take agreement, and roles for IFC and ADB, with the investments of all four actors reaching $30mln. Root Capital is investing in learning and refining its approach to delivering smallholder R&R finance through its Coffee Farmer Resilience Initiative and has made several loans to a combined total of approximately $8mln to date. In all of these areas, investors are yet to reach scale and focus on attracting a step-up in capital.

R&R delivers multiple sources of value to a diverse set of stakeholders, suggesting that opportunities should exist to develop blended finance approaches to potentially attract commercial investors. Smallholder R&R delivers economic benefits to a wide range of industry participants while also increasing social and inclusive growth agendas for country governments. It can deliver environmental benefits from the creation of a sustainable pathway for tree crop intensification that avoids deforestation and forest degradation, while also potentially sequestering additional carbon in (rehabilitated) soil and tree stock amongst other environmental benefits. Actors that attribute value to these different outcomes and have the mandate to provide risk mitigation measures (such as guarantees) and zero or low-return finance could potentially be integrated into R&R project finance structures to crowd in financing from other lenders, including commercial lenders, which currently find the risk and uncertainty associated with many smallholder R&R projects, combined with the lack of liquidity, unattractive versus the promised returns.

Different investor types seek different features in R&R programmes when making the decision to invest. The motivations for government investors, and therefore the features of R&R programmes that they look for, are driven by their rural and asset creation strategies and with a focus on speed, scale and typically broad to almost-universal take up by their target groups. In situations such as an emergency response to disease, this approach may be one of the most effective.

For DFI's, although broader social and environmental returns can be important, they also seek underlying commercial logic, even if they are willing to adopt very aggressive lending strategies (e.g. not requiring collateral, seeking a target of 0% return). Programmes that combine long term off-take, risk mitigation measures (such as first loss or shared loss guarantees) and approaches to minimise or eliminate the need for consumption loans and grants (such as through gradual renovation and infill planting, or alternative employment and/or agriculture alongside the maturity period for new trees) are particularly sought after elements of project design. Ensuring that the actor(s) involved in execution have a stake in the success of the program is also particularly critical. These features have been highlighted by investors and project developers inputting into this report, as well as recent activity such as the recently announced Ecom coffee replanting program, with IFC and IDB as co-investors and Starbucks providing a long-term off-take agreement for the farmers in the program.

Social lenders, led currently by Root Capital, are a potentially critical investor class, given their focus on innovation in sustainable and scalable delivery of finance to smallholders, and their desire to mobilise additional investors to leverage their learnings and thereby catalyse further investments into the category. Currently, Root Capital is focused on developing a detailed understanding of the dynamics surrounding R&R execution as well as the resulting investment metrics (especially repayment rates, but also yield and farmer income implications); at this current stage, they are focused on identifying high-performing farmers organisations (including, but not limited to, producer co-operatives, private aggregators, exporters and savings and credit cooperatives) that have collateral, as they develop their long-term R&R lending proposition. Other actors, such as foundations, impact investors and carbon investors currently play a relatively minor role in smallholder R&R, and the outlook is for this to continue.

3. Key Challenges and Potential Solutions to Scaling R&R

3.1 Overall challenges to R&R

Developers of R&R projects seeking finance to launch and scale up their activities, and prospective investors seeking attractive R&R programmes to support, both suffer the 'pioneer problem': there are several uncertainties regarding smallholder R&R for which there appear to be solutions in principle, but there are a lack of reference projects that can demonstrate that these solutions work in practice (or which of these solutions are best) and what returns may be achievable. This inhibits investment into projects that can scale up pilots and generate the track record that project developers and investors are looking for.

The challenges that are most typically referenced by actors and prospective investors in the R&R space typically fall into two areas – ensuring the underlying viability of R&R projects, and managing a mismatch between investors expectations and what R&R projects offer as an investment opportunity. Although there are country and crop specific nuances, most issues fall under these areas.

Underlying project viability	Investor-vs-project expectations mismatch
▪ Fundamental components of R&R must be there, and it must be delivered as an integrated system ▪ R&R must be feasible and attractive to smallholders (vs. all alternatives) ▪ Farmers need to be organised or cost effective to serve ▪ Must address generic smallholder finance challenges, which are more acute in long-term lending ▪ Side selling must be addressed, or 'designed out' ▪ Requirement to manage inherent commodity and agricultural risks, as well as repayment risk with mitigations (e.g. guarantees)	▪ Time horizon desired vs. long-term nature of R&R… ▪ …and lack of liquidity and structured exits forces long-term commitments to projects beyond norms ▪ Typical deal / ticket size far smaller than desired ▪ Complexity inherent to projects: in R&R execution, and finance, which typically involves many partners ▪ Complexity in aligning incentives, especially for blended finance projects ▪ Concerns regarding approaches to address 'grace periods': consumption loans, level of equity required
Most challenges have been 'solved in principle' but need track record to prove they work in practice	***Relative 'newness' of smallholder R&R projects reduces willingness to change investor expectations given risks***

Pioneer Problem
Lack of track record to prove 'investability' of projects inhibits scale investment into projects to generate track record

3.2 Underlying project viability – Challenges and Solutions

Overall, solutions to the challenges to achieving underlying project viability are emerging, from our review across projects in specific countries and crops in. Different R&R program archetypes have varying levels of

exposure to different challenges, and overall there are multiple solutions and methodologies emerging. A selection of the most commonly found challenges and emerging solutions, include:

1. Cost effective availability of the core components of R&R, and successful implementation of R&R: the fundamental components for a cost effective R&R program must exist. The operational building blocks of an R&R program are becoming established as a package of planting material (if replanting or grafting), training, inputs and financing for these components. Constraints and bottlenecks to R&R programmes' operational feasibility often have a country-specific dimension. Governments typically have a critical role to play in determining the conditions for the adequate supply of appropriate R&R inputs, but in cases where supply is insufficient in terms of quantity or quality, some project developers have developed their own sources of supply. The inputs for R&R and appropriate agronomic practices must be delivered in an integrated way over several years. A consensus is emerging that the separate components of an R&R package need to be delivered in a system to farmers if farmers are the ones to implement R&R. Other approaches have side-stepped the challenges of training and ensuring consistent application of new techniques by smallholder, by applying commercial models of R&R such as extending normal plasma plantation operations to smallholders on a temporary basis (temporarily taking over smallholder plots and undertaking the renovation for them, then returning plots) or by creating farmer services entrepreneurs that deliver R&R services and inputs for a fee.

2. Ensuring that R&R is attractive and feasible for smallholder farmers: The combination of the scale of investment required in R&R and the extended period over which it delivers results can make smallholder farmers unwilling or unable to undertake R&R, especially given real or just perceived price risk and fundamental agricultural risks. The scale of upfront investment in renovation can be (at least partially) addressed in several ways: by taking a more gradual approach (such as renovating only 10% of the estate per year), by undertaking a blend of rehabilitation and renovation to aim to avoid material reductions in smallholder production over time.

3. Aggregation or Farmers: Farmers need to be cost effective to serve with smallholder R&R services, and this typically requires that they are organised, or that a process of organisation takes place. Only about a third of smallholder farmers in the four crops studied are currently organised in structured value chains yet most R&R programmes aim to work with these 'pre-organised' farmers for practical reasons. Serving independent smallholder farmers is logistically difficult and can create challenges in models that require deploying finance or on-lending. Farmer organisations can serve as distribution channels for training, inputs or planting material while at the same time strengthening farmer integration in the value chain and providing them with increased negotiating power. Multiple approaches for developing farmer organisations (faster, less selective methods versus slower approaches that upskill managerial, financial and technical competencies) are being trialled as ways to address this, while other approaches also include development of professional farmer service companies that act as aggregators.

4. **Ensuring that R&R financing is attractive and feasible for investors:** The long-term nature of R&R makes the existing challenges of smallholder finance more acute, and addressing these challenges is critical for the success of R&R programmes. The challenges of smallholder finance are well documented and understood[28] as well as emerging new approaches to resolving these challenges. For smallholder R&R, long loan tenors, combined with grace periods, lack of collateral and extended exposure to commodity and agricultural risk are a challenging proposition for prospective investors. The solutions emerging for such challenges are also similar to those for smallholder finance in general, and there are some differences in how these solutions are implemented across archetypes. For example, social lenders such as Root Capital have focused on cooperatives where some form of collateral may exist, including movable assets or leveraging off-take agreements; the Fairtrade Access Fund lend to producer groups without sufficient hard collateral if they have a strong business plan & sound financial records. Beyond this, the use of blended finance that combine non-returns seeking capital and guarantees are able to defray risk deliver risk adjusted returns that can crowd in returns-seeking capital, which is critical for scaling projects.

5. **Side Selling**: Side selling challenges are often acknowledged as a key challenge for developing scalable projects in regions with low farmer organisation and loyalty; however, models have been developed that aim to 'design out' the challenge through means such as creating farmer service delivery entrepreneurs that can build direct farmer relationships and manage side selling better, while other models factor in premiums to be paid to farmers that are in R&R programmes. Many projects still factor in side selling, and ensure that their economics remain resilient to its effects within levels that are reasonable based on historical norms.

6. **Risk Mitigation:** Given the underlying commodity price and agricultural risks, as well as risks entailed through extending long-term debt to smallholders, there is typically a critical need for risk mitigation measures. Examples that currently exist include the provision of a shared loss guarantee by USAID's Development Credit Authority to the Coffee Farmer Resilience Initiative, managed by Root Capital, and in another form the off-take agreement from Starbucks as part of the recent Ecom – International Finance Corporation (IFC) – Inter-American Development Bank (IDB) – Starbucks project to address coffee rust in Central America, which includes a $12m shared loss guarantee from the Canadian Climate Fund for Private Sector in the Americas.

[28] Various reports documenting the current financing gap for smallholder farmers, and the challenges of upscaling smallholder finance exist, including "Catalyzing Smallholder Agricultural Finance" Dalberg (2012) (http://dalberg.com/documents/Catalyzing_Smallholder_Ag_Finance.pdf); "Investor and Funder Guide to the Agricultural Social Lending Sector" Institute for Smallholder Finance (2014) (http://www.globaldevincubator.org/wp-content/uploads/2014/06/Investor-and-Funder-Guide-to-the-Ag-Social-Lending-Sector.pdf) and "Direct-to-Farmer Finance Innovation Spaces Playbook" Institute for Smallholder Finance (2014) (http://www.globaldevincubator.org/wp-content/uploads/2014/10/Direct-to-Farmer-Finance-Innovation-Spaces-Playbook.pdf)

Figure 11: Overview of R&R program archetypes and the key problems solved by type

		Maturity of the Model	Who Does R&R	Financing Model	Key Problems It Solves
Co-Op R&R Service Delivery	Social Lender Driven	• Most intensively pioneered by Root Capital since 2014	• Farmer	• Loans provided to the co-operative; selects farmers and on-lends	• Avoids high-costs of providing finance + services direct to farmers • Typically collateral available • Addresses asymmetric information
	Coop Creation & Development	• Aggregation schemes are mature, now adding R&R	• Farmer	• Loans provided to the co-operative; selects farmers and on-lends	• Avoids high-costs of providing finance + services direct to farmers • Addresses asymmetric information • May support better R&R execution
Commercial R&R Service Delivery	Nucleus-estate-delivered	• Cargill model is >20yrs old • Established in other crops	• Nucleus / Outsourcer	• Nucleus finances R&R • Farmer pays w/ % of output or sales price	• Ensures best practice R&R execution, yield uplift and fundamental R&R economics
	R&R entrepreneurs creation	• Experimental, programs still @ pilot / demonstration	• R&R-Service co, or farmer	• Farmer funds from own resources • May receive finance from ServiceCo	• Eliminates time and cost of aggregating farmers • Addresses asymmetric information • (potentially) commercially scalable
Integrated Direct-to-Farmer Models	Supply Chain Actor / Cert. Agency Provision	• Extension of value-chain fin. • Includes new schemes	• Farmer	• Diverse	• Leverages existing buyer relationships to manage side selling • Leverages transaction history to address asymmetric information
	Landscape level agroforestry projects	• Builds on existing carbon / forestry project design	• Farmer / R&R-Service Co (that is part of the project team)	• Diverse	• Leverages multiple sources of value (incl carbon) to drive project IRR • Integration of intercropping, timber for diverisified farmer income
	Public Sector Provision	• History of >50yrs of planting and renovation schemes	• Farmer	• Typically combination of grants and/or concessional loans	• Can 'enforce' scale and rapid reactions to events (e.g. roya)

3.3 Investor versus Project Expectations Mismatch – Challenges and Solutions

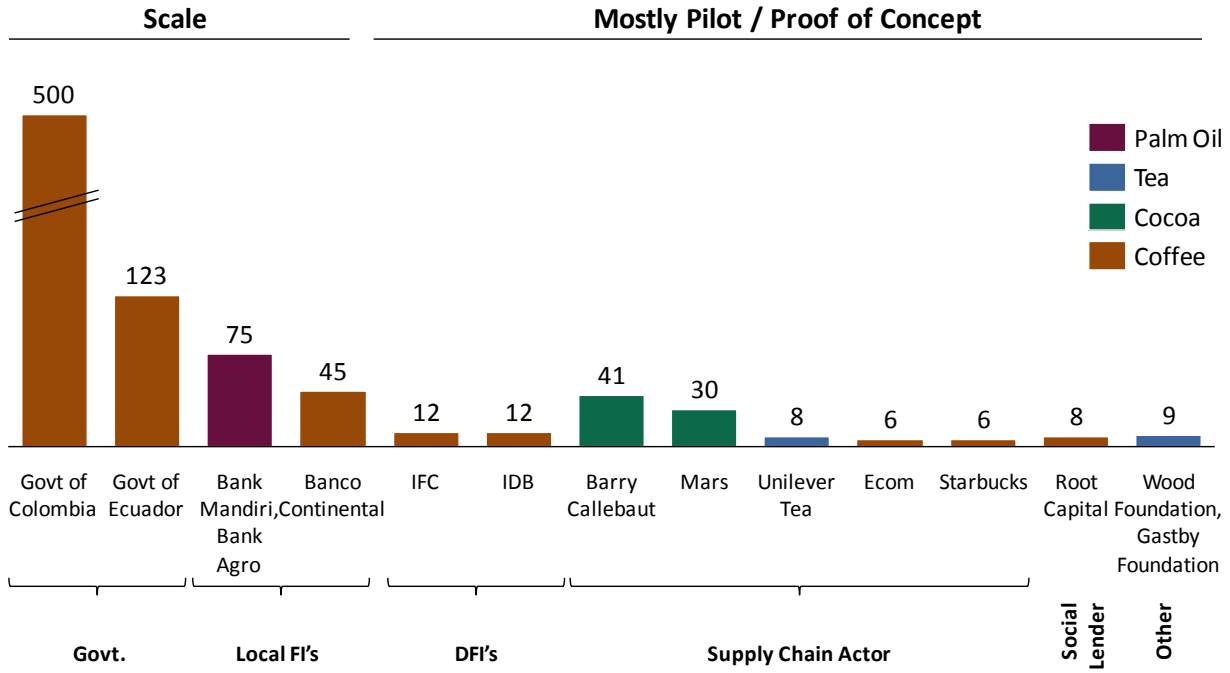
Prospective investors into smallholder R&R projects typically find that there are several challenges regarding the investment proposition that arise frequently across the projects they assess; some of these challenges may require adapting expectations once the investment rationale behind R&R is more established, while some challenges should naturally become less binding as investments into smallholder R&R build momentum.

