Connectivity and the Tea Sector in Rwanda

Value Chains and Networks of Connectivity-Based Enterprises in Rwanda

Christopher Foster and Mark Graham

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UNIVERSITY OF OXFORD

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1. EXECUTIVE SUMMARY

1a. Summary of objectives

East Africa was the world's last major region without submarine fibre-optic broadband internet access, and until the summer of 2009 had been forced to rely on slow and costly satellite connections for access. However, the region has recently been connected via fibre-optic cable, in theory, allowing much greater speeds at much lower prices.

This rapid transformation in the region's connectivity has prompted politicians, journalists, academics, and citizens to speak of an ICT-fuelled economic revolution happening on the continent. However, while some research has been conducted into the impacts of ICTs on economic processes and practices, there remains surprisingly little research into the impacts of changing connectivity on economic processes and practices in East Africa.

Here we summarise research examining the effects of this changing connectivity in the Rwandan tea sector.

1b. Overview

Media expectations of connectivity

Prior to the arrival of the fibre-optic cables, we identified three primary ideas promulgated in the media. First, potential access to a '**global marketplace**' where online visibility, and more direct communication at distance would allow firms to build new customers and markets.

Changing connectivity was also perceived to support socio-economic development where previously disconnected **individuals would be able to disintermediate middlemen** and capture better value through the use of connectivity.

A third idea suggested that these **positive outcomes of internet use were expected to happen routinely** as a result of the better broadband availability in the country.

Expectations and reality

We set out to investigate these ideas and to examine how they fit with practice in the tea sector. We drew on over 50 in-depth interviews to examine information flows and internet and ICT use.

First, in terms of the expectation that Rwandan firms would become better integrated in the 'global marketplace', our evidence suggests that this vision has largely been realised. Tea firms in Rwanda are increasingly linked into global value chains of production. However, the idea of independent Rwandan tea firms using improved connectivity to become visible online and directly reach markets did not fit with reality. Rather, connectivity is one element in the private-sector reform of the tea sector, through which Rwandan firms are becoming part of a global production of tea. Rwandan firms are increasingly connected into international tea firms and markets, who further package and market tea to customers.

Second, for the expectation that disconnected economic actors would use connectivity to cut out intermediaries and directly access markets, there was much less evidence that changing connectivity has brought about significant transformation. We found some online information flows amongst farmers, particularly amongst tea co-operatives (e.g. identifying pests and diseases, advice on planting and growing tea bushes). Yet, inconsistent access to connectivity and exclusion from information and knowledge flows meant that connectivity was having a limited effect.

Third, expectations were that positive effects of connectivity would be inevitable once basic infrastructure was installed. We found this was only true in terms of more educated and skilled users and firms in the tea sector (such as tea factories and logistics firms). Gains from using connectivity by tea farmers or co-operatives tended to require further support such as skills building and provision of appropriate ICT which could support their needs.

1c. Findings and recommendations

Online visibility of Rwandan tea

Evidence suggests that tea firms in Rwanda have reaped little benefit from making themselves visible online. In our research, it was only developed country retailers who more successfully drew on Rwandan images and tea branding and made these activities visible online as part of selling their specialist tea varieties. Some other firms – brokers and tea factory owners – did have websites but these were mainly corporate and informational. Thus, there was little evidence that online visibility had helped Rwandan tea firms to reach new categories of consumer in any way. This finding then questions policy approaches and ambitions where Rwandan firms look to drive growth through visibility.

That said, more generally in East Africa we argue that it is important to strive to maintain visibility as a viable producer of tea within the global market. Online visibility **promoting regional teas and branding them in global markets** could potentially drive growth and fit with East African Community agendas. Promotion and branding can build the profile of the region as a viable tea producer (for both consumers and buyers).

Online co-ordination and communication

Connectivity is benefitting actors in the tea sector by reducing the cost and difficulty of communication over long distances, and as the tea sector is integrating globally this is becoming increasingly important. Increasing benefits come to those who can access these flows of communication and information (i.e. better planning, tracking of tea production, and ability to read and respond to market needs), but the unevenness of access can enhance rather than reduce inequality (for instance, extending rather than reducing the differences between farmers and tea factories).

Rural actors in tea production chains in particular have made the smallest gains from changing connectivity. Indeed, **co-ordination and communication flows tend to exclude tea co-operatives and farmers**, and unclear communication (e.g. on global prices, tea trends, new initiatives) can undermine their ability to get a fair deal in the tea sector, and to respond to changing markets.

Online automation and tracking in tea

Changing connectivity has enabled increasing automation and tracking for tea producers who use digital connectivity to transmit data and provide services in the supply chain. In the Rwandan case, there is evidence that such automation and tracking has been an important element in allowing Rwanda to integrate more easily into global production.

However, global rules and assumptions that are 'encoded' into standards and service also make production standardised and generic. Rwandan-based factory managers and growers have less control of strategic decisions which are planned and dictated from larger private tea firms. Online automation and tracking also supports marginalisation and reduced roles of certain elements of tea production (such as the Mombasa tea auction, co-operative associations and farmers) as these automated information flows sidestep these actors. Such marginalisation, which includes key local actors and those that support low-income farmers, is not-necessarily of benefit to the long-term development and vibrancy of the Rwandan tea sector.