The long tenor of R&R loans, and the associated long-term nature of R&R projects, can create challenges for investors that target shorter time horizons. Investors may consider financing tenors of 5-6 years (which is not unusual for farmer mechanisation loans) as long-term. Projects that require investors to participate for 5-7 years (and potentially much longer), with little market liquidity and therefore constrained opportunities for exit, face challenges regarding investors' desire for a higher level of liquidity than may be possible.

Currently many projects – outside large government-led programmes – are at pilot or demonstration scale, and do not target reaching a large number of smallholders yet. As an example, the recent Ecom-IFC-IDB-Starbucks-GAFSP project targets reaching 550 farmers in Nicaragua; the Biopartenaire program run by Barry Callebaut is one of the largest non-government programmes in terms of numbers of farmers impacted, with 25,000 reached so far and a target of 100,000. Even relatively large programmes in this range seek to attract $30-40m in funding. Individual loans from Root Capital into its Coffee Farmer

Resilience Initiative are between $300,000 - $700,000 per investee for half of their investees and $1-2m per investee for the other half, suggesting that individual investments for this model are likely to be relatively low per loan. Most of these projects are at pilot or proof of concept stage, and therefore do not have the absorptive capacity for materially higher funding until the underlying models are tested and matured. Justifying the transaction costs for such projects if aiming to invest directly is currently challenging for many investors, and may therefore require some operating subsidy or other incentives if this channel for providing &R& financing is deemed effective and efficient, and worth supporting to reach scale.

Figure 12: Examples of investments channelled into R&R by Institution Type (USD million, historical and future publicised commitments)



The inherent complexity of R&R projects, that require assembling several inputs, achieving farmer behaviour change, and operationalising smallholder R&R finance, can be daunting for investors that do not see a series of well-tested solutions being stacked together, but instead a range of relatively innovative but not well-established solutions being combined. Costs associated with renovation and rehabilitation activities can vary widely across programmes, partly driven by differences in program design, by differences in the way costs (and especially government subsidies) are accounted for, and also by country-level differences; reading across these differences can be challenging. The perceived risk of such programmes is therefore high.

For many projects, an important consideration in the context of high (perceived and actual) risk, and the opportunity to generate commercial, as well as social and environmental value, creates a possibility to explore blended finance approaches, although these have often proven difficult to put into practice. The underlying livelihoods impact of well executed R&R programmes can be significant for farmers directly

affected, and with a strong set of multipliers and related benefits in areas such as health and education; there is also a somewhat more established carbon-value centric set of forestry project developers such as the Mars/Danone Livelihoods Fund and Ecotierra that have successfully developed mechanisms to capture the value from reforestation and avoidance of forest degradation. Combining these actors to supply blended finance, and therefore subsidise or guarantee returns for other investors, is achievable in theory. In practice, the concessional nature of such funding can create challenges, especially for supply chain actors that may be able to finance pilot-scale projects with a relatively low cost of capital from their balance sheet; even those that are willing and able to attract concessional sources of impact capital may find managing the incentives of multiple actors including multiple development actors, government stakeholders and other commercial partners difficult to align. While some project have managed to successfully put in place blended finance, for many other actors, moving ahead with a smaller pilots or demonstration projects that could be possible with outside funding may often appear the most attractive route.

Finally, there are some fundamental concerns that some investors have regarding the core elements of the R&R 'investment product' which can create challenges in being able to invest without radical alterations to project design. Grace periods are often a key area for concern; some investors are unwilling to invest in projects that involve consumption lending over this period, or find the proposition of extending non-compounding loans over this period to weigh too heavily on project returns to warrant investment. In some areas, the presence of government subsidies and cash transfers (such as in Indonesia's PTPN 13 project to renovate smallholder palm oil plantations, or Colombia's FNC program with cash transfers to smallholder farmers that renovated their plots with coffee-rust resistant new varieties) can take the 'grace period' challenge out of consideration. However, challenges in extending smallholder finance still remain for R&R, especially given its long-term nature.

3.4 Some Potential Measures to Accelerate the Development of the R&R Market

As outlined above, while there are many specific challenges regarding project viability and investor expectations, many of these challenges are already en route to being solved as project developers continue to innovate, and will naturally be resolved as a track record and best practice starts to emerge and more liquidity (and norms around the smallholder investment proposition and returns) emerge.

Although we are broadly positive on the prognosis for the sector, the 'as is' scenario will involve a very long gestation period before the emerging 'R&R market' moves beyond fragmented pilots and demonstration projects towards an established sector that delivers scale investment opportunities, pooled projects with diversified indirect and direct routes for investors, and fact-based norms regarding returns.

To catalyze this process, we would recommend three sets of measures:

1. **A knowledge agenda and platform:** given the current level of innovation in R&R project design, and multiple approaches being taken to resolve several common challenges, there is high potential value in accelerating the learning process by sharing project design thinking and identifying, disseminating and accelerating the adoption of emerging best practice. There is an allied critical

need to accelerate the time to achieving a 'track record' for the R&R sector by incorporating and systematising learnings from a diverse range of programmes, including government programmes such as PTPN 13 and FNC[29]. There are several options for how such as platform could be organised, and IDH aims for this report to initiate a discussion within the emerging 'smallholder R&R community' of farmers, project developers, (prospective) investors and lenders and supply-chain actors on how this could be structured.

2. **Creating standardised and agreed templates that make structuring and negotiating R&R projects faster, easier and cheaper:** high transaction costs exist in securing funding for projects, and especially for projects aiming to blend multiple types or sources of capital across investors with varying impact mandates and return expectations. In the short term there may be value in developing standards around renovation and rehabilitation costs by crop, fundamental investment terms and loan product components. There are also opportunities to develop template project finance structures that articulate some key generic project structures as a starting point for discussions to align multiple project stakeholders: the existence of agreed templates can avoid 're-creating the wheel' for new projects, by creating a point of reference for prospective investors and project developers to start discussions from.

3. **Creating a platform for collaboration across the different stakeholders that are needed to make R&R projects work at scale, to make identifying partners & investment opportunities easier:** In many cases, R&R projects in the same crop, or diverse crop-projects in the same location, may have similar needs in terms of suppliers and implementation partners. There are opportunities for such suppliers and partners to leverage their capabilities across multiple projects and in some cases to investigate how projects for different crops in the same region could collaborate and drive efficiencies in project delivery costs, and strengthen the financial case for R&R investments to both farmers and investors. Longer term opportunities may exist for multiple projects to collaborate and seek funding as a combined set of projects, offering opportunities for investors to diversify geographically and across crops, and potentially create larger scale investment opportunities. Some project developers are already pooling projects, and any collaboration platform development should aim to leverage (rather than replace or compete with) such approaches. Finally, given the high risks involved at the current pilot to proof-of-concept stage of development for smallholder R&R projects, there is currently a high need for concessional sources of investment (such as non-returns seeking & market building impact investment) and especially guarantees to mitigate investment risk.

[29] See the report produced by Rabo International Advisory Services "IDH Study Rehabilitation & Renovation of crop trees in cocoa, coffee and palm oil" for detailed case studies of these two programmes, as well as Mars' cocoa program in Cote d'Ivoire.

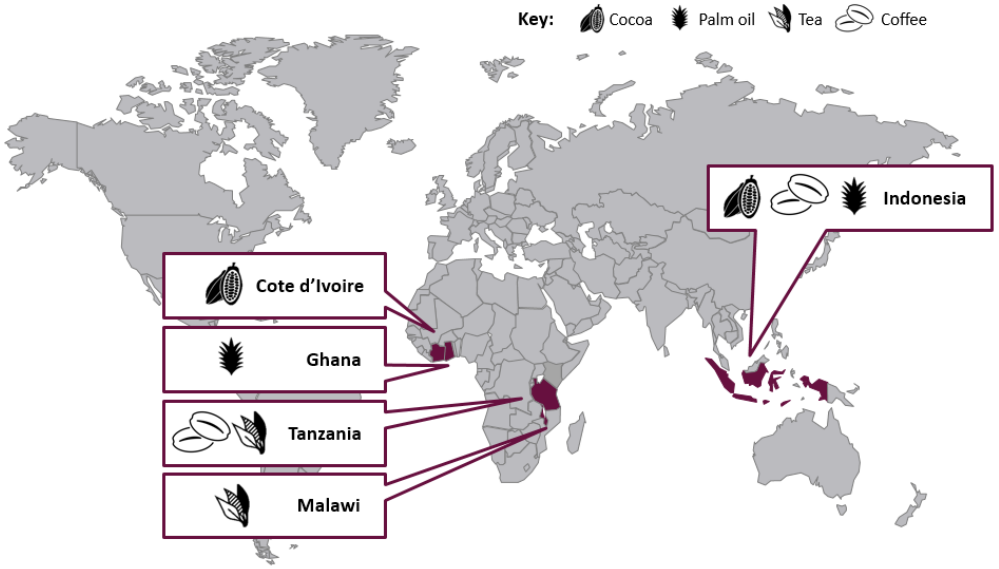
4. Crop and Country Level Dynamics in R&R

Tea, coffee, cocoa and palm oil have very different agronomic and economic factors that affect the need for R&R, as well as what needs to be supplied in terms of R&R services and financing for each commodity. Unique crop characteristics, including widely varying age-yield profile, propensity and incidence of disease, and maintenance or good agricultural practice protocols, combined with global market dynamics that affect volume of demand and price volatility means that what is needed to undertake R&R, what it costs and what it is worth varies substantially from crop to crop. Identifying and assessing these differences will be key to first understanding under what conditions an investment case for R&R exists and second, designing tailored, effective R&R programmes.

There are also an additional set of country-level dynamics that have a critical bearing on what is possible within R&R, which stakeholders can be involved and what the economics could look like. The role of governments in determining policy, and the level of government involvement in key areas such as the provision of subsidies or services to smallholder farmers can have an important shaping role on what R&R interventions are commercially, or even legally, possible; they can also have an important influence on the incentives for private sector actors to provide R&R services and finance. Differing histories regarding planting and the transition of plantation ownership to smallholders typically defines the ageing of the stock of trees or bushes owned by smallholders and the resulting underlying need for R&R. Other country-specific factors such as the structure of the industry, the history of farmer organisation, the topology of agricultural land and its underlying productive potential, and overall integration of different regions into national and international markets is also typically critical.

This section presents an overview of the fundamentals at the crop level, before outlining two country-specific situations for R&R for each of them. We have focused on the following countries:

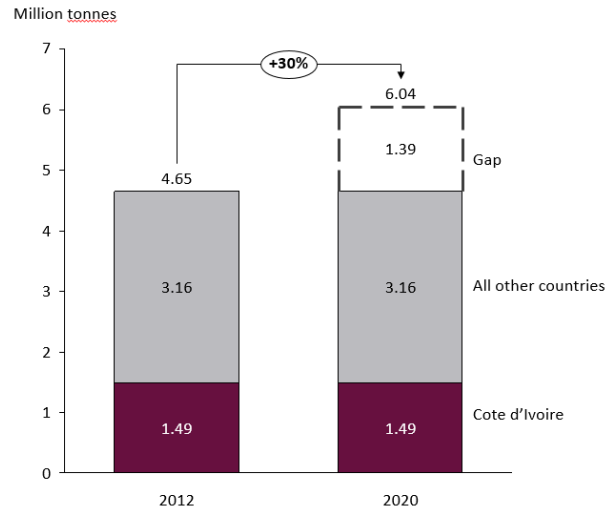
Figure 13: Country-crop case studies



4.1 Cocoa

Between 65-70% of global cocoa production comes from West Africa, and smallholders produce around 90% of total volumes across countries. Cocoa production is concentrated in West Africa, and in Ghana and Côte d'Ivoire in particular: combined these two countries are expected to account for nearly 60% of global production at year-end 2015. Smallholders are responsible for the majority of cocoa production, and larger estates make up less than 10% of production. [30]

Figure 14: Historical and Forecasted global demand



The future of cocoa supplies has been intensely debated over the past years, as some observers worry cocoa supply will not keep up with increasing demand. While the International Cocoa Organisation (ICCO) believes in a small cocoa supply deficit over the coming years - forecasted to reach 100,000 tonnes in 2020 - it is at odds with perspectives of major chocolate producers such as Mars, Nestle and Barry Callebaut that demand for cocoa will increase by 30% by 2020, bringing the supply deficit to around one million tonnes.[31] The main concern is that drought and disease, coupled with unsustainable farming practices and competition for arable land, will limit farmers' capacity to adapt to increasing demand. [32]

To increase yields on existing plantations, R&R programmes in cocoa should focus on pruning, replanting and grafting. Rehabilitation, including pruning, stumping and grafting of trees, allows for productivity improvements of plots where yields are low due to poor farm management or disease. Aeration of dense plots, by removing trees that are planted too close to each other, is another way of allowing existing trees to reach maximum capacity. Renovation of plots, via replanting or infilling under older trees, requires a larger up-front investment. Although infilling does not reduce productivity of the plot as replanting does, this practice increases the risk of transmitting disease from older to younger trees and is only an option where plots are sparsely planted. Replanting trees that have passed their peak productive years raises productivity in the long term, but must be combined with long-term finance to cover farmers' loss of income during the regrowth period.

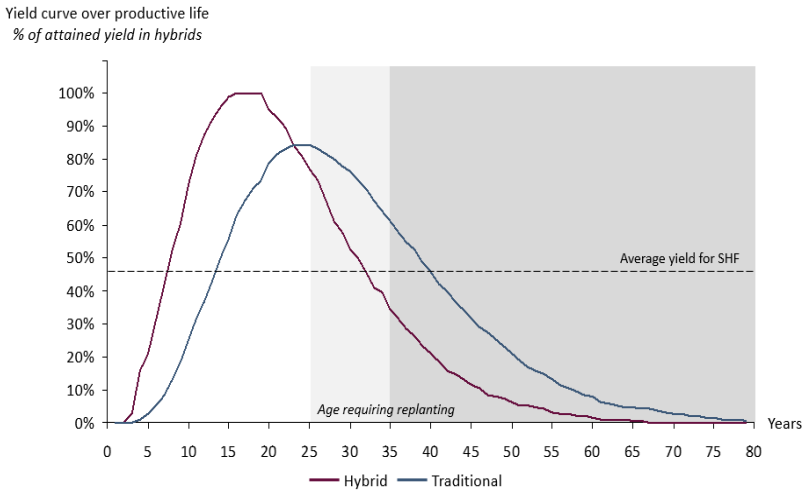
[30] Country ministries of agriculture and statistical offices; FAO; ICCO; Interviews; Dalberg analysis

[31] Dalberg interviews and estimate; Confectionery News (2015) "Dry West African weather to bring 56,000 MT cocoa deficit in 2015/16: Rabobank"; Confectionery News (2014) "Chocapocalypse 2020: Was the cocoa shortfall overblown?"; ICCO (Aug 2015) "Quarterly Bulletin of Cocoa Statistics"; Wall Street Journal (2012) "A Race to Satisfy World's Hunger for Chocolate"; The Guardian (2012) "The future of chocolate: why cocoa production is at risk"; Bloomberg (2013) "Ivory Coast Offers Cocoa for 2014-15 in a Futures Bull Market"

[32] FSG Impact (2009) "Managing Risk in Côte d'Ivoire's Cocoa Sector"; Rainforest Alliance (2014) "Sustainable Cocoa Investment Challenge"

Around 26% of land harvested by SHFs consists of old trees that need replanting. The ideal age for replanting varies according to the shade management, inputs and planting material as well as climatic conditions. As a general indication, shaded hybrid cocoa trees in demonstration plots should be replanted around 25 years and traditional tree varieties under traditional shaded farm systems should be replanted around 35 years. Assuming that trees older than 35 years benefit more from renovation than rehabilitation approximately 2.3 million hectares, or 26% of trees would need replanting across all smallholder farms.[33] Although yield uplifts depend on replanting conditions, varieties and farm management, previous programmes have shown that farmers can experience yield uplifts from 500 kg/ha to 1.45 tonne/ha, with adequate support. If all land needing renovation was replanted, this could generate an additional 2.2 million tonnes of cocoa per year globally during the peak productive years of the cocoa trees.[34] If that amount were to be added to global supply in a very short time period (or even just a small proportion of it) there may be a risk of oversupply. While the general consensus is that cocoa demand is rising, it is not straightforward to estimate how much additional supply could be absorbed over a given time period. However, given that only a proportion of this supply increase is likely to be feasibly realised over even the medium term, it is unlikely that R&R activities pose a proximate risk of a supply glut. However, this exposes a general practical challenge regarding cocoa R&R: there needs to be sufficient absorptive capacity for any increased production in the market (however defined) and if this cannot be assured, it may be dangerous to assume that future prices may remain the same or rise versus today.