Further research is needed on **how online automation and tracking in the tea sector can better fit into Rwandan tea**. For example, how can information systems better consider the support required by the key characteristics and actors of the Rwandan tea sector (e.g. high quality tea, co-operatives etc.)? How can generic information systems and services be appropriated for Rwandan activities?

Online knowledge and learning

Expectations were that changing connectivity would enable innovation by farmers and new links into markets as lower-income actors exploited their 'latent' resources (e.g. land quality, entrepreneurship, culture). Yet, there is no suggestion that these processes are occurring in Rwanda. Rwandan processors and tea farmers are locked into their existing relationships, and there are financial and legislative barriers that prevent significant upgrading. Acknowledging these limits, we still found some potentials around knowledge and learning for supporting tea-sector growth.

New **markets and products for tea** can provide potential new directions. For example, new non-European tea markets are growing, and lesser known tea niches (i.e. new varieties and products) may not have been fully explored in Rwanda. Clearer information provision about market potential, through surveys, research and online sources could provide the ability for tea firms to more coherently consider new potential as markets.

There is evidence that **policy support for improving information use by farmers and cooperatives** could be vital. This could look to support informal learning that has been identified (such as cooperative information sharing and farmer knowledge acquisition online) through supporting skills and better provision of online resources. To maximise goals of improving farming, development of such resources should be as transparent as possible and consider the presence of multiple media in such settings (e.g. PC, mobile, SMS, voice, paper, face-to-face).

1d. Conclusions

Digital connectivity is increasingly important to the tea industry in Rwanda. The benefits of changing connectivity are generally being felt upstream in the Rwandan tea industry (for instance, by enabling higher volumes of production and management for larger tea firms). The challenge is to ensure that improved benefits are felt further down the production chain for farmers and co-operatives, and that Rwandan firms are not marginalised in global production.

2. INTRODUCTION

2a. An introduction to the larger project and the contexts of the work

East Africa was the world's last major region without fibre-optic broadband internet access, and until the summer of 2009 had been forced to rely on slow and costly satellite connections for access. However, the region has recently been connected via fibre-optic cable, in theory allowing much greater speeds at much lower prices.

This rapid transformation in the region's connectivity has prompted politicians, journalists, academics, and citizens to speak of an economic revolution fuelled by Information Communication Technologies (ICTs) happening on the continent. However, while some research has been conducted into the impacts of ICTs on economic processes and practices, there remains surprisingly little research into the emergence of a new connectivity in East Africa.

This report focuses on changing connectivity in the Rwandan tea sector, seeking to understand precisely what impacts changing connectivity is having, who benefits, who doesn't, and how these changes interlink with expectations for change. Is connectivity spearheading new types of development fuelled by ICTs, or does engagement with the global economy enabled by connectivity reinforce dependence, inequality, underdevelopment, and economic extraversion? The in-depth research presented in this report on the state of the sector in Rwanda seeks to enhance our understanding of these questions, as well as to provide insights on policies and strategies that might help enhance the potentials of such roll-outs.

This research draws on two principal sources of material. Textual analysis of press and speeches that reference connectivity were used to examine the 'expected' effects of broadband connectivity. In-depth interviews with 53 firms and policy makers together were then undertaken in the Rwandan tea sector to study the communications ecology, and highlight the potential effects that ICTs and broadband connectivity have had on the sector.

2b. Research goals

Rwanda's tea sector is a potentially insightful sector to examine. It provides a perspective on the role that connectivity is playing outside the much-hyped sectors of the 'knowledge economy' (such as new IT service sectors). It is important to remember that agricultural-based commodity sectors still contribute nearly all export assets in Rwanda, whilst agriculture more generally is a mass source of employment (MINAGRI 2012). Thus it is crucial to examine changing connectivity where the socio-economic changes are liable to be felt more immediately and widely amongst the population.

In terms of the expectations surrounding the sector, a key goal of the Rwandan ICT policy is to "transform her subsistence agriculture dominated economy into a service-sector driven high value-added information and knowledge economy that can compete on the global market" (GoR 2001 p.7). This may imply that sectors such as tea are overlooked in terms of policy, focus and activities.

Our focus on practices is then directed at understanding how expectations align with the way that connectivity is introduced, articulated and used in the sector. Projections about the effects of changing connectivity are often made in the absence of data about current communications practices, and tend not to draw upon established agricultural sectors such as tea. This project therefore needs to draw on extensive empirical work to examine the changing communications ecology and the effects of the region's new-found connectivity.

Five interrelated questions are posed as regards the project goals outlined in the previous section:

1. How are the potential effects of the East African fibre-optic link represented in political and public discourse within Rwanda?
2. How are ICTs, including mobile devices, old satellite and new broadband internet connectivity, variably integrated into value chains and flows of knowledge, commodities and capital in the Rwandan tea industry?
3. Is the Rwandan tea sector characterised by innovative uses of broadband connectivity or unexpected challenges to broadband use?
4. How are changes in the use of methods of communication and internet access linked to altered socio-economic conditions of economic actors?
5. How do those changes differ from academic, public and political discourses surrounding potential effects?