Figure 15: Age-productivity curve for cocoa



Given the age distribution of trees, around 51% of SHF farms can benefit from rehabilitation. Trees that perform poorly due to poor farm management, lacking inputs or disease can reach significant yield uplifts from rehabilitation efforts. Disease is a particularly important driver of need for rehabilitation as it causes losses of 30-40% of production in West Africa each year.[35] Previous programmes have shown that smallholder farmer yields can be raised from 500 kg/ha to 1 tonne/ha with well-managed rehabilitation programmes, which could generate an additional 1.4 million tonnes of cocoa per year globally.[36] An identical set of caveats regarding the value of increased production from renovation applies also to

[33] In Cote d'Ivoire, Ghana and Indonesia, country-specific data indicated that trees not replanted in the past 25 years would require renovation. For all other countries, the age of 35 years was used. SHF land with aged trees was calculated by multiplying the total land harvested by the % of land with trees above the age limit and the % of land under SHF. Cocoa grown in direct sunlight may need replanting as early as 18 years.
[34] Based on interviews with cocoa seedling propagators, programme operators and industry experts
[35] Barry Callebaut (2014) "Cocoa Sustainability Report"
[36] Based on interviews with cocoa seedling propagators, programme operators and industry experts

rehabilitation: there needs to be absorptive capacity for any additional cocoa production, otherwise prices are likely to fall.

The potential of R&R to increase the production of existing plots substantially - in fact far beyond projected future demand - should be seen as an indication that meeting an increase in demand is possible without causing further deforestation or soil degradation. Implementing R&R furthermore has social benefits as healthy and productive plots provide sustainable incomes to farmers in a sector where the two main producer countries, Côte d'Ivoire and Ghana, have average cocoa farmer incomes of 0.5 USD per day and 0.84 USD per day, respectively.[37]

Implementing R&R in cocoa comes with several challenges, particularly the lack of farmer organisation and a challenging business case for R&R from the farmer perspective. Across cocoa, less than 10% of farmers are organised into farmer organisations. Lacking organisational infrastructure makes delivering finance or inputs difficult and time-consuming for implementers. On the demand side, the appeal of long-term, slow payback investments in cocoa is limited due to the low profitability of the crop compared to alternative livelihoods. This is reflected in younger generations' unwillingness to take over farms: the average age of farmers is currently 51 in West Africa[38] and 42 in Indonesia.[39] Farmers of this age will likely not reap the benefits of an investment in replanting during their working lives.

[37] Barometer Consortium (2015) "Cocoa Barometer 2015"
[38] Barry Callebaut (2015) "Challenges in Cocoa Farming"
[39] Cocoa Sustainability Partnership (2013) "The 2020 Roadmap to Sustainable Indonesian Cocoa"

4.1.1 Cocoa in Côte d'Ivoire

Key statistics	Potential additional production (export value)
Total production, million tonnes: 1.75 (forecast 2014-5) % of global production: 42%[40] (forecast, 2014-5) % of production by SHF: around 90%	Renovation (US$ million): 2,600 Rehabilitation (US$ million): 1,600

The need for R&R

- **The Ivorian cocoa sector has an acute need for R&R investments.**
  - The cocoa trees are old as the average age of the tree stock is 47 years old.
  - The last large cycle of cocoa planting was carried out in the 1970s, and at least 30% of all trees are of low-yielding varieties and above 25 years of age, and in need of replanting.
  - The need for R&R is also driven by widespread deforestation and loss of suitable land for cocoa planting due to poor soil management and expansion of crop cultivation.
- **Land needing renovation: 660,000 hectares**
  - Around 30% of SHF land under cocoa cultivation is estimated to require renovation due to old age or their low-performing variety.
- **Land needing rehabilitation: 1,150,000 hectares**
  - Based on the age distribution of the tree stock, current low yields and the disease picture, 51% of SHF land under cocoa cultivation is estimated to need rehabilitation efforts such as pruning or stumping.[41]

The policy environment

- **Cocoa is an important export crop in Côte d'Ivoire and the main government interlocutor in the sector is the specialised government body Le Conseil du Café-Cacao.**
  - Since 2012, the government has acted to provide a stronger economic logic for SHFs to maintain production by guaranteeing a minimum farmgate price that aims to reach 60% of export prices.
- **A 10 year cocoa sector strategy called 2QC (Quantity-Quality-Growth) has been implemented, aiming to improve farm management practices, combat disease, rejuvenate cocoa trees and enhance soil quality by 2023.**
  - A strict no-grafting policy was previously in place due to worries of spreading swollen shoot virus (CSSV) but since 2013 some pilot grafting projects have been allowed to proceed.
  - Grafting is included as a potential rehabilitation technique in the 2QC strategy.[42]

Selected Current R&R programmes

2010-2020	Mars Cocoa Sustainability Program	*Under implementation*
Target scale:	120 trained cocoa doctors by 2016.	
Current scale:	55 operational cocoa doctors.	
Details:	R&R material/training provided by cocoa doctors trained by Mars to become R&R service providers on an on-demand basis. Each doctor aims to reach around 100 SHFs.[43]	

[40] 2014-2015 forecasts project that Côte d'Ivoire will produce 1.75 million tonnes, and amount to 42% of global production. This is a significant increase from the latest confirmed numbers in 2013 of 1.45 million tonnes of production and 32% of the global production.
[41] Assiri et al, 2009, page. 65, http://agritrop.cirad.fr/555828/1/document_555828.pdf; FSG Impact (2009) "Managing Risk in Côte d'Ivoire's Cocoa Sector"
[42] Ecobank (2014) "The impact of reform on Côte d'Ivoire's cocoa grinding sector"; Le Conseil du Café-Cacao (2014) "Programme Quantite-Qualite-Croissance '2QC' 2014-2023 Resume"; Le Conseil du Café-Cacao et al. (2013) "La Régéneration du Verger Cacaoyer en Côte d'Ivoire"
[43] Dalberg interviews

2008-Present	Barry Callebaut - Biopartenaire	*Under implementation*
Target scale:	Reach 100,000 farmers.	
Current scale:	25,000 farmers reached.	
Details:	Creates a training distribution and cocoa sourcing network using a cooperative structure, where farmers elect village coordinators to work with Barry Callebut. Focus on rehabilitation to improve farmer income and yields.[44]	

Key challenges and potential solutions

Challenge	Potential solutions
Elevated farmer poverty and resulting poor soil quality due to lack of investment and inputs used. • 60% of farmers live below poverty line. • 30-40% of soils somewhat or very degraded.[45]	**Focus on soil rehabilitation in R&R programmes** • Incorporate a focus on improving soil quality to compensate for previous soil management. • Include training modules on broader soil and farm management, as well as key R&R techniques.
Lack of access to quality planting materials • Approval by government agencies of new planting material can take a long time. • Only 10% of planting material needed to cover Côte d'Ivoire's replanting need is available. • Although grafting is being allowed to some extent, the availability of budwood is limited and climatic constraints slow budwood multiplication.[46]	**Focus on stumping and pruning as a first step** • Currently 35% of cocoa trees are grown without shade and 44% of farmers do not use pesticides • This means significant yield uplifts are possible via rehabilitation and disease management. • Industry experts estimate that yields can increase between 30-100%, depending on the state of the plot, by improving the use of existing planting material.[47]
Low levels of farmer organisation and side-selling • Only around 20% of farmers belong to a structured farmer organisation and the largest cooperative structure represents 1% of farmers. • Value chain dominated by small-scale collectors with little tradition of farmer loyalty to traders and frequent side-selling.[48]	**R&R programmes should include farmer organisation** • Integrate a model of farmer organisation, e.g. via village-level representatives or service-provision companies that encourage farmer loyalty (see Mars/Barry Callebaut programmes) • Include rewards for loyalty, such as for example input price reductions.

[44] Dalberg interviews

[45] Assiri et al. (2009) "Les caractéristiques agronomiques des vergers de cacaoyer (Theobroma cacao L.) en Côte d'Ivoire"; FSG Impact (2009) "Managing Risk in Côte d'Ivoire's Cocoa Sector"; Ecookim (2015) "Presentation"; Barry Callebaut (2014) "Cocoa Sustainability Report"; Barry Callebaut (2014) "Annual Report 2013-14"

[46] Dalberg interviews with industry experts; Rob Lockwood (2012) "Improved Seed for West African Cocoa Farmers"

[47] Dalberg interviews with industry experts.

[48] Interviews with supply chain actors; Ecookim (2015) "Presentation"; World Agroforestry Centre "An Overview of Cocoa Production in Cote d'Ivoire and Ghana"

4.1.2 Cocoa in Indonesia

Key statistics	Potential additional production (export value)
Total production (million tonnes): 0.35 % of global production: 8% % of production by SHF: 95%	Renovation (US$ million): 840 Rehabilitation (US$ million): 1,560

The need for R&R

- **Significant need for R&R given the age distribution, low yields and disease incidence in Indonesian cocoa.**
  - Average age of cocoa trees is 17 years.
  - Production increased up until 2013 due to land expansion but with decreasing yields. Estimates for 2014 and forecasts for 2015 expect production to be in steep decline. R&R is necessary to improve yields and avoid deforestation of pristine rainforest areas.[49]
- **Land needing renovation: 170,000 hectares**
  - Around 10% of cocoa trees are more than 25 years old and in need of replanting due to low yields.[50]
- **Land needing rehabilitation: 860,000 hectares**
  - Around 51% of the trees have entered a phase of lower productivity and could benefit from rehabilitation efforts such as pruning, stumping and improved farm management techniques.[51]

The policy environment

- **Government-provided loans allow some farmers to access finance for inputs or R&R.**
  - Most cocoa farmers have no collateral and 50% do not have any type of savings.
  - One third of cocoa farmers can take out loans, typically used for agro-inputs but 11% use them for R&R
  - Loans come from three main sources: government-owned Bank Rakyat Indonesia (25% of loan recipients), commercial and local rural banks (24%) and value chain finance via crop collectors operating locally.
- **Government subsidies of inputs do not correspond to the requirements of cocoa farming.**
  - The government scheme in place to provide SHFs with widely accessible, heavily subsidised fertilisers provides fertiliser mixes that are not appropriate to cocoa farming.
  - To improve productivity via R&R, appropriate inputs are essential and can form a bottleneck to scaling.[52]
  - R&R providers may face challenges in convincing farmers to switch to an appropriate product unless it is provided at a competitive rate compared to the state-subsidised fertilisers.

Selected Current R&R programmes

2013-2020	Mars Cocoa Sustainability Program	*Under implementation*
Target scale:	50 additional cocoa doctors to be trained by end 2015.	
Current scale:	30 operational cocoa doctors.	
Details:	R&R material/training provided by cocoa doctors trained by Mars to become R&R service providers on an on-demand basis. Each doctor aims to reach around 100 SHFs.[53]	

[49] FAO STAT; Confectionery News (2015) "What is the Future for Cocoa Growing in Asia"
[50] Replanting needed due to old age and low yields resulting from the cocoa variety and management techniques. The 2020 Roadmap to Sustainable Indonesian Cocoa, 2013, page. 68: http://www.newforesight.com/wp-content/uploads/2014/06/CSP-Roadmap-Report_here2.pdf
[51] Confectionery News (2015) "What is the Future for Cocoa Growing in Asia"
[52] Cocoa Sustainability Partnership (2013) "The 2020 Roadmap to Sustainable Indonesian Cocoa & Agrimoney, 2013: http://www.agrimoney.com/news/indonesia-struggles-to-boost-coffee-cocoa-output--5900.html
[53] Dalberg interviews

2012-2017	Swisscontact, Sustainable Cocoa Production Program	*Under implementation*
Target scale:	Train 60,000 farmers in GAP to improve productivity.	
Current scale:	46,000 farmers trained. Average 61% yield uplift (from 422 kg/ha to 688 kg/ha)	
Details:	Collaboration with major supply chain actors to provide GAP training to farmers and extension service officers, to strengthen farmer organisation and to set up farmer-driven nurseries.[54]	
2009-2015	Gernas Pro Kakao	*Under implementation*
Target scale:	Distribute 70 million seedlings.	
Current scale:	125,000 ha rehabilitated according to govt. sources.	
Details:	R&R material/training provided by cocoa doctors trained by Mars to become R&R service providers on an on-demand basis. Each doctor aims to reach around 100 SHFs.[55]	

Key challenges and potential solutions

Challenge	Potential solutions
The appeal of alternative livelihoods • Due to low productivity, cocoa is currently financially unattractive compared to competing crops such as rubber and oil palm. • Successful cocoa farmers can earn nearly 30% higher annual profits than cocoa farmers. • Yields need to be increased from the current average of 400-450 kg/ha to 2MT/ha to provide an attractive alternative to alternative livelihoods.[56]	**R&R packages must support SHFs in the long term** • Farmers must be convinced that an investment in cocoa is likely to yield long-term benefits as compared to alternative livelihoods. • A realistic assessment of farmers' capacities and plot potential should be carried out to confirm that R&R is a sustainable alternative. • Off-taker contracts provided at the outset can help assure farmers that excess produce will be sold.
Most farmers operate in loose value chains • Lack of organisational infrastructure can complicate R&R input and service distribution. Currently, only 3% of farmers market crops via a farmer org. and 10% sell harvests directly to an exporting firm. • However, farmer loyalty to a single trader is relatively well established as 81% of farmers sell to a local trader and around half of these farmers use the same trader each harvest. Many local collectors furthermore provide services such as no-interest loans with repayments deducted from sales.[57]	**Engage local value chain actors in R&R project implementation** • Farmer organisations can be leveraged to reach out to smallholders and reduce cost and difficulty of extending inputs, planting material or services. • Local knowledge is furthermore key in successful farmer selection. • Selected cocoa collectors could be leveraged to identify interested farmer groups and provide insight into credit track record. • These may also be trained to provide R&R services.

[54] Swisscontact (2015) http://www.swisscontact.org/en/indonesia/projects/projects/p/Project/show/sustainable-cocoa-production-program-scpp.html

[55] Dalberg interviews

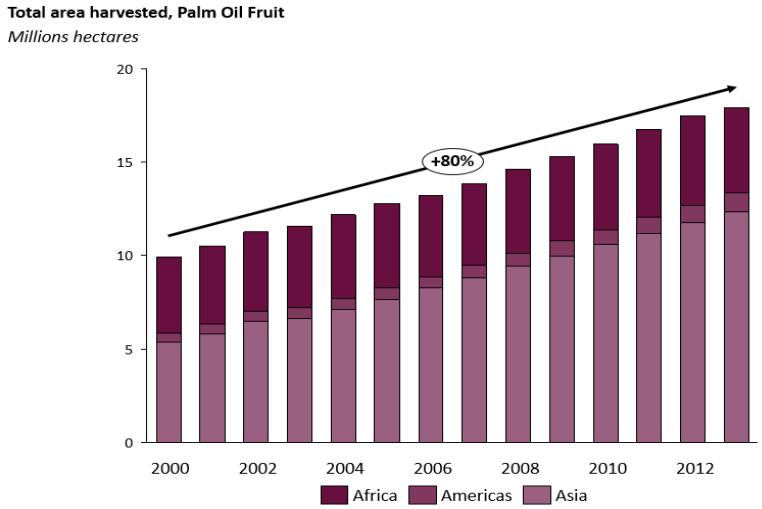
[56] Assuming a market price of USD 3,000 per tonne. Interview with Peter van Grinsven, Mars Incorporated & Indonesia investments: http://www.indonesia-investments.com/business/commodities/cocoa/item241; P.47-49, http://www.newforesight.com/wp-content/uploads/2014/06/CSP-Roadmap-Report_here2.pdf; Dalberg analysis

[57] Page 89, http://www.newforesight.com/wp-content/uploads/2014/06/CSP-Roadmap-Report_here2.pdf & USAID, pages 24-27, http://solutionscenter.nethope.org/assets/collaterals/Cocoa_Farmer_Market_Insights_Research_-_Final_Report.pdf

4.2 Palm Oil

Palm oil is the most consumed oil in the world and demand is expected to increase. Worldwide demand for palm oil is expected to grow by 20% by 2021, largely driven by its growing use in food products and, to a lesser extent, the general trend for use of vegetable oils as biofuel feedstock. In developed countries, per capita consumption of palm oil is expected to increase by 12% between 2012 and 2022. Palm oil production is concentrated in two countries: Indonesia and Malaysia. Together, they produce over 85% of global palm oil. On a global level, smallholder farmers produce around 30% of all palm oil.[58]

Figure 16: Global palm oil area harvested 2000-2013



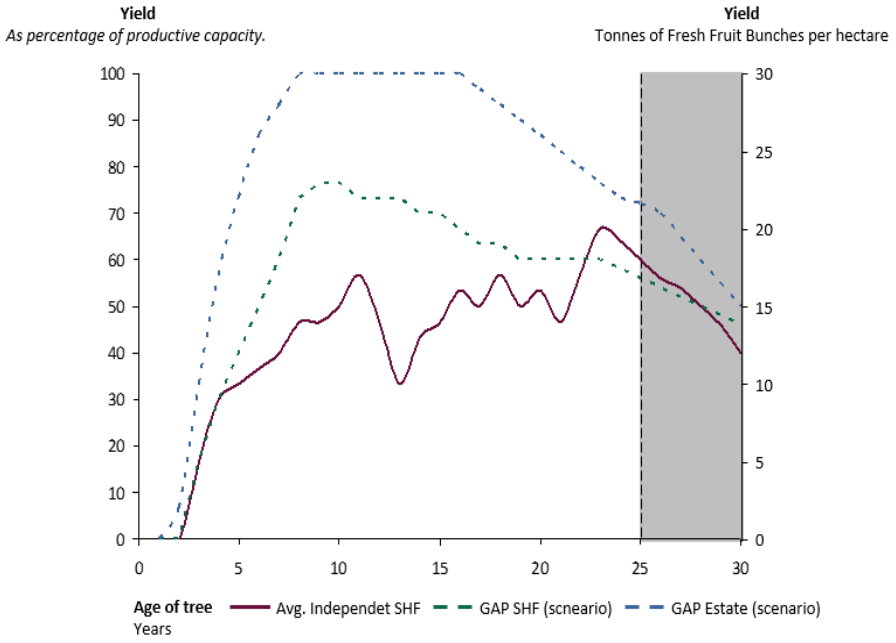
To meet demand without causing further deforestation, improving productivity through R&R will be key. Although palm oil is the most productive vegetable oil, and therefore well suited to meeting growing demand for food products, it has also been one of the leading drivers of deforestation globally over the past 20 years. The global area harvested of oil palms has increased by 80 % between 2000 and 2013. To meet demand in a sustainable way, existing plots need to be made more productive.[59]

R&R programmes in oil palm can increase smallholder farmer yields by 15-60% and allow them to approach or reach similar yields to commercial plantations. R&R need is driven mainly by the age of trees as, after the age of 25 years, trees typically get too tall for efficient harvesting and yields decline rapidly. Renovation programmes with good agricultural practices and high-performing varieties have produced yield increases of 50-60% in major producing countries, effectively reducing the yield gap between commercial and smallholder plots. Rehabilitation efforts such as better use of inputs, pruning or weeding are effective for plots that underperform despite having younger trees. Farmers stand the most to gain from rehabilitation during the trees' most productive years between 8 and 19 years of age when programmes have produced yield uplifts of 15-20%. A number of programmes have successfully created

[58] ACET 2013; OECD-FAO (2015) "Agricultural Outlook 2015"; World Bank 2015; FAOstat, 2013
[59] OECD-FAO (2012) "Agricultural Outlook 2012-2021"

R&R packages to provide SHFs with planting material, inputs and financial support. For example, Cargill's replanting programme in Indonesia has succeeded in making SHF achieve yields similar to, or even exceeding, estate yields.[60]

Figure 17: Palm oil age-productivity profiles



Around 25% of land planted with oil palms worldwide requires renovation. Assuming that all oil palms exceeding 25 years of age are too tall to harvest, around 1.4 million hectares of smallholder land is currently in need of renovation interventions. If all this land was replanted with high-performing varieties, and yield uplifts similar to those of previously implemented projects were achieved, an additional 11.6 million tonnes of fresh fruit bunches could be harvested each year during the peak productive years of the trees.[61]

Furthermore, an additional 50% of SHF plantations have low productivity and could benefit from rehabilitation. Independent smallholders, as compared to organised farmers, typically do not reach the full potential of their planting material or site due to limited access to inputs and extension services. Rehabilitation programmes in these underperforming farms have previously achieved yield uplifts of around 2 tonnes of FFB/ha/yr. At the global level, around half of SHF are estimated to operate independently. If all of their land was rehabilitated, and yield uplifts match previous programmes, this

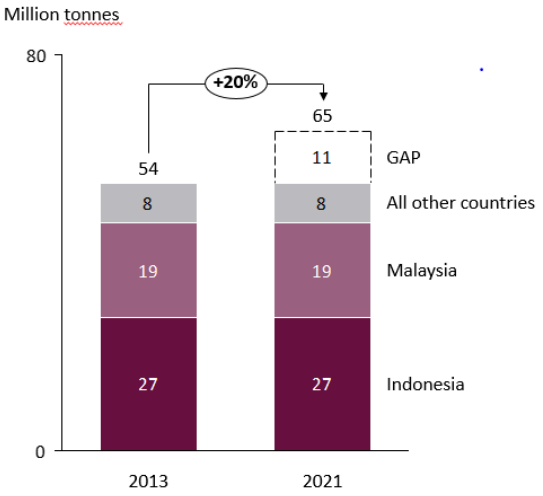
[60] http://theredddesk.org/countries/indonesia; Ling, 2012: "Weather effects on palm oil production: Supply outlook 2012/2013"; Dalberg interviews with crop experts; Yield profiles are adopted from: IFC, 2013 "Diagnostic study on Indonesian oil palm smallholders", p. 23. Assuming 100% yield potential is 30 tonnes/FBB/HA. Data derived from 1509 plots with an average of 2 ha distributed over 1069 smallholders. Independent smallholder curve reflects yearly volatilities in production caused by externalities and diverging farmer practices. The yield curve shown here is not the one that is used for the business case calculations in the Indonesian case study in the next section.

[61] Dalberg Analysis

could lead to an additional 3.7 million tonnes of fresh fruit bunches harvested per year until the trees grow too tall and need replanting.[62]

To be successful, R&R programmes need to overcome the high cost of renovating oil palm plots and the perceived risk of investment. Palm oil takes ~8 years to reach peak productivity and 48 months before first harvest. Intercropping with food or other cash crops could be a way of providing income to farmers during the gestation period, but the competition for light, water and nutrients means that the timing and crop selection needs to be done carefully.[63] Replanting furthermore involves shouldering the risk of losing money if seedlings are mistreated during planting or insufficiently cared for after planting as they may then grow poorly or die prematurely. The agronomical demands of renovation limit farmers' possibilities to take on wage employment during the first years after the intervention, as close management is required over this period. Compared to the economic case for clearing additional land, the reality of losing income for 3-4 years period is particularly challenging for farmers who are working in a high-value crop. R&R programmes need to present a sufficiently compelling business case to farmers, emphasising the long term benefits, to lower the appeal of land expansion. This may need to be done with grant-based support from governments or international organisations although private sector outgrower systems have also been implemented to cover farmers' incomes during the gestation period.

Figure 18: Projected demand in 2021



[62] Ibid.
[63] Natural Habitats (2015) "An Important Role of Intercropping in Modern Agriculture"

4.2.1 Palm Oil in Indonesia

Key statistics	Potential additional production (export value)
Total production (million tonnes CPO): 26.9 % of global production: 49% % of production by SHF: 35%	Renovation (US$ million): 3,700 Rehabilitation (US$ million): 4,200

The need for R&R

- **Indonesia is the world's biggest palm oil producer, housing a very large SHF population with sub-optimal yields**
  - Indonesia produces 49% of global palm oil production across 10 million hectares of land.
  - Approximately 1.5 million smallholders hold four million hectares of oil palm. Around half of these operate as independent farmers who typically have below average yields and could benefit from rehabilitation efforts.
- **Land needing renovation: 500,000 hectares**
  - Around 15% of trees need replanting across Sumatra and Kalimantan (Borneo), a total of 1.5 million hectares of oil palm. Conservative estimates suggest that a third of these are held by SHFs.
- **Land needing rehabilitation: 1.7 million hectares**
  - Around 43% of SHF trees could benefit from rehabilitation efforts such as pruning and GAPs.[64]

The policy environment

- **Strong government support for R&R programmes due to the importance of palm oil as an export crop (≈11% of total export earnings) and the need to slow the rate of deforestation and protect Indonesia's forests.[65]**
  - Environmental concerns are growing: the recently extended Forest Moratorium labels 43 million hectares of forest and peatlands as protected areas, restricting the possibility to expand land under cultivation. In these areas, R&R activities are essential to increase productivity.[66]
  - The government provides active support to R&R activities by channelling funds from an export levy on palm oil to renovation efforts via a new government body called the CPO Fund Agency. A levy of 50 USD per tonne of palm oil exports is to be used to improve productivity of existing plots.
  - Income support for palm oil farmers that undertake replanting is provided with government funds, although it is limited at 100,000 IDR (~7 USD) per/ha/month.[67]

Selected Current R&R programmes

1977-1993	Nucleus Estate (NES) programmes (I-VII)	*Completed*
Details:	Establish new palm/coconut SHF plantations with land part-owned by estates. Loans to renovate SHF plots provided by state with 2-3 year grace periods and 17-19 year repayment	

[64] IFC (2013) *"Diagnostic Study on the Indonesian Smallholders in the Oil Palm Sector",* Appendix II: http://www.rspo.org/file/Diagnostic_Study_on_Indonesian_Palm_Oil_Smallholders.pdf

[65] The Guardian, "Indonesian Palm oil destroys forest", 2013

[66] USDA, Foreign Agricultural Services, 2013: INDONESIA: Palm Oil Expansion Unaffected by Forest Moratorium; World Research Institute (2012) Indonesia's Moratorium on New Forest Concessions, http://www.wri.org/publication/indonesias-moratorium-new-forest-concessions; World Research Institute (2015) Extending Indonesia's Moratorium Is a Win for Business, http://www.wri.org/blog/2015/05/extending-indonesia%E2%80%99s-forest-moratorium-win-business; Dalberg interviews

[67] The levy is expected to generate USD 750 per year, and around 340 million in 2015, that will be used in the first stage to replant 2,000 hectares of oil palm. Indonesia-Investments (2015) "What you need to know about Indonesia's palm oil export levies"; Deal-Street Asia (2015) "Indonesia CPO Fund Agency starts operations, to help increase bio diesel production"

	periods. The program took longer than planned due to lacking farmer confidence in the long-term profitability of the investment. [68]	
2007-2018	PTPN13 (PERSERO) Revitalisasi Programme	*On hold*
Target scale:	Replant 15,000 ha at total cost of 75 million USD (5,000 USD/ha)	
Current scale:	Replanting rate below target	
Details:	Local credit facilities finance replanting at concessional rates for the 3.5 year gestation period. PERSERO acts as guarantor. Replanting rate has been very low and cooperatives have been unable to meet repayments.	
2014-Present	Cargill Replanting Program, South Sumatra	*Under implementation*
Target scale:	Reach 8,700 SHFs, or 17,500 ha at a total estimated cost of 91 million USD.	
Current scale:	*TBD*	
Details:	Cargill implements replanting by taking over SHF plots for 48 months during the gestation period and shoulders the cost of the intervention. Farmers then recover land and repay the investment via a deduction of 40% of proceeds from future harvests.	

Key challenges and potential solutions

Challenge	Potential solutions
Ensuring repayment capacity in renovation projects • Both the NES and the PTPNXIII programmes were implemented quickly and rapidly brought to scale. • However, both programmes have struggled with farmer capacity to repay. • It is still too early to tell whether this problem will also affect the Cargill Replanting Program. However, initial results are positive and the program has taken a different stance in choosing to work only with organised farmers.	**Risk management through gradual implementation** • Applying a gradual, long-term view allows for thorough selection of farmers and gradual disbursement of credit that may reduce default risk. Root Capital in Latin America • Programmes working with independent farmers have had greater difficulties in ensuring successful repayment rates than those engaging with cooperatives or farmer organisations, indicating that strengthening farmer organisation is key. **Applying (emerging) best practices from social lenders in R&R** • Social lenders such as Root Capital are pioneering approaches to leverage farmers organisations (such as producer cooperatives, private aggregators, exporters, savings and credit cooperatives) as a key conduit for R&R financing to smallholders: selection of high-performing or high-capability organisations that are able to manage on-lending, and continued investment in upskilling these organisations, are practices that could be applied to Palm Oil
Rehabilitation is more challenging than replanting, given that need is greatest among independent SHFs • Due to the difficulty in engaging independent SHFs, rehabilitation may prove more challenging than replanting.	**Strengthening farmer organisation, or finding other models to engage farmers, is key to success** • Inspiration can be drawn from other crops, such as cocoa R&R in Indonesia, in which supply chain actors have worked with unorganised farmers via

[68] World Bank "Nucleus Estate and Smallholder Projects in Indonesia", http://lnweb90.worldbank.org/oed/oeddoclib.nsf/DocUNIDViewForJavaSearch/95D104DD2107D21D852567F5005D8461?opendocument

• However, increased use of fertiliser, better farm management as well as weeding and pruning improves productivity at a lower cost to the farmer and at a faster pace than renovation.	on-demand R&R centres and service providers that create farmer selection and aggregation. • Organisations such as VECO have worked to strengthen farmer organisations in the cocoa sector.