The report is organised as follows. In the next section, we will briefly outline the research approach undertaken, which forms the basis on which the research questions are answered. In section 4, we frame these research questions in terms of how the literature has discussed connectivity and development, and drawing on discourse material we examine how such ideas are articulated by the media and politicians on East Africa. Section 5 introduces the tea sector more generally, drawing on global value chain and global production network models to focus specifically on how Rwandan firms integrate into a globalised tea sector.

Later sections summarise the empirical research findings in the tea sector as related to the five research questions outlined above. We analyse how the internet is used (section 6), how changing connectivity has transformed existing production (section 7) and highlight key innovations and unexpected effects to come out of this (section 8).

This work then leads to conclusions in two areas. In section 9, drawing on fieldwork we conclude as to what benefits and problems connectivity has led to in the tea sector in Rwanda. Contrasting these findings with policy discourses we highlight some additional risks and policy recommendations around ICT, changing connectivity and the tea sector in section 10.

3. APPROACH AND METHODS

3a. Discourses and expectations of connectivity

This report draws on two types of materials in order to examine perceptions around connectivity in the region: a media content analysis was used to capture some of the most visible and prominent voices discussing changing connectivity, and analysis of connectivity was also made within national policy. In particular, focus was placed on the periods prior and post the 2009 introduction of the TEAMS and SEACOM fibre-optic links to East Africa, which promised to upgrade connectivity in the region.

Capture of material was done through keyword searches in the Lexis-Nexis online database in order to examine media accounts of the arrival and perceived impacts of the fibre-optic cables on East Africa. Specifically, we identified articles that mentioned broadband internet in close proximity to either an East African country or one of the fibre-optic cable providers. The end result was a sample of 378 international and East African media reports about the landing of the cables. We supplemented these texts with an interrogation of the national development plans of all East African nations and speeches given by heads of state about the arrival of fibre-optic cables.

Data that specifically related to connectivity in the tea sector was more sparse, and collection was therefore more opportunistic. This material includes some additional newspaper material and further policy material around tea and commodity exports. This provided understanding of the underlying contexts under which connectivity was specifically being articulated in the sector. The data was also used as secondary sources to support and triangulate interview accounts.

3b. Interviews

As outlined in later sections, the research discussed in this report looks towards an examination of tea production in Rwanda, which is part of a global tea sector. The research particularly focuses on the globalised relations and linkages in tea production, which traverse multiple countries, and how changing connectivity affects such linkages. The supply chains of tea production were initially mapped during pilot work and this mapping of the core roles of tea production was used in sample selection for qualitative work.

Given the Rwandan focus, the majority of the research focussed on actors in the tea sector in Rwanda, but Rwandan work was supplemented with analysis of intermediaries and buyers based in Kenya, and also actors linked to consuming countries that could be traced back to Rwandan tea production. Fieldwork in the tea sector in Rwanda took place over two principal periods, September 2012 to March 2013, and March 2014. This dual fieldwork was important as the tea sector was in a state of flux during this period, with ongoing initiatives that changed the make-up and goals of tea actors[1]. The second period of fieldwork also included a number of repeat interviews with firms in order to verify the preliminary conclusions of the initial work.

Interviews lasted approximately one hour, with interview themes drawing on the research questions and frameworks outlined in the next sections. These interviews looked to draw out elements around ideas of connectivity, as well as their effects, particularly in terms of reconfiguring relations within production (see Appendix 11a for sample interview questions). The coverage of actors interviewed is shown in Table 1.

Actor	Description (full details in next section)	No. of interviews
Cooperative Associations	Provide services and represent tea farmers. Cooperative associations[2] are entities that are distinct from farmers in that they tend to have full-time managers, staff and buildings. Research included interviews with: • Co-ops for smallholder farmers • Co-ops where farmers shared tea plantations, acting as a group	14
Factories	Factories buy the harvested green leaf from farmers and process this to convert to black tea to be sold globally.	12
Private owners of factories	Representatives of firms who own tea factories	4
Brokers	Involved in the sale of black tea produced in tea factories, principally in the tea auction in Mombasa, Kenya	5
Warehousing and blenders	Pre- and post-auction roles connected to the Mombasa auction. (These roles are often combined.) • Warehousing involved storage of tea in Kenya • Blending involves mixing different grades of tea for later sale as blended tea	4
Buyers and retailers	Involved in buying tea and/or selling into end markets. Multinational tea firms integrate both roles, but there are also specific buyers who will sell to multiple tea retailers.	9
Sectoral and policy actors	Involved in co-ordinating sector. Included national tea export agencies and other policy actors	5
Total		53

Table 1: Interview coverage in the tea sector[3,4]

3c. Analysis

Transcripts of both interviews and discourse material was analysed using NVivo qualitative software for code-based searching and reporting (Gahan & Hannibal 1998, Van Hoven & Poelman 2003). In terms of analysis, they were dealt with in slightly different ways, so are outlined separately below.