4.2.2 Palm Oil in Ghana

Key statistics	Potential additional production (export value)
Total production (million tonnes): 0.12 % of global production: 0.22% % of production by SHF: 80%	Renovation (US$ million): 92 Rehabilitation (US$ million): 412

The need for R&R

- **Despite young trees, need for R&R is great in Ghana's oil palm given the yield gap between SHF and estates.**
  - Oil palm productivity is low at 4.2 tonnes of FFB/ha for SHF and 11.8 tonnes of FFB/ha for estates.
  - Most smallholders use the lower yielding Dura variety and could benefit from replanting with the higher yielding Tenara variety.
- **Land needing renovation: 24,700 hectares**
  - Most trees are young but around 8% of the SHF tree stock are 19-25 years and of the low-yielding variety.
- **Land needing rehabilitation: 285,000 hectares**
  - Around 92% of SHF land could provide higher yields if rehabilitation efforts such as fertiliser use, pruning and weeding were implemented. 69

The policy environment

- **The government has developed a national strategy for expansion of the palm oil sector.**
  - Ghana is currently a net importer of palm oil. Through the national strategy, the government hopes to increase production to 1.6 million tonnes between 2015 and 2025: a twelvefold increase from 2013.
  - There is a need to raise external funds to carry out the national strategy.
- **Despite the national strategy, SHFs voice complaints about lacking government support**
  - Insufficient extension services and financial support are major concerns as palm oil growers compare their situation to rubber and cocoa farmers who typically get more agronomical training. 70

Selected Current R&R programmes

2015-2025	Ghana Oil Palm Development Plan	*Planned*
Target scale:	Develop 50,000 ha, costing USD 50 million (USD 1,000/ha). Replant 110,000 ha, costing USD 342 million (USD 3,100/ha). Expected to reach 55,000 SHF.	
Current scale:	*Not yet implemented.*	
Details:	Plan seeks to gain external financing to establish new palm plantations and replant plots that are old or planted with low-yielding varieties.[71]	

[69] Fold and Whitfield, 2012, "Developing a palm oil sector, the experiences of Malaysia and Ghana compared"; "Masterplan Study on oil palm industry in Ghana", 2011
[70] "Masterplan Study on oil palm industry in Ghana", 2011
[71] "Masterplan Study on oil palm industry in Ghana", 2011

Key challenges and potential solutions

Challenge	Potential solutions
Appeal of alternative livelihoods • Oil palm has low profitability for SHF, given the low yields achieved, which also limits their capacity to invest in productivity improvement. • Both rubber and cocoa are more profitable crops than oil palm at present. [72]	**Spotlight on renovation, processing and GAPs** • To improve final yields, the SHF production system needs to incorporate three core solutions: • First, replacing old varieties with higher-yielding trees is key to improving yields. • Second, improved processing technologies are necessary to improve post-harvest yields. • Third, by adopting better agricultural practices and use of inputs smallholder farmers would be able to reach yields similar to the estates.
Lacking organisation and risk of side-selling • At present, there is little collective organisation and no strong industry association in the country that could help implement R&R programmes and reach out to farmers. • Implementing a Nucleus Estate model as a way of organising farmers, inspired by Indonesian R&R programmes, could prove difficult given current excess milling capacity – a key contributor to side-selling. [73]	**Uncouple investment from sourcing and reward loyalty** • The oil palm sector could draw inspiration from initiatives in West African cocoa where private sector companies such as Barry Callebaut have uncoupled the investment in improving productivity from increased sourcing. By providing an on-demand model, farmers pay for R&R services that allow incremental improvements in income or obtain loans from local financing institutions based on trust in the private sector initiative rather than their personal credit worthiness. They provide rewards to farmers who remain loyal but the model in itself reduces the importance of recuperating the investment through increased sourcing and limits investor exposure.

[72] Sustainable Palm Oil platform (2015) "Africa"
[73] Fold and Whitfield (2012) "Developing a palm oil sector, the experiences of Malaysia and Ghana compared"; Dalberg interviews

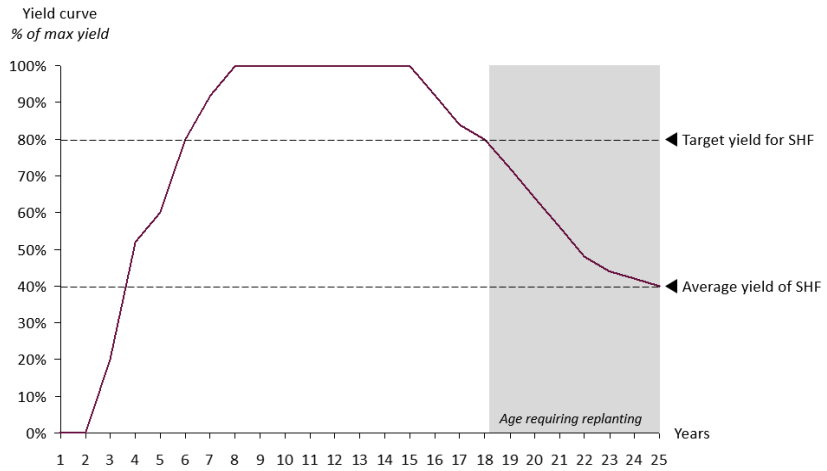
4.3 Coffee

Brazil and Vietnam produce almost half of the global coffee production, and smallholders dominate production across all producing countries (although to a lesser extend in Brazil). Brazil and Vietnam together account for 49% of total production and globally smallholder farmers produce around 70% of total production.[74] Around 60% of global production is made up of Arabica beans, which are most common in Latin America. Robusta dominates in Asia, while East Africa is more evenly divided between the two varieties.[75]

The market outlook for coffee is positive with demand set to increase. Although current production exceeds consumption by around 0.42 million tonnes, demand is growing steadily at 2.5 % per year and is predicted to continue to grow in the coming years, especially fuelled by the growing middle income generation in Asia. Some industry forecasts even predict that by 2020, increased demand will require an additional 1.8 - 2.4 million tonnes of coffee, representing more than a second Viet Nam in terms of production.[76]

To fill the supply gap without clearing land, raising SHF productivity will be essential since commercial farmers are already largely at maximum capacity. R&R packages in coffee include farm management improvements, rehabilitation of trees using pruning or stumping and renovation of plots via replanting or infilling. Although many factors affect yields, a well-managed SHF Robusta farm can reach 2 tonnes/ha with new planting material and 1.5 tonnes/ha with rehabilitated, older planting material. For Arabica farmers, the yields reached are lower at around 1.5 tonnes/ha with new planting material and 1 tonne/ha for rehabilitated plots. This can be compared with Arabica average yields of 0.5-0.6 tonnes/ha and Robusta averages of 1-1.4 tonnes/ha.[77]

Figure 19: Age-productivity curve for coffee (source?)



Around 34% of smallholder coffee trees have passed 20 years of age and would benefit from renovation. Although the yield curve of coffee depends on farm

[74] FAOSTAT; Country ministries of agriculture and statistical offices; University of Vermont; Dalberg interviews; Dalberg analysis

[75] Intracen (2009) "Coffee production by type, Arabica and Robusta", http://www.intracen.org/coffee-guide/world-coffee-trade/world-production-by-type-arabica-and-robusta/#sthash.e6pO5D7Z.dpuf

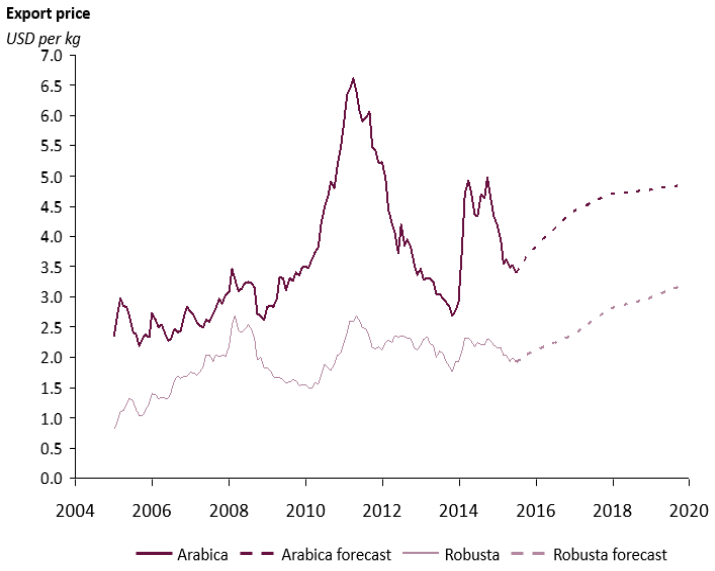
[76] Interview Michael Opitz & SCP IDH Indonesia & Hivos Foundation: https://hivos.org/sites/default/files/coffee_barometer_2014_report_1.pdf

[77] Robusta farmers in Viet Nam sustain yields around 2 tonnes/ha via timely replanting and good farm management practices. Arabica farmers in Brazil keep average yields around 1.4 tonne/ha. In most other producer countries smallholders achieve the significantly lower average yields reported here. Source: Dalberg interviews; National Ministries of Agriculture.

management, planting conditions and variety, coffee productivity typically starts declining once trees reach 15-20 years of age.[78] There is therefore a substantial opportunity to increase smallholder coffee production through renovation. Assuming that all plots with trees aged over 20 years could be replanted, a total uplift of 1.55 million tonnes (25.8 million bags) could be made per year during the high-productivity period of the coffee trees. This corresponds to more than the annual coffee production of Viet Nam in 2013, currently the world's second largest coffee producer.[79]

Renovation could also become necessary due to climate change. Since coffee has adapted to grow in specific climatic conditions, even a small temperature change can make it impossible to grow Arabica coffee. A recent CGIAR report highlights that effects of climate change can already be felt in Eastern African coffee production and that in Brazil, the world's largest producer, climate change adaptation via for example replanting with drought-resistant varieties will be crucial to maintaining production.[80]

Figure 20: Historic export prices and forecast, Arabica and Robusta



Around 17% of SHF plots have low yields and could benefit from rehabilitation. Rehabilitation is useful for younger trees that underperform due to lack of inputs, pruning or poor agricultural practices. About 1.4 million hectares of SHF land are estimated to underperform according to these criteria. If all this land was rehabilitated, this could produce an additional 400,000 tonnes (6.7 million bags) of coffee per year.[81]

Making the real – or perceived – business case for R&R compelling for a smallholder can be a challenge, given the historical price volatility of coffee and the appeal of alternatives. A high degree of historical price volatility, especially in Arabica, exposes farmers to considerable commodity risk.[82] During the period of reduced or zero production after undertaking R&R they risk being unable to capitalise on any upward spikes in prices, while in the longer term they can be uncertain about their ability to fulfil loan obligations unless long term price guarantees are provided. Against this background, alternative crops such as soy,

[78] Hivos Foundation, https://hivos.org/sites/default/files/coffee_barometer_2014_report_1.pdf. The yield curve is based on Robusta plantations in Viet Nam. Source: page 14: http://ageconsearch.umn.edu/bitstream/47638/2/Thang.pdf SHF land with aged trees was calculated by multiplying total land harvested by the % of land with trees older than 20 years and the % of land under SHF. The age limit of 20 years was used for all countries but Viet Nam where replanting is considered necessary at 15 years by national agencies.

[79] FAOStat; Dalberg Analysis; Dalberg interviews with crop experts

[80] CGIAR (2015) "Arabica coffee production at risk due to changing climate"

[81] SHF in Brazil and Viet Nam have relatively well performing plots compared to other countries and since these represent almost half of global production, the yield uplift from rehabilitation is relatively small. Source: Dalberg Analaysis; FAOStat

[82] % change between minimum price and maximum price between 2010-2014 Source: ICO, http://ico.org/new_historical.asp?section=Statistics

palm oil, rubber, tea and cocoa can provide alternative, and often more stable, sources of income in many countries.[83]

Past R&R programmes have often been motivated by sudden crises and focused mainly on rapid replantation. Over the past years, several outbreaks of disease such as Coffee Leaf Rust in Latin America or Coffee Wilt Disease in East Africa have forced public and private actors to undertake large-scale replanting programmes. To pre-empt crises, some programmes have focused on distributing disease- or pest-resistant seedlings but few programmes have integrated a broader set of R&R activities including training, monitoring and financing. It is now becoming apparent that without tight integration of a complex of R&R services over an extended duration, R&R programmes will typically have low success rates.[84]

[83] Dalberg Interviews, CSP report Indonesia; Index Mundi: http://www.indexmundi.com/commodities/?commodity=other-mild-arabicas-coffee&months=120&commodity=robusta-coffee; Forecast: http://gfs.eiu.com/Article.aspx?articleType=cf&articleId=1333465 97&secId=4

[84] Dalberg interviews

4.3.1 Coffee in Indonesia

Key statistics	Potential additional production (export value)
Total production (million tonnes): 0.70 % of global production: 8% % of production by SHF: 95%	Renovation (US$ million): 1,060 Rehabilitation (US$ million): 304

The need for R&R

- **Indonesian coffee production can be increased substantially through R&R.**
  - Average smallholder yields are 500-700kg per hectare, 60% of commercial growers in the country.
  - Average age of trees is older than 20 years.
  - Significant yield increases can be achieved in plots with younger-than-average trees if a productivity package focusing on stumping, pruning, inputs and GAPs was implemented.
- **Land needing renovation: 660,000 hectares**
  - Around 55% of trees have past 20 years of age and are at a point where replanting should be considered.
- **Land needing rehabilitation: 520,000 hectares**
  - Around 44% of SHF land could gain 60% yield increases from rehabilitation, using existing planting material.[85]

The policy environment

- **The largest obstacle for farmers from the policy environment is the lack of access to extension services.**
  - The Indonesian government has worked in the past to provide farmers with assistance for renovation.
  - However, lacking extension services limited the effects of the replanting schemes since farmers were not provided with the support they needed to successfully replant and keep seedlings alive.
  - Extension services also have limited capacity to provide training in pruning/stumping techniques.[86]

Selected Current R&R programmes

2010-2020	Nescafe Coffee Farmer Connect	*Under implementation*
Target scale:	220 million plantlets distributed across 14 countries by 2020.	
Current scale:	160 million plantlets distributed.	
Details:	Program aims to develop and distribute high quality seedlings and source coffee. Too early to comment on progress in Indonesia, but they have experienced high demand from farmers.	

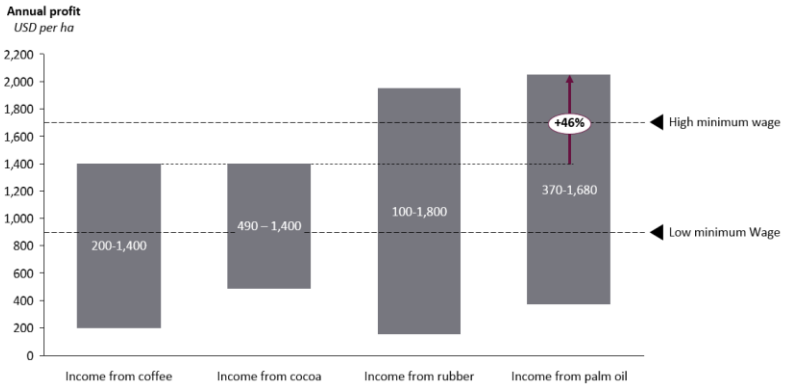
Key challenges and potential solutions

Challenge	Potential solutions
Access to finance among coffee farmers is limited. • Overall in the country, only 20 deposit accounts exists per 100 persons, and this number is significantly lower in rural areas.[87]	**Supply chain actors can support SHF in financing R&R.** • By providing guarantees via off-taker contracts or support in implementing R&R, supply chain actors can allow SHF to gain confidence of local financial

[85] SCP, 2014: *Indonesia - A business case for sustainable coffee production;* Dalberg interviews with crop experts
[86] Interview Imam Suharto, IDH; Interview Dr. Ranny Chaidirsyah, Ministry of Agriculture Indonesia; Interview Gregory Hess, Tree Global
[87] IFAD, 2015, page 2: http://www.ifad.org/operations/projects/regions/PI/factsheets/id.pdf

• 90% of farmers have no land titles to use as collateral.[88]	institutions, as seen in Indonesian cocoa. • Investments in R&R can also be repaid in deductions from harvests channelled to supply chain actors.
Low profitability of coffee has constrained farmers' capacity to invest. • Low yields and coffee prices have placed pressure on farmers' incomes, and coffee is currently relatively unattractive compared to other livelihoods. • Annual profit from rubber can be 30% higher than coffee production.[89]	**R&R financing will have to provide attractive income support during the establishment period** • Beyond providing a grace period on the loan, R&R financing for coffee farmers will have to include income support to bridge the low income period and establish coffee as an attractive livelihood. • Without support, coffee farmers who can invest in their plots may prefer switching crops.

Figure 21: Annual profit range per hectare of competing crops[90]



[88] IFC, 2013: http://www.ifc.org/wps/wcm/connect/443a6f00408d25feb13ab1cdd0ee9c33/EAP-Indonesia+Agri-finance.pdf?MOD=AJPERES
[89] New Foresight, 2013: http://www.newforesight.com/wp-content/uploads/2014/06/CSP-Roadmap-Report_here2.pdf
[90] Ibid.

4.3.2 Coffee in Tanzania

Key statistics	Potential additional production (export value)
Total production (million tonnes): 0.07 % of global production: 0.8% % of production by SHF: 95%	Renovation (US$ million): 337 Rehabilitation (US$ million): 49

Key challenges and potential solutions

- **The overwhelming majority of coffee trees in Tanzania are old and in need of R&R.**
  - Around 70% of coffee trees in Tanzania are estimated to be very old, the average age of trees varies by region but is on average around 34 years.
  - In many places, trees of 50 to 80 years can be found. Although old coffee trees can produce yields if they are well taken care of, these ages are significantly past the peak productive age of the plant.
  - The total area of land holding aged trees with low productivity is around 154,700 hectares.
  - The yields of coffee trees in the country are very low, on average reaching only 250 kg/ha for Arabica and 550 kg/ha for Robusta trees.[91]

The policy environment

- **The coffee board and specialised coffee research institute manages the sector and is funded via a 0.75% export levy on coffee.**
  - Currently, a main government-funded scheme is the provision of seedlings at a subsidised price of half the cost of production.
  - However, despite subsidies, many farmers perceive the risk of investment as too elevated given the current low prices and experienced global coffee price swings and demand for seedlings is limited.
- **Lacking extension services increase the risk of investing in R&R. In one assessment of staff needs for a sustainable land management project, the village and ward levels were found to be lacking 50-80% of the necessary extension service staff.[92]**
  - Mortality rate of seedlings planted without appropriate care is elevated.
  - Most farmers only have access to rudimentary extension services, which risks raising the total cost of investment as seedlings, especially the less sturdy Arabica seedlings, fail to grow properly without care. [93]

Selected Current R&R programmes

2012-Present	The Coffee Partnership of Tanzania	*Under implementation*
Target scale:	90,000 farmers reached with training in GAPs and farmer organisation.	
Current scale:	40,000 farmers reached.	
Details:	Program provides training in farmer group formation and GAPs but does not include an integrated R&R package with planting material and finance.	
2005-2021	**Tanzanian Government: Coffee Tree R&R**	***Under implementation***
Target scale:	TACRI to produce 20 million seedlings annually until 2021	

[91] Dalberg interviews (Werzgyk, Opitz, Ralph)
[92] Kessy (2014) "Analysis of Staffing and Training Needs for Effective Delivery of Extension Service in Sustainable Land Management in Kilimanjaro Region, Tanzania"
[93] Interviews with industry and crop experts.

Current scale:	60 million seedlings planted since 2005, according to government estimates.
Details:	Program aims to increase productivity of SHF and heighten farmer incomes by encouraging R&R and, especially, replanting via distribution of seedlings at half of production cost.

Key challenges and potential solutions

Challenge	Potential solutions
Perceived risk of investment & appeal of alternatives • Given high mortality rate of seedlings, lacking extension services and previous price volatility in global coffee prices, the perceived risk of investing in coffee is elevated. [94] • Other alternative livelihoods can be more stable and profitable: for example, successful rubber farmers earn almost 30% more in annual profit.[95]	**Targeting organised, intercropping farmers** • Wise farmer selection is key to engaging only farmers who are capable of undertaking long-term R&R efforts and shouldering debt. • 80% of farmers are involved in farmer groups, but not all of these are well-functioning: selecting the most proactive will be key. • Many coffee farmers in Tanzania live in poverty. To make an investment in R&R more attractive, programmes can integrate a complete livelihood picture to support both coffee and food crop production. This is also important to avoid misuse of inputs, e.g. farmers diverting coffee-specific fertiliser mixes to food crops.[96]
Need for fully-financed replanting • Given the very elevated age of the tree, R&R will in some areas be restricted to replanting or infilling. • The potential production uplift of old trees from rehabilitation will not be sufficient to pay for gradual replanting. • Replanting therefore requires significant financial support for farmers who are already at low income levels.	**Arabica: Investing in post-harvest processing** • Arabica farmers accessing central processing can produce coffee of higher quality and price. • Allowing farmers to first improve the quality of their product by providing more opportunities for central processing could, coupled with rehabilitation where effective, raise incomes that can be reinvested in replanting.
Market distortions in planting materials • Seedlings are currently being provided at around half the cost of production by the government.[97] • While this makes planting material available to farmers, the policy makes it difficult for the private sector to compete with higher-yielding or otherwise improved varieties that could make the business case for R&R more convincing. [98]	**Driving availability of key inputs and planting material** • Selective liberalisation of the inputs and planting material markets, to allow private sector players in, may support greater quality and availability of these critical components of R&R • Such activities need to be managed in tandem with governments' agendas to support smallholder farmer livelihoods and incomes, which typically drive at least part of the rationale for such policies of subsidy and control: there may therefore be a case for producers to offer their customers lower
Poor quality of inputs available. • Quality control was historically carried out by the apex organisation for each crop. After liberalising	

[94] Dalberg interviews with crop and industry experts.
[95] New Foresight, 2013: http://www.newforesight.com/wp-content/uploads/2014/06/CSP-Roadmap-Report_here2.pdf
[96] Dalberg interviews with crop, country and industry experts.
[97] Dalberg interviews with country specialists.
[98] Interviews with crop experts

the sector, control of inputs has been largely lacking. • The distribution of low-quality inputs affects farmers' trust in the products while acclimatising them to low price ranges.[99]	prices, and for governments to direct subsidies towards private sector players. Mechanisms such as performance based contracts or advance market commitments (purchasing a pre-agreed volume at a pre-agreed price, to provide producers with confidence that they can achieve a given price if they invest in supplying at a given scale) could be adopted.

[99] Dalberg interviews with Supply chain actors

4.4 Tea

China and India dominate global tea production, together producing nearly 60% of the world's tea. Almost all tea varieties come from the green leaves of the tea bush *Camellia sinensis* but are differentiated during processing. Of the two major tea varieties (black and green), black tea is the most common (representing around 60% of global production) and produced mainly by India, Kenya and Sri Lanka. China is the main producer and consumer of green tea.[100] At a global level, smallholder production contributes roughly 60-65% of global production.[101]

Demand is projected to increase over the next decade, and quality producers can benefit particularly. Over the next decade, demand for tea is expected to increase due to improved economic conditions in major consumers such as the US and the EU region, India and China.[102] Although global supply has been growing over the past years, this has been concentrated in green tea exports from China, which are predicted to continue to grow by around 5% per year over the next decade. However, increasing demand for speciality, herbal and high quality tea is also rising, leaving a role for scoping of new markets where SHFs could produce tea at similarly high quality levels as Sri Lanka and Kenya. This type of production requires labour intensive plucking techniques and performant processing.[103]

R&R can improve yields and quality of tea by focusing on infilling, replanting with higher-yielding varieties and good agricultural practices. Tea bushes typically require replanting after 50 years although, under proper management, they can produce for more than 100 years.[104] Although significant yield gains can be achieved where low-yielding varieties (seedling tea) can be replaced with higher-yielding varieties (clonal tea), the longevity of tea bushes means that farmers who cannot afford the up-front investment in renovation still have options for improving productivity through R&R. Where plantations are sparsely planted, infilling can be used to increase the density of bushes per hectare, a practice that can produce significant yield gains without negatively affecting farmers' income from existing bushes. Regular downpruning (or stumping) of tea bushes can also revive production over 25 years, although some bushes generally die in the process. Appropriate pruning and downpruning practices should also be implemented in plots that have already been replanted with clonal tea to maintaining high yields.[105] Additionally, plucking techniques are key to maintaining quality and should be integrated into R&R programmes. Improved use of fertilisers, good agricultural practices and weeding are also a key element in R&R intervention.

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[100] Tea Sector Overview, IDH, 2011; Two varieties are recognised; Camellia sinensis var. sinensis (Chinese tea) and Camellia sinensis var. assamica (Assam tea, Indian tea).

[101] FAOstat, 2015; FAO, 2012: "Contribution of smallholders to the tea sub-sector and policies required to enhance their livelihoods"

[102] The Economist Global Forecasting Unit (2014) https://gfs.eiu.com/Article.aspx?articleType=cfs&articleId=1801830564; Transparency Market Research (2014) "Tea Market - Global Industry Analysis, Trend, Size, Share and Forecast, 2014-2020"; Forum for the Future (2015) "The future of tea: A hero crop for 2030"

[103] http://www.mirror.co.uk/news/uk-news/soaring-demand-posh-tea-sees-4915656 & http://www.ijbssnet.com/journals/Vol_5_No_12_November_2014/13.pdf

[104] Dalberg interviews.

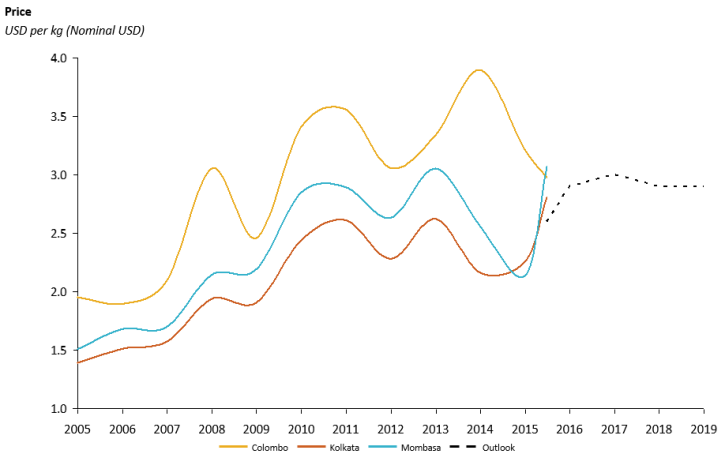
[105] Tea bushes should be pruned on a biannual basis and 'downpruned' (stumped) on a 25-30 year basis. Regular biannual pruning does not reduce income as harvesting can be initiated after 40 days. It takes around 1.5 years after downpruning for a bush to reach full production again.

Around 24% of all SHF tea plantations have bushes older than 50 years that should either be downpruned or replaced with higher-performing varieties. Almost a quarter of all tea plantations held by SHF (609,000 hectares) are low-yielding and hold bushes that need either rehabilitation or renovation. Although target yields vary according to climatic conditions, varieties and farm management, a well-adapted tea variety that is replanted should be able to produce around 2.2 tonnes of Made Black Tea/ha in most countries. Older plots, producing 1 tonne/ha or less, can also be rehabilitated via downpruning after which they can reach yields of around 1.5 tonnes/ha. However, some older bushes will die during the process.

Potential yield uplifts from R&R represent more than a second Kenya in terms of production. If all the land currently holding trees with low productivity was replaced by varieties that yield better and are easier to pluck, an additional 670,000 tonnes of Made Black Tea could be harvested per year in the peak productive years of the bushes. Significant yield uplifts are also possible from downpruning this same land, which, if carried out on all land where it is relevant, could provide an estimated additional 280,000 tonnes of tea harvested.

However, R&R programmes are challenged by price volatility and low profitability of tea for the farmers. There have been substantial differences in the prices paid at main auctions (Kolkata, Colombo and Mombasa) during the last decade. Prices can be affected by supply shocks such as droughts, which often impact production in East Africa. Smallholder farmers are vulnerable to price volatility since the majority of production costs are labour costs (55-73%). Additionally, the share of smallholders in commercial auction prices varies dramatically between countries, from 25% of the made tea price in Rwanda to 75% in Kenya.[106] Smallholder incomes could be improved by raising the productivity of plots but this is dependent on accessing finance for the up-front investment, and on demand and farmgate prices being kept sufficiently high to repay the investment.[107]

Figure 22: Historic prices and future outlook



Furthermore, R&R is complicated the lack of farmer organisations. With the exception of a few countries such as Kenya and Sri Lanka, farmer groups and collective organisation is very limited in the tea sector. Tea farmers either partner with estates or work independently. Although sustainability certification goes some way to organising farmers, and large actors such as Unilever have committed to source 100% certified tea, this segment still only accounts for around 15% of global tea production[108].