Discourse material was classified according to the date on which it was published (i.e. prior to fibre connections, during roll-out, after roll-out) and was coded based upon a three-fold schema, so as to allow analysis related to the research questions outlined above:

- Expected consequences of changing connectivity
- Unintended consequences and innovations emerging from changing connectivity
- Reported effects of changing connectivity

Tea-sector interview material was first attributed to the role in the production chain (following Table 1), and then coded, using a pre-defined set of codes drawing on the research questions and framework models, to conceptualise the potential effects of new connectivity in the region. A full list of the codes is outlined in appendix 11b. This included, for example, codes for occurrence of items such as:

- codes based around how interviewees and reports brought up images and expectations of this changing connectivity
- discussion of changes in production that linked to changing connectivity
- practical issues that they encountered when they were taking advantage of this changing connectivity.

During both these processes of coding, new themes also emerged that were coded in order to provide a more grounded influence of empirical research on findings, and to allow a more complete analysis that might have been missed had we used only the pre-defined codes. These emerging themes were subsequently examined in more detail; some then being integrated into the core analysis, and others that were deemed to be outside the core scope of this research being rejected. Coding work thus followed well-established techniques of content analysis, which allow qualitative and quantitative interpretations of relations between categories and emergent themes (Krippendorff 2012, Lutz & Collins 1993, Slater 1998).

The core analysis presented in the next sections draws out the key elements that emerged from this work. By examining the codes across actors, expectations of connectivity, and roles in production, we were able identify common or competing discourses around effects of the internet and ICTs, and analyse the effects of changing connectivity in the tea sector. As outlined above, the dual periods of work in Rwanda were designed to allow iterative analysis (Miles & Huberman 1994), where initial results and outputs were discussed with key actors during later interviews to ensure that they were a fair representation of what was occurring in the sector. These meetings also provided a forum for additional inputs and participant triangulation on early conclusions.

4. EXPECTATIONS OF CONNECTIVITY

4a. ICTs and development

Contemporary debates around ICTs and development are highly relevant to the Rwandan context, where ICTs are increasingly being perceived as tools to foster economic connections and knowledge flows with the outside world, as well as to improve efficiency and transparency to reform, breaking the stranglehold of incumbent actors.

On one hand, improving the ICT infrastructure is often seen as a key means of encouraging such economic globalisation, where the lack of ICT infrastructure is seen as "a major bottleneck to growth and poverty alleviation in developing countries" (World Bank 2005). Globalisation becomes a necessity in order to create a "level playing field" on which developing countries can compete (see Friedman 2007, Gates et al. 1995), where globalisation also provides a means for new flows of global knowledge and learning into developing countries (Bell 1984).

On the other hand, discussion around ICT and connectivity has also looked towards wider human and social-economic development. For instance, discussions have highlighted how ICT can help achieve the millennium goals, whether that be in supporting knowledge building and information access in rural areas, or providing new ICT-based services that support low-income groups (Batchelor et al. 2003, UNCTAD 2010). These ideas are also constituted in a number of reports published at a global level that highlight the idea that ICTs could help to alleviate poverty (UN 2003, UNDP 2003). Goals for connectivity have also diffused into regional-level strategies. In East Africa, the potential socio-economic impacts of connectivity have been strongly articulated within Rwanda's Vision 2020 and Kenya's Vision 2030, with ICT and connectivity not positioned solely within economic development but also in achieving socio-economic goals (GOK 2007, GoR 2009). Both literature and strategies tend to draw on ideas of the 'digital divide', focussing on the lack of ability of citizens to access such connectivity (whether that be related to infrastructure, skills, costs, culture) (Norris 2001, Selwyn 2004, Warschauer 2003). According to the digital divide narrative, ICT infrastructure is one element in reducing this digital disparity through providing more accessible, reliable, and cheaper access, and this new access should also lead to significant development.

However, counter-arguments are offered to these seemingly dual benefits that come from ICT and connectivity. Improvements in communication and transportation technologies can as much enable and give shape to processes of neo-colonialism as they can drive economic development. For instance, commentators such as Sardar (1995) see the internet "as a new phase in a long history of the West's attempt to colonise not only the territory and the body but also the mind of the Third World 'other'" (in Schech 2002 p.18). Domination can be extended to distant spaces through the knocking down of virtual and physical barriers, and producers can grow dependent on unstable market conditions and distant consumer preferences (Adams 1995). Digital divide narratives have also been much criticised within ICT for development work as underplaying the importance of issues of sustainability, usage and, ultimately, impact. In short, reducing the digital divide may not necessarily drive development in the way that was initially anticipated, or at least not without a wider set of activities and policies. Indeed, benefits may simply mirror existing inequalities in society rather than drive empowerment and development (Heeks 2008, Thompson 2004).

In sum, this discussion on ICT and development frames the five research questions proposed in this project. In the next section we will explore how these ideas have been represented within the media and political discourse in East Africa as broadband connectivity has arrived.

4b. Discourses around changing connectivity

In this section, media and political discourses around changing connectivity are analysed, outlining the ways that connectivity has been discussed. Given that we found that views across East Africa broadly align, in this section we focus on key regional perspectives during the period when the first fibre-optic cables were connected to the region. This is then followed by a more specific discussion of the ways that changing connectivity has been envisioned in the Rwandan tea sector.

General expectations

For work on general perceptions, we were interested in expectations of the outcomes of changing connectivity as discussed by politicians and other key actors in the press, particularly those who moved beyond simple statements that connectivity will reduce broadband prices or increase speeds, to explore more refined visions of connectivity driving economic transformations (or not).

The results are separated into the two directions outlined in the literature in the previous section (economic and wider human development), and so these expectation are used to highlight more concrete articulations about how connectivity is envisaged by key players with respect to East Africa. As well as discussion linked to the two directions found in the literature on ICT and development, we introduce a third direction. This was by far the most present in the content analysis, and relates to highly generalised visions of connectivity. Below, we comment on why this is so present within expectations and what it might mean in terms of policy and interventions around the internet in Rwanda.

Bringing about a "level playing field" - In media and political speeches that discuss connectivity and economic development, we found specific discussion relating to the idea that East Africa is seen as "behind" in terms of technologies, skills, knowledge and global linkages. The expectation is that connectivity allows these previous disparities to be removed:

> *"This [changing connectivity] effectively means that Kenya is now part of the global information superhighway and will be able to compete on a more level platform with more established economies." (*The Nation*, 2009)*

> *"[And broadband plays a key role]....to ensure that Rwandans along with other Africans, are equipped with the education, skills, confidence and opportunities to innovate and be competitive globally." (Paul Kagame, 2010)*

We also see more concrete discussions around some of the processes that might bring about this 'catch-up'. In terms of flows of information and knowledge towards East Africa, catch-up is seen to be driven by this changing connectivity; improving flows of rich information that will transform the way that East African organisations act:

> *"With this technology in place, a doctor at Johns Hopkins Hospital in New York will be able to supervise and direct a doctor at Muhimbili Hospital." (Jakaya Kikwete, President of Tanzania, 2009)*

> *"When this cable goes live we are expecting to see a huge increase in the amount of content flowing between these two continents ... [and] ... provide a crucial link in supporting economic growth in the region for many years to come." (*Total Telecom Online*, 2009)*

In the opposite direction, East African firms previously set apart from the wider global economy will now be able to access and be visible in the 'global marketplace', integrating into markets and providing services that stretch

beyond their borders. Indeed, this new linkage can allow locally created innovations to be more widely relevant:

> *"In the current business environment, information systems, the internet and global communication networks are creating new opportunities for organisational coordination and innovation." (Ham-Mukasa Mulira, Senior Presidential Advisor ICT, New Vision Uganda, 2009)*

> *"The whole idea of being innovative isn't national, but it is global; it is not confined to Rwanda, but within that there is the Rwandan portion. Even if some innovations are started locally, they should be globally competitive." (President Kagame, Wired, 2013)*

The expectation, then, is of an integrated Rwanda in which high-speed connectivity allows Rwandan firms to better coordinate their processes and systems with those at a global level. Firms will collaborate and interact more intensively through these high-speed linkages. Such a vision of economic growth is seen to be pushed by formal firms, often involved in services and located in plush new offices in urban centres, as illustrated by the banner image of a key fibre-optic cable supplier (Figure 1).

Figure 1: Publicity in SEACOM documents vividly illustrates the expectations. Images of urban and business users, linking into global business and leisure, support the idea of a new integrated Africa through connectivity

In terms of orientating activity, discussions and discourses tie in with the idea of the primacy of the global marketplace. Knowledge flows *from* the global market, and local firms become economically successful through *linking to* these markets. This discourse also implies support for activities where Rwandan tea firms integrate into global production, with new information and knowledge being diffused into Rwanda following modernisation of the sector. Connectivity is expected to provide new visibility and knowledge flows, allowing firms to understand global markets and adapt their innovative product to them.

It is therefore important to scrutinise Rwandan tea firms, and how changing connectivity is enabling them to integrate globally, in more detail. Do Rwandan firms really link into new global production networks as is articulated in the public discourse? What knowledge flows occur, and are Rwandan firms able to innovate as they create and enact those linkages?

Empowering the unconnected - In media and political speeches that discuss the wider socio-economic effects of connectivity, it is seen as offering great opportunities for those firms and actors who have been more marginal – to build knowledge, and find and enter into more competitive markets. Perspectives here particularly position East Africa as having 'latent' resources – entrepreneurs, ingenuity, climate, soils – that will be unleashed by growing connectivity:

> *"it no longer is of utmost importance where you are but rather what you can do – this is of great benefit to traditionally marginalized regions and geographically isolated populations. In our context, it will allow us to make use of our most important and most abundant resource – Our People." (President Kagame, 2006)*

This perspective has particularly been linked with the agricultural sector through reference to how changing connectivity might transform the rural smallholder farmers, seen as lacking knowledge of markets for their goods. Here ICTs and connectivity are perceived to work in a positive manner:

> *"Even small growers and local entrepreneurs have been greatly impacted by the ICT-led revolution in Africa – mobile phone-based exchanges link the buyer and seller with market data, which eliminates unnecessary journeys, stabilizes prices, and allows the grower to capture more value." (President Kagame, 2009)*

> *"For rural Tanzania.. a farmer will be able to sell their beans as far as President Hugo Chavez's (Venezuela) kitchen easily when they link-up with a buyer on the other end." (President Kikwete, 2009)*