[106] The Gatsby Foundation (2011) "Rwandan Tea Sector"
[107] FAO report: "Contribution of smallholders to the tea sub-sector and policies required to enhance their livelihoods", 2012; Tea Sector Overview, IDH, 2011; World Bank Commodities, 2015; Economist Intelligence Unit, 2015 (Forecasted numbers)
[108] http://www.fairtrade.org.uk/en/farmers-and-workers/tea and http://www.rainforest-alliance.org/newsroom/press-releases/annual-growth-2011

4.4.1 Tea in Tanzania

Key statistics	Potential additional production (export value)
Total production (million tonnes): 0.03 % of global production: 0.6% % of production by SHF: 30%[109]	Renovation (US$ million): 17.8 Rehabilitation (US$ million): 8.9

The need for R&R

- **Yield performances in Tanzania are low, even for estates, and there is significant need for improving productivity through R&R.**
  - Total area planted with tea is 23,468 Ha, with smallholders accounting for 12,196 Ha and 30% of production.[110]
  - SHF farmers in Tanzania reach ~1,100 kg/ha on average, whereas estates reach ~2,100 kg/ha on average.
- **The main need is for infill planting and replanting with higher-yielding varieties**
  - Although ~10,000 hectares (45%) is aged 50 or above, this is not the main driver for R&R since these bushes can be rehabilitated to produce higher yields.
  - Instead, infilling where bushes have died and replanting with higher-yielding varieties drives need.
  - 25% of SHF land could use infilling but this should only be pursued where soil and climatic conditions are favourable to tea plantations. In some former tea areas, other crops are better adapted to local conditions.
  - More than 65% of land under tea is planted with low-productivity seedling tea.
- **There is also a strong need for rehabilitation and improved GAP**
  - More than half of tea farms are poorly managed and in need of GAPs and rehabilitation efforts such as pruning and stumping to produce higher yields.[111]
  - Better plucking techniques and post-harvest processing can also serve to increase incomes by increasing the quality of the produce
- **In some cases, replanting with alternative crops should be considered.**
  - Most smallholder tea plantations were established after government encouragement of smallholder production of tea in the mid-1960s.
  - These plantations are not always located in areas that are suitable for tea production.
  - Instead of renovating these plots with tea, it can be preferable to replant the plots with alternative crops.[112]

The policy environment

- **Tea is the 4th largest export crop in the country**
- **Smallholders have difficulties profiting from government subsidies for the tea sector.**
  - Subsidies worth 2 billion TZS (~1 million USD) have been distributed to encourage the production of clonal planting material.[113]
  - However, this does not come close to filling the need for replanting in the country.
  - Fertiliser subsidies are also available but Tanzanian SHFs are typically unable to make use of them given that the vast majority live on less than a dollar a day.

[109] Gatsby Foundation (2015) "Tanzanian Tea Sector"
[110] Source: TSHTDA (Tanzania Smallholder Tea Development Agency) Strategic Plan 2013/2014-2017/2018
[111] Tea Board of Tanzania; Dalberg Interviews
[112] John Baffes (2004) "Tanzania Tea Sector: Constraints and Challenges"; Dalberg interviews
[113] http://teaboardtz.org/mfeb2013.pdf

Selected Current R&R programmes

2009-Present	Wood Foundation, Chai Programme	*Under implementation*
Target scale:	Doubling smallholder tea production in Tanzania, total 30,000 farmers.	
Current scale:	14% increase in SHF production, 74% increase in revenue per hectare.	
Details:	Part-funded by DfiD, the USD 17 million programme aims to improve the market-based pricing mechanism of the Tea Board, improve payment processes with electronic weighing scales and mobile payments, and improve yields via extension services and increased mechanisation.	

Key challenges and potential solutions

Challenge	Potential solutions
Low profitability of tea compared to higher paying horticultural crops. • Low price of green tea leaves due to their poor quality and high cost of inputs has led some farmers to abandon their tea farms. • There is currently little incentive to invest in R&R as cost of production often exceeds income.[114] • For farmers with capacity to invest in their plots, horticultural crops can provide a financially more attractive option.[115]	**Couple capital injections with training, follow-up and quality control.** • Farmers cannot, given the current profitability of tea, finance R&R investments with own funds so a grace period coupled with income support is the minimum required financial package. • To reduce dependency of R&R interventions on reaching yield targets, it is key to focus on improving quality of production, both as regards plucking techniques and processing. • A model that has worked in other countries in the region has been to provide SHFs with ownership stakes in processing factories to incentivise improvements in plucking techniques and raise incomes, as shown by the Unilever/Clinton Guestra Enterprise partnership.
Poor collective organisation • Tanzanian SHFs are a independent and dispersed across big areas. • This means that communal collection of tea leaves is largely lacking. • Transporting leaves to collection sites can decrease incomes as quality deteriorates during transport.[116]	**Improving organisational infrastructure** • Organisations such as Neumann Stiftung have adopted a long-term approach in building advanced farmer organisations. However, with Tanzania's background of collective organisation during communism, it may be easier to engage farmers via the supply chain – for example through the type of on-demand services provided by Mars in cocoa and Nestle in coffee. These systems would allow farmers to opt in and out at their convenience rather than belonging to a more structured organisation. • Given the currently low income levels of Tanzanian tea farmers, adopting an on-demand system would be dependent on providing some form of financing for the up-front investment.

[114] Dalberg interview
[115] Tea Board of Tanzania and Tanzania Small Holder Tea Development Agency, 2009
[116] Dalberg interview

4.4.2 Tea in Malawi

Key statistics	Potential additional production (export value)
Total production (million tonnes): 0.05 % of global production: 1% % of production by SHF: 10%	Renovation (US$ million): 6.6 (SHF level) Rehabilitation (US$ million): 2.8 (SHF level)*

*** There is a significantly larger opportunity at the estate level.**

The need for R&R

- **The need for R&R in Malawi is substantial**
  - The average age of tea bushes in smallholder plots is around 50 years.
  - Smallholders achieve 40-60% of estate yields. On average, smallholders produce 1-1.5 tonne/ha whereas estates produce around 2-2.5 tonne/ha[117]
  - Industry estimates indicate that 3,400 hectares of larger tea plantations also require renovation to replace low-yielding varieties with higher-performing clones. Replantation is estimated to cost around 8,900 USD per hectare, bringing the total cost of renovation for estates to 31 USD million. Additional necessary improvements to estates, such as irrigation and processing infrastructure, brings the total cost for a revitalisation of the tea sector in Malawi to around 50 USD million.[118]
- **The majority of tree bushes are of low-yielding varieties.**
  - The majority of old trees are lower-yielding seedling teas.
  - In 2000, only 40% of tea planted was of clonal or polyclonal varieties.[119]
- **Infilling of smallholder plots alone could increase yields by up to 30%.**
  - Average bush density for smallholders is around 6-8,000 plants/ha, while it is 15,000/ha for recently planted estate plots.[120]

The policy environment

- **Government intervention in the sector has been limited.**
  - The Malawi government has set minimum wages for plantation workers in the tea sector.
  - However, unlike other Malawi cash crops like tobacco and cotton, there are no subsidies on inputs – making the cost of production for tea elevated for smallholders in the country.
  - Tea is the second export crop after tobacco and the government is currently reviewing its policies on Special Crops, including tea.[121]
- **SHF are dependent on support provided by private estates**
  - Tea estates account for 90% of production and 90% of SHFs produce for one of the estates.
  - Inputs or extension services come mainly from estates and certification schemes.
  - Estates use a common, transparent pricing system with set monthly prices and bi-annual bonuses.
  - Estates furthermore provide inputs via interest-free loans that are repaid via deductions from SHF pay. This can be compared with commercial interest rates of up to 40%.[122]

[117] Dalberg Interviews; USAID, 2006; Kadele Consultants & Imani Development, 2002
[118] IDH (2015) Malawi 2020 Revitalisation Program
[119] Nixon, 2001
[120] Note: USAID, 2006, estimates that 50% of land under tea could use infilling. Ethical Tea Partnership, 2013; FAO http://www.fao.org/3/a-i4537e.pdf
[121] CARER (2008) "Malawi Tea Research Project"; Oxfam (2013) "Understanding Wage Issues in the Tea Industry"; Dalberg interviews
[122] Dalberg interviews; FAO http://www.fao.org/3/a-i4537e.pdf

Current R&R programmes

2015-Present	Malawi 2020 Tea Revitalisation Programme	*Start-up phase*
Target scale:	Enable tea plantation workers to earn a living wage by 2020.	
Current scale:	Start-up phase.	
Details:	In collaboration with 19 supply chain actors, IDH is working to improve quality of Malawi's tea in order to increase prices to farmers. This requires a renovation of 3,400 hectares of tea estate plantation, at a total cost of USD 50 million. This will be coupled with investments to improve plucking techniques and processing facilities.[123]	

Key challenges and potential solutions

Challenge	Potential solutions
Low profitability of tea in Malawi and high cost of R&R • Recent tea price decreases, coupled with the very poor quality of Malawi give tea farmers low capacity to invest in their land. • The high price of seeds and fertiliser furthermore reduce farmers' appetite for R&R investments.	**Making use of value chain finance** • External financiers can leverage existing industry structures to invest in R&R. • Currently, estates only fund smaller productivity investments without taking on longer term projects. • Estates have a successful track record of extending loans to SHFs, with repayment rates up to 96%. • Co-investing through estates builds a simple financial structure that does require the participation of a large number of local actors.[124]
Changing weather patterns are a major threat • Average annual rainfall in Mulanje district, the main tea-growing region, has fallen by a quarter from 2,000 mm in 1960 to 1,500 in 2012.[125] • Production decreased by 35 % in 2014 because of droughts that also threaten to kill older bushes.	**Couple financial expertise with R&D institutions** • R&R programmes will need to work closely with research institutions to select the best clones, from both a quality and drought-resistance perspective. • 39 cultivars have currently been released with improved drought-resistance. • In Kenya, tea bushes have also successfully been grafted to improve drought-resistance, which could provide a cheaper method than replanting.[126]

[123] IDH (2015) Malawi 2020 Revitalisation Program
[124] USAID, 2006
[125] Ethical Tea Partnership, 2013
[126] SciDevNet http://www.scidev.net/global/indigenous/news/drought-resistant-tea-highlighted-in-natural-product-research.html; Tuwei et al. (2008) "*Effects of grafting on tea, 2: drought tolerance",* Experimental Agriculture

5. ANNEX

5.1 External interviews

Supply chain actors		
Name	**Position**	**Organisation**
Eric Poncon	Country Director Costa Rica	Ecom coffee
Fátima Ismael	Director	SOPPEXCCA
Gregory Hess	CEO	Tree Global
James Craske	Country Manager Kenya/Uganda	Yara
Kumar Venkateswaran	Business Unit Controller	Cargill Tropical Palm Holdings
Meret Brotbek	Sustainable Sourcing Manager	Unilever
Michael Schlup	Partnerships Coordinator	Barry Callebaut
Peter Sprang	Regional Representative	VECO Indonesia
Peter van Grinsven	Cocoa Sustainability Director	Mars cocoa
Ralph Medoch	Part owner	Blue Mountain Coffee Farms Ltd
Simon Hindley	Procurement Director	Unilever Tea
Stefan Canz	Global Manager: Coffee Farmer Connect Programme	Nestle
Financial Institutions		
Name	**Position**	**Organisation**
Angela Records	International Agricultural Research Advisor	USAID
Anton Timpers	Senior Investment Officer	FMO
Brian Milder	Senior Vice President	Root Capital
Bruce Wise	Sustainable Business Advisory	IFC
Curt Reintsma	International Development Executive	USAID

Emilie Ottervanger	Senior Associate Agri Commodities	ABN-Amro
Guillaume Bouculat	Financial Director	Livelihoods Venture (Mars/Danone Livelihood Fund)
Hildebrand Shayo	Financial and Economic Analyst	Tanzania Investment Bank
Ian Lachmund	Vice President Special Programmes	DEG
Jim Henderson	Agri-finance Consultant	AgDevCo
Koert Jansen	Managing Director	Fair and Sustainable/Incluvest.
Liesbeth Kamphuis	Associate Director Impact Banking	ABN-Amro
Mark Sieffert	Alliance Development Specialist	USAID

Crop and sector specialists

Name	Position	Organisation
Carl Cervone	Director Strategic Initiatives	Technoserve
Elies Fongers	Senior Project Manager	Rabo International Advisory Services
Etienne Desmarais	President	Ecotierra
Hans Perk	Manager Business Development	Solidaridad
Helene Roy	Senior Associate Sustainable Finance Initiative	RainForest Alliance
Julian Wassenaar	Member of Strategic Initiatives	Technoserve
Michael Opitz	Chairman of Executive Board	Hanns R. Neumann Stiftung
Michelle Buckles	Director of Sustainable Finance	RainForest Alliance
Michiel Kuit	Owner	Kuit Consultancy
Richard Fairburn	Independent Agribusiness Consultant	Sustainable Agribusiness International

Government actor

Name	Position	Organisation
Dr. Emmanuel Simbua	Research Director	Tea Research Institute of Tanzania

Eng. Mathias Assenga	Director General	Tea Board of Tanzania
Dr. Ranny Chaidirsyah	FEATI project technical officer coordinator	Ministry of Agriculture, Extension Division

5.2 Overview of R&R programmes assessed in this study

R&R Archetype		Crop	Name of Programme Time Period	Execution Partner	Lender	Current/Target Scale	Status	Country
Social Lenders		Coffee	Coffee Farmer Resilience Initiative: 2012→	Local Coop (SOPPEXCCA) (Nicaragua)	Root capital, IDB, Skoll Foundation	Target: $10 million; 40,000 SHF	◑	Latin America
Supply Chain	Integrated	Palm oil	Cargill replanting 2014	Cargill & local coops.	Cargill & local banks,	Current: 8,700 SHF, 17,500 hectares	◑	Indonesia, Sumatra
	External R&R provider	Tea	Unilever Tea 2015 →	For-profit Service company	Unilever	Target: 1,000 SHF, 3,000 hectares, $7-8 million.	○	Tanzania Rwanda
		Cocoa	Biopartenaire: 2014-2019	Village coordinators	Barry Callebaut	Current: 25,000 SHF / Target: 100,000 Aim for commercialisation by 2019	◔	Cote d'Ivoire
		Cocoa	Mars Cocoa Sustainability Programme: 2010-2016	'Cocoa doctors' that train SHF	Mars	Current: ~8,500 SHF Target: ~12,000 SHF	◑	Indonesia, Cote d'Ivoire
		Coffee	Nestle Coffee Farmer Connect: 2010- 2020	Local nurseries, factories, agronomists	Nestle	Target: ~213 million investments and 220 million plantlets by 2020.	◑	Global
Partnership		Palm oil	PTPN13 Revitalisasi: 2007-2014	Local coops.	PTPN13: guarantor Local banks: lenders	Current: $ 75 million, 151,000 hectares (programme on hold ATM)	●	Indonesia
		Cocoa	CocoaAction Partnership 2014-2020	TBD	TBD	Target: 200,000 SHF in 2020	○	Cote d'Ivoire & Ghana
		Tea	CHAI – Tea for development: 2009-2015	Local associations	Wood & Gatsby Foundation	Target: $9 million, 30,000 SHF	◔	Tanzania
		Coffee	IFC, ECOM, Starbucks, IDB partnership	Exportadora Atlantic, subsidiary of ECOM	IFC, IDB, ECOM	$30 million	◔	Nicaragua
		Coffee	IHCAFE, Banco Continental,. and Banco Hondureño del Café	CrediCafe, agency providing loans to farmers	Banco Continental and BANHCAFE	$45 million	◑	Honduras
		Coffee	Coffee Partnerships of Tanzania, DEG, 2012-	Farmer organisations	Private sector, Bill & Melinda Gates Foundat.	Current scale: 40,000 farmers trained. Part-funding amounts to $8 million.	◑	Tanzania
		Coffee	Swisscontact Sustainable Cocoa Program, 2012-2017	Supply chain actors, farmer organisations	Private sector	Current: 46,000 farmers trained Target: 60,000 farmers trained	◑	Indonesia
		Tea	Malawi 2020 Tea Revitalization Programme, IDH (2015-2020)	Tea estate plantations	Private sector, foundations	Target scale: renovate 3,400 ha at a cost of $31 million.	◔	Malawi
Government		Coffee	National replanting program 2009-2013	Federacion de Cafeteros (FNC)	Government, USAID	Current: 300,000 ha has been replanted, subsidy of $520,000	●	Colombia
		Coffee	Government replanting programme, since 2005	Tanzanian Coffee Research Institute	Government of Tanzania	Current: 60 million seedlings planted.	◑	Tanzania
		Tea	Indian Tea Board 12th Scheme: 2016-2017	SHF, local coops.	Indian Tea Board	Target: 40,000 hectares	◑	India
		Cocoa	La Gran Minga del Cacao Nacional	Local NGOs	Ministry of Agriculture, Ecuador	Current: ~50,000 ha pruned trees Target: Additional 100,000 ha by 2016	◑	Ecuador
		Cocoa	Gernas Kakao	SHF, national extension services	Government of Indonesia	$109 million. Replanted 70,000 ha. Rehabilitated145,000 ha.	●	Indonesia
		Palm oil	Nucleus Estate (NES) Programme 1977-1993	SHF, State-owned companies	Government of Indonesia	$1.3 billion.	●	Indonesia
		Palm oil	Ghana Palm Oil Development Plan (2015-2025)	SHFs	Government of Ghana, external finance	Target: Replant 110,000 ha. Rehabilitate 50,000 ha.	○	Ghana

Key: Cocoa, Palm oil, Tea, Coffee ○ Pilot ◔ Start-up ◑ Under Implementation ● Implemented

5.3 Descriptions of selected R&R programmes[127]

5.3.1 Cocoa

R&R Case Study: Cocoa Action Partnership (Côte d'Ivoire & Ghana)	
Status	Start-up phase
Programme overview	Cocoa Action (started in 2014) aims to sustain the cocoa industry and improve the livelihoods of cocoa farmers by training and delivering improved planting material and fertiliser to 300,000 cocoa farmers by 2020. The project brings together 11 major industry actors including ADM, Barry Callebaut, Cargill, Mars, Nestle, Mondelez and Olam.
Key successes	The partnership has brought together industry actors for an unprecedented collaboration and has engaged with the major government actors in both countries on several occasions over the past year.
Key challenges	Key coordination challenges remain as the diverse set of actors work to align interests. The implementation of R&R activities has not yet started to take place.