Similar potentials of connectivity were put forward in discussions where farmers were seen to be exploited by unscrupulous middlemen. In such cases connectivity was articulated as allowing direct linkages to customers rather than vulnerability to exploitation and corruption. For instance, press articles in Kenya outlined the potential of automated trading systems, which allow new ways of equitably connecting farmers to markets:

> *"[such systems in coffee can provide]...a secure and reliable system of handling, grading, and storing commodities, matching offers and bids for commodity transactions, and a risk-free payment and goods delivery system...[allowing farmers to]...kick brokers out of the marketing chain." (Business Daily, Kenya, 2010)*

> *"I am fed up with middlemen who exploit us....Soils are very fertile and when there's adequate rain, we experience a bumper harvest...if I access the market, earnings will be higher." (Farmer discussing new internet platforms, The Nation, 2010)*

The key differences to this articulation compared to the previous section, of larger firms competing more evenly with global markets through connectivity, is that this discussion normally revolves around a different set of actors. Here it is less affluent actors, particularly farmers, entrepreneurs and youth. Use of connectivity is seen to relate more to "empowerment" and "poverty reduction" as much as directly to bottom-line economic development.

In terms of agriculture, this discourse around connectivity can be linked to a number of direct initiatives undertaken by the government in Rwanda that operationalise technology in line with these expectations. For instance, the central focus of the Agricultural Information and Communication Centre (CICA) is an agricultural system called 'e-soko' which

> *"exploit[s] the existing infrastructure such as mobile phones, radios, telecenters, internet cafes to enable consumers be aware of current market prices, quantities and location of commodities and allow suppliers (farmers, agricultural cooperatives, importers) to inform their market prices, quantities and location of produce." - Rwandan ICT Policy 2010 (GoR 2005)*

Embedded in such initiatives is the idea of a farmer who can exploit new information sources at his or her fingertips, making active and direct choices on markets which may not necessarily be the closest to the farmer's field. It will be interesting to see if connectivity does indeed allow less affluent farmers the ability to improve their position and disintermediate; and the types of information and knowledge that flow to these actors, thereby aiding or hindering this activity.

Unsupported visions of connectivity and transformation - During the coding of media and political speeches into the two themes previously identified in the literature review, we also found a large number of visions of connectivity that did not fit well to either group. This material often referred to well-known concepts around connectivity; that is, the ability for interaction without the barriers of geographic conditions, and condensing time in terms of flows of data and activity (Castells 2000, McLuhan & Powers 1989). However, discussion was conducted without any grounding in specific detail. That is, many visions of the transformative power of changing connectivity tended to remain as generalised statements without any evidence of specifically how and where those transformations would be brought into being (e.g. by whom? In which sector? By what process?). The quotes below illustrate some of the general statements made by political leaders.

> *"Not only does broadband deliver benefits across every sector of society, but it also helps promote social and economic development, and will be key to helping us get the Millennium Development Goals back on track," (Dr Hamadoun Touré, secretary general of the ITU)*

> *"Readily accessible bandwidth will not only lower telecommunications costs, but also provide new opportunities in all sectors and translate the country's concept of a 'working nation' into a much stronger economy." (Mwai Kibaki, former president of Kenya)*

> *"Broadband is a transformative technology which is fundamentally changing the way we live." (Paul Kagame, President of Rwanda)*

These unsupported statements around the transformative potentials of communication technologies are also exemplified in the often-repeated statistic that 'every 10% growth in broadband subscriptions leads to 1.3% increase in economic growth'. This figure, originally produced by the World Bank in their report "Information and Communications for Development 2009" (Khalil et al. 2009), has become a refrain for politicians and policy makers, even though these figures are far from categorical.[5]

Whilst we acknowledge that it is not uncommon for senior figures to use rhetoric without grounding their words in empirical observations, it was surprising the extent to which discussion on connectivity were not grounded in specific processes of transformation. These notions of connectivity are not completely without context, rather they vaguely look towards ideas from economics of the spillover effects of technology and from the information society of intangible improvements from connectivity (Castells 2000). They thus imply that the impacts of connectivity are measured in direct outcomes.

These views are also closely linked to visions of modernisation (Graham 2008). Public utterances of hopes and goals with reference to building a society that is seen as "modern" may be more important than the actual impacts of connectivity (i.e. for politicians, creating a perception that the society is modern is as important as the concrete impacts from connectivity).

We are interested in how these expectation for connectivity apply to approaches on the ground. Firstly, they suggest an inevitability of development. Once the broadband cables are landed and connected, the market-driven processes of local distribution, markets and impacts should be left to take their course in industries in East Africa. They also imply a more arm's length, techno-centric approach to how connectivity is used and implemented given the perceived inevitability of the gains from connectivity. Secondly, the entwining of the internet and notions of modernity are liable to dictate which sectors, and within sectors which actors, are perceived appropriate to develop, finance and promote software, websites and skills.

Perceptions: Connectivity and Rwandan Tea - Media and speech material that specifically related to changing connectivity in the tea sector was rare, and thus analysis here is based upon a scattering of articles and references in policy. In general they can be read as corresponding closely to the arguments made so far in this section.

In 2013, the annual African tea trade convention, the premier African industry event around tea, was held in Kigali. The keynote speech was made by President Kagame. In this speech we can see references to themes around Rwandan tea linking into global markets. Recent policy has resulted in the tea sector becoming modernised through privatisation as the path to a "level playing field" in the global tea market. Kagame also highlights the importance of the "adoption of new technologies to keep it *[the tea sector]* competitive on the global beverage market" and the need for "continued research and development and technological innovations in order to have products aligned to the new and emerging sophisticated consumer demands".

In a similar way, Agnes Kalibata, the Minister of Agriculture, discussed the role that ICT and connectivity can play in agriculture at a recent global technology and agriculture for development conference held in Kigali (ICT4Ag 2013) and these discussions can be read as aligning with ideas around how changing connectivity can lead to socio-economic development. ICT solutions are a key tool in transforming fortunes in the sector, particularly among less affluent farmers, and she mentions the need for new knowledge flows and ICT for new market linkages.

These ideas are also mirrored in official strategies, for instance in the most recent "Revised Tea Strategy for Rwanda 2005-2010". ICT and connectivity are rarely brought into this discussion (MINAGRI 2008), but improved connectivity can be read as underlying some of the proposed activity relating to encouraging firms to compete in the global marketplace: "developing a Rwanda brand" suggests online visibility and building awareness of Rwandan tea; "increasing direct sales" implies a role for networked communication in building new direct links with retailers and consumers, and improved flows of information in production. There are also sporadic references to how information flows may empower the farmers in the tea sector, with "cooperation among cluster members with technology and information sharing" (ibid. p.19). So the types of idea articulated by these Rwandan leaders around agriculture align with the two types of expectation around connectivity that were outlined above.

However what is most striking in these speeches and in policy around Rwandan tea is the lack of specifics on ICT and connectivity. This is all the more surprising because Rwanda is active in its regulation of tea. For instance the tea strategy extends to a full 45 pages of detailed initiatives and schemes (MINAGRI 2008). But whilst the sector is micro-managed, the ways that changing connectivity might contribute to sectoral development barely gets a mention. In our interviews with policy makers it was not that they were unaware of how connectivity was being used, indeed it is important to the sector in Rwanda, but it quickly becomes a background element in their considerations. This is exemplified by this national policy maker with a focus on the tea sector, who speaks of connectivity as an infrastructural element

> *"I can't say it is big or small but it has an impact. It is used in communication and reporting. It is an efficient way of information sharing...around the country."*

Thus, in policy and in our discussions with policy makers, connectivity is often seen as something unspectacular; and so hardly something to be researched or legislated, but rather an automatic corollary of fibre connection and sector improvement.

4c. Summary

In this section we first introduced the ways that connectivity and development have been discussed in the academic literature. An analysis of perceptions about changing connectivity complements these notions and provides more detail about how some very general notions – *competing in the global market place* and *empowering the poorly connected* – are expected to be realised in practice in East Africa, and more specifically in the Rwandan tea sector.

We can also isolate four key properties of connectivity that have been articulated as potentially crucial to development. Online *visibility,* and growth in online *services* will allow firms to be visible, to improve, and to be active innovators in the global market. There is also potential to use connectivity to expand *access to knowledge* and improve *information flows*, both for larger firms and less formal actors, to enable potentially new dynamic activity.

However, these are only perceptions, and it is unclear how such activities are actually being experienced and performed. In particular, we have highlighted more critical literature which suggests that connectivity may lead to less positive outcomes. In terms of expectations amongst politicians in East Africa, we have also highlighted the inevitable but intangible ways that connectivity is perceived to have an impact once it is introduced. These suggest hands-off, private-sector led developments that may also lead to exclusion of actors in the tea sector, and so this should be examined in more detail in practice.

5. POSITIONING RWANDAN TEA

5a. Frameworks for analysis

The previous section explored perceptions, highlighting a potential set of benefits but also highlighting potential barriers around connectivity that require more in-depth empirical analysis. In this section, we outline a clear and systematic framework that allows examination of the potential economic effects of broadband connectivity within production, drawing on global production networks and value chains frameworks. Following an introduction of these frameworks, we use them to discuss the tea sector in Rwanda in more detail. This provides a clear basis to analyse the effects of connectivity, discussed in the later sections of this report.

Models

Activities around the tea sector and connectivity in Rwanda are best understood when Rwandan firms and policy makers are considered to be part of wider global tea sectors that move beyond national borders. Adopting a national perspective in an export-orientated sector would risk underplaying the role of international actors, rules and relations that orientate the structures and institutions of tea in Rwanda. Tea production is best understood through reference to the transnational flows of goods and knowledge, and how multiple actors integrate into the processes of production.

To conceptualise such a production process, this report draws on the literature around globalised production, in particular two models – global value chains, and global production networks. Global value chains (GVC) models look to examine

> *"the full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use." (Kaplinsky & Morris 2001 p.4)*

Global value chains models draw on business understanding around how production activities are vertically integrated or outsourced, according to large firms' needs and this leads to interlinked chains of activity (Porter 1998). GVC models thus take a relational orientation, which in addition allows for analysis of power and an understanding of indirect control that occurs in guiding production chains (Bair 2005, Gereffi 1999).