R&R Case Study: Biopartenaire, Barry Callebaut	
Status	Under implementation
Programme overview	Biopartenaire functions as a cooperative model in Côte d'Ivoire via which Barry Callebaut can source cocoa directly from farmers. Although most other companies source cocoa via cooperatives, connecting directly with cocoa farmers means that Barry Callebaut can access the 80% of farmers who are not currently organised in Côte d'Ivoire. Integrating the entire value chain also means that Barry Callebaut has increased control over implementation of sustainability actions and sourcing. The programme works via a network of village coordinators who source cocoa in a certain catchment area and are paid by commission. These coordinators can also call on Barry Callebaut when a farmer wants services such as pruning that can be provided by the company.
Key successes	As of 2014, Biopartenaire had reached 25,000 farmers.
Key challenges	The key bottleneck to reaching the goal of 100,000 farmers lies in finding the right talent – from the management to the technical assistance level.

[127] Unless otherwise notes, the descriptions of selected R&R programmes are based on interviews with close knowledge of the programme as well as any publicly available programme website.

R&R Case Study: Mars Cocoa Sustainability Programme	
Status	Under implementation, reaching scale
Programme overview	The programme was implemented in 2013 in Indonesia and in 2010 in West Africa to improve cocoa farmers' productivity. The programme focuses on two areas: Providing an R&R package including inputs, planting material and high-quality agronomical training Setting up a business-driven provision of extension services using local 'cocoa doctors' who are trained to provide farmer training, sell inputs and planting material. Mars invests in the programme on a commercial basis, with the view of improving productivity, creating farmer loyalty and eventually sourcing a steady supply of cocoa from farmers. The cocoa doctors invest in a start-up package from Mars that allows them to set up their business activity. The farmers typically need to access finance that will bridge their low-income period during R&R and provide them with resources to invest in inputs and planting material. A typical loan in Indonesia or Côte d'Ivoire for replantation, training and inputs is around USD 5,000.
Key successes	The programme has 30 cocoa doctors in Indonesia and another 55 in Côte d'Ivoire (25 of which are provided by other industry actors). The aim is to extend the amount of active cocoa doctors to 120 by 2016. The programme provides an innovative risk-management approach for financial institutions lending to smallholder farmers as the loan is provided on a gradual basis with a team of agronomists that can step in if farmers are underperforming and in risk of not repaying their loans.
Key challenges	The access to inputs and planting material can be a key bottleneck to the programme as national regulations can prevent the selection and distribution of high-performing hybrids.

R&R Case Study: Gernas Kakao	
Status	Implemented
Programme overview	This government-led programme was launched following an extensive infestation of farms with cocoa pod borer. The aim was to improve the productivity of Indonesian cocoa via rehabilitation and intensification. Part of the programme emphasised the replantation of plots with higher-productivity hybrids to replace the currently low-yielding trees. The budget set up for the programme was USD 109 million to replant 70,000 ha of old and unproductive trees with 70 million seedlings (1000 trees/ha) and to rehabilitate 235,000 ha via side-grafting, to intensify production on 145,000 ha via improved cultivation skills and to train 450,000 farmers in improved pest control.

Key successes	The programme showed an understanding among the Indonesian government about the necessity to invest in the cocoa sector and provided an ambitious outline that fell short of its targets due to some implementation issues.
Key challenges	Despite government expenditure of USD 100-150 per farmer, cocoa pod borer is still causing significant losses. One of the main difficulties in the programme was that farmers lacked knowledge about how to successfully side-graft and plant improved varieties. The project provided plant materials and inputs but without the necessary knowledge and technical assistance needed to make grafts and plants survive. This example highlights the importance of training and follow-up with the farmers. Although the project had aimed to provide 1 extension worker per 500 farmers, the reality was closer to 1 extension worker for every 5,000 farmers.

R&R Swisscontact, Sustainable Cocoa Production Program	
Status	Under implementation
Programme overview	The programme aims to collaborate with major supply chain actors in order to provide GAP training to farmers and extension service officers. Besides extension services, the programme also focuses on strengthening farmer organisations and setting up farmer-driven nurseries.
Key successes	The target scale is to train 60,000 farmers in GAP in order to improve productivity. So far, 46,000 farmers have been trained. These experience a yield uplift of, on average, 61% (from 422 kg/ha to 688 kg/ha).
Key challenges	Although yield uplifts are being achieved, they do not correspond to the type of uplifts presented by some other programmes.

5.3.2 Palm oil

R&R Case Study: PTPN13 (PERSERO) Revitalisasi Programme	
Status	Implemented – currently on hold.
Programme overview	Revitalise and establish (new) farms of plasma smallholders by replanting of oil palms, with credit guaranteed at concessional rates by PERSERO. Ran from 2007 to 2018. The program operates under a single management system dictated by PERSERO, and PERSERO gives TA, provides seedlings and inputs. The program is currently on hold.
Key successes	Bundling of R&R interventions through one supplier (PERSERO) and attempt to create commitment from smallholders via contracted selling mechanism.

Key challenges	Even with concessional finance, many farmers have been unable to meet their repayment obligations and the business case has not been adequately attractive to speed up replanting rates.

R&R Case Study: Cargill Replanting Program	
Status	Under implementation.
Programme overview	Cargill's replanting program in South Sumatra is focusing on replanting SHF farms that are 23-25 years old. Works both under plasma and KKPA scheme. Under the plasma scheme, smallholders remain the owners and operators of the land but Cargill develops the plantations for the first 48 months, and then passes the plantations back to smallholders to operate. Under the KKPA scheme, Cargill operates the plantations using its own labour and equipment and transports the crop to its mill.
Key successes	Cargill has invested in selecting high performing smallholders thereby reducing risks of crop failure and achieving high yields. Cargill continues to train farmers and provide governance structures for local cooperatives to ensure high performance. They have reduced side-selling through transparency and long-term commitment towards SHF.
Key challenges	Program hasn't managed to engage with independent smallholders at scale.

R&R Case Study: Indonesian NES programmes - government supported renovation	
Status	Implemented.
Programme overview	The Nucleus Estate (NES) programmes (I-VII) were mass efforts by the Indonesian government to promote the palm oil industry between 1977 and 1993. The NES efforts were collaborative projects between the Indonesian government and international donors (mainly the World Bank, Asian Development Bank, KfW and IFAD) in which state-owned companies used their expertise to help establish smallholdings on unexploited land for landless and poor settlers (this process is also referrred to as PTPN).
Key successes	Extending finance to smallholders. The framework for NES included development of ~2 hectares of palm oil as well as smaller areas of food crops and garden areas for each settler (between 3 and 5 hectares in total). The development cost of this land (funded by the government and donors), including tree planting costs, housing, a portion of infrastructure needed in the area and further costs to bring plants to maturity, were converted by Bank Rakyat Indonesia (BRI) into standardised loans for the smallholders. Loans for smallholders had fixed interest rates and grace periods of 2-3 years. Repayment of loans were expected over a 17-19 year period by repayment of 25-30% of annual production to the estate mill. Smallholders were free to sell the remainder of their crop elsewhere, but it was expected that prices offered by estates would be sufficiently above local traders, thereby increasing benefit for all outgrowers.

Key challenges	The success of the NES programmes were largely dependent on the huge amount of government support and willingness to promote (and create) a smallholder palm oil industry. Unless such willingness exists elsewhere, the model will be hard to replicate.

R&R Case Study: Ghana, Oil Palm Development Plan 2015-2025	
Status	Planned.
Programme overview	The objective of the programme is to replant as well establish new plantations during a 10-year period (2015-2025) across the country. The plan is to develop in total 50,000 hectares (10,000 nucleus estate and 40,000 SHF) and replant 110,000 hectares, reaching a total of 55,000 smallholder farmers.
Key successes	Shows government interest in the sector but it is too early to discuss any results from the plan.
Key challenges	The plan will have to mobilise large amounts of external capital and faces challenges regarding the incorporation of many farmers who are currently operating at very small scale.

5.3.1 Coffee

R&R Case Study: Nescafe Plan, Coffee Farmer Connect Indonesia	
Status	Upstart phase in Indonesia.
Programme overview	The programme was set up to ensure a stable supply of beans to Nestle's factories. Nestle sets up local nurseries and factories and then allows farmers to buy high quality planting material at the cost of production. The plantlets have been developed by Nestle to correspond to the growing conditions in the region. Nestle does not provide capital for the low/no-income period involved in replanting. The goal is to distribute 220 million plantlets by 2020 and to source 90,000 tonnes of coffee that is compliant with the Sustainable Agriculture certification criteria.
Key successes	The programme is currently in place in 14 countries. The global programme is so far on track, with 140 million plantlets distributed to date.
Key challenges	In Indonesia, the programme has only run for two years after the trial stage and it is therefore too early to tell what the repayment or adoption rate looks like. Key challenges for the future lie in the production of plantlets, during which Nestle must take care to avoid spearding nematodes while simultaneously maintaining very high efficiency to keep down prices. Nestle has not experienced a lack of farmer demand for plantlets, but prices have to be kept sufficiently low to be attractive.

R&R Case Study: Coffee Partnerships of Tanzania (CPT), DEG[128]	
Status	Under implementation.
Programme overview	The programme was set up in 2012 with the aim of supporting 90,000 farmers via farmer group formation, GAPS and organisation of the supply chain. The programme is part-funded by the Gates foundation (USD 8 million) It is also supported by private sector partners who match and exceed the grant funds through investments in staff, nurseries and processing facilities. There are 6 private sector actors, including 5 traders among which are ECOM, OLAM and HRNS. Although farmer group formation is the key objective, providing disease- and drought-resistant seedlings and access to finance are a key objective for longer term sustainability.
Key successes	40,000 farmers trained in group formation and GAPs as of February 2015.
Key challenges	The programme has faced two main challenges: access to finance and access to high-quality planting material. The CPT has found it difficult to provide access to finance for smallholder farmers because of side-selling issues. Since there are no registration systems or contract enforcement mechanisms, it is difficult for lenders to have any guarantees that the money will be repaid. Additionally, market distortion by government actors is common, seedlings are often given out for free or at a subsidised rate. CPT has found it difficult to provide high-quality seedlings since farmers are willing to pay 300 T.Shilling for a plantlet although the cost of production is around 600 T.Shilling.

R&R Case Study: Tanzania government: coffee tree replanting	
Status	Under implementation.
Programme overview	Major replantation of improved Arabica varieties, with an estimated 60 million seedlings planted since 2005 (according to TaCRI). The improved Arabica seedlings are provided by Tanzanian government actors (TaCRI) The distribution of seedlings falls upon the responsibility of private sector actors and farmers, TaCRI does not have the mandate or capacity for this Seedlings are provided at below production cost Replantation of Robusta has also been proposed (via distribution of Robusta tree seedlings) as part of Tanzania's state-led programme to develop its coffee industry.
Key successes	The programme shows government initiative and willingness to support the coffee sector. The seedlings were of improved varieties, which is an improvement to the very similar, earlier

[128] Interview with Supply chain actors and http://www.ippmedia.com/frontend/?l=77086

	Ugandan government scheme.
Key challenges	The replanting programme has not gone hand in hand with technical assistance and therefore, many plantlets have not survived after being planted. This leaves farmers worse off than before if they took down old trees that still had some productivity in order to replant the new seedlings. Even if all of the seedlings had survived, the programme only covered about a third of Tanzania's need. Both private sector actors and farmers lack capacity to distribute seedlings. The improved varieties are less costly to maintain because they require less herbicide, weeding and pesticides but since farmers generally infill plant, the normal spraying programme has to go on as usual and savings are not being realised. The provision of subsidised seedlings leads to an unwillingness among farmers to pay full price for seedlings and difficulties for private nurseries to sustain their activities.

5.3.2 Tea

R&R Case Study: Wood Foundation Chai Program	
Status	Under implementation.
Programme overview	The aim of the programme is to double smallholder tea production and increase farmers' margins as well as enhancing the competitiveness of the sector. The program runs from 2009-2015 and is operational across Tanzania.
Key successes	The programme reaches all 30,000 smallholders in Tanzania and their ~7,000 ha under cultivation. During the programme, the smallholder share of made tea prices has risen from 26% to 34% while average yields have increased from 950kg made tea per hectare to 1,100kg made tea per hectare, an increase of 22%. Average smallholder profits per hectare have increased by 70% from around US$126 in 2009 to around US$218 in 2011/12 although the average tea farmer only has 0.4 hectares of tea. (Results were measured in 2011/2012)
Key challenges	Project success is largely dependent on price of green tea leaf. SHF do not own processing factories (like in Kenya) and therefore only receive a quarter of the made tea price (in Kenya, farmers receive 75%).

R&R Case Study: Malawi 2020 Tea Revitalisation Programme, IDH	
Status	Upstart phase.
Programme overview	The aim of the programme is to enable tea plantation workers to earn a living wage by 2020. In collaboration with 19 supply chain actors, IDH is working to improve quality of Malawi's tea in order to increase prices to farmers. This requires a renovation of 3,400 hectares of tea estate plantation, at a total cost of USD 31 million. This will be coupled with investments to improve irrigation in order to

	increase climate change resilience while also improving processing facilities. These additional activities will make the total cost of the program around USD 50 million.
Key successes	Although the project is yet only starting up, it is positive that several private sector actors are engaging to revitalise the Malawian tea industry.
Key challenges	Raising the required capital for investment will be the first key challenge to overcome.