In value chain models, insight emerges through models of the production chain, which allow systematic models of "the trajectory of a product from its conception and design, through production, retailing and final consumption" (Leslie & Reimer 1999 p.404). In analysis, the notion of *value* is used in order to understand where benefits are extracted in terms of actors and geography. Further, analysis of value chain relationships can provide insight into the forms of *governance* by which firms coordinate and control activity, even where firms are not directly integrated into all elements of activity (Gereffi et al. 2005, Gereffi 1994). For firms involved in value chain activity, improvements might come through *upgrading,* where firms improve their positions in such chains, albeit within the framework set by value chain governance (Humphrey & Schmitz 2000, Kaplinsky & Morris 2001).

Global production network frameworks (GPN) respond to the perceived weakness of GVC approaches, which focus on production relationships to the detriment of a wider understanding of global production (Henderson et al. 2002). As Coe et al. (2008) put it, GPN models

> *"helps us to see beyond the linear progression of the product or service in question to reveal the complex circulations of capital, knowledge and people that underlie the production of all goods and services." (Coe et al. 2008 p.275)*

This network perspective results in an analysis where each element of a production chain is intimately linked to a network of relationships within specific institutions, contexts and geographies that influence production (Henderson et al. 2002). GPN analysis thus positions power relations not just as production relationships, but also as involving a wider constellation of actors. These models of production are thus better considered in local contexts, where this model provides better understanding as to how firms embed within places, networks and regions; in addition it allows integration of the social, economic and political aspects of these specific places, which is central to a GPN analysis of production (Coe et al. 2004). GPN analysis thus moves away from solely tracking the production of goods like tea, and takes more explicit spatial and institutional consideration into analysis, where "networks of production 'interrupt' – and are interrupted by" (Dicken 1998 p.54) their embeddedness within policy, institutions and structures.

Integrating connectivity

Many authors and policy makers have pointed to the potential of connectivity to transform production, particularly by threatening the existence of intermediary actors, and to reorganise economic spaces and relations (Benjamin & Wigand 1995, Congress 1994, Drucker 1999, Janelle & Hodge 2000, Javalgi & Ramsey 2001). Indeed, in terms of value chains, Gereffi (2001 p.35) boldly announced in 2001 that "the internet is already beginning to have a significant impact on the structure and competitive dynamics of global value chains", where changing connectivity is reconfiguring chain relations, and offering new innovative structures of production. The internet can also potentially "overcome[s] space and time frictions" (Dicken 1998 p.81), which alter the position and accessibility of a place in the world. This is said to be at the core of growing flexibility and information intensity of GPNs, and also the increasingly reconfigurable nature of global production (Dicken 1998, Hanson 2000, Janelle 2004, Yeung 2002).

However, despite the existence of a few case studies and myriad reports in the popular press, (Amighetti & Reader 2003, Chandrasekaran 2001, Rhodes 2003), there has not yet been a comprehensive body of empirical work produced which details how connectivity reconfigure GVCs and GPNs in developing countries. In particular there is a paucity of research examining the impact connectivity is having on lower-income actors in developing countries, where broadband connectivity is only recently becoming common (as in the case of East Africa). One also needs to be aware of more critical analysis of the transformation of connectivity in a handful of critical evaluations of the notion of disintermediation (French & Leyshon 2004, Zook 2008), and in geographic studies that suggest that frictions of distance continue to influence ways in which we communicate and interact economically (Bathelt & Henn 2014, Goodchild 2008, Graham 2008, Massey 1993, Massey 2005, Massey 1994, Sheppard 2002).

GVC and GPN models provide a systematic basis to analyse the effects of connectivity. They allow us to systematically highlight the key roles and networks around the production of tea, and to explore how connectivity is reconfiguring them. As the literature outlined above suggests, some of the effects of changing connectivity on GVCs and GPNs may allow relationships to be redefined or removed through digitally mediated reconfigurations of our relations with space and time. However, there is a lack of literature on developing country sectors, as well as critiques suggesting that connectivity may be less transformative than has been generally articulated. Thus it is crucial to empirically examine the dynamic processes of chain and network reconfiguration as a core focus of our study.

5b. Tea production and Rwanda

Outline

Tea production has a long history, and the processes of tea growing and many of the institutions that exist to this day still reflect its origins in colonialism. The tea trade was originally constituted by large farms that employed low-paid local labour, orientated towards export of tea to the UK (in India and Sri Lanka, and later

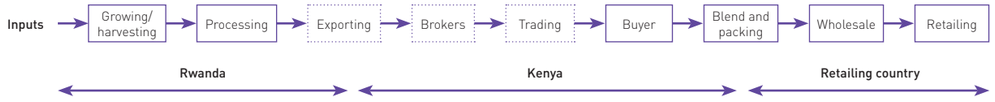

Figure 2: Tea production
Non-buying intermediaries and agents shown by dotted boxes
Source: Fieldwork

in Kenya). Global tea growing continued in these countries after independence, driven by state-owned tea factories supported by national marketing boards. It was during this post-colonial period in the 1960s that Rwanda first began commercial growing of tea (Elkins 2005, Griffiths 1967). As with other commodities worldwide, the past decade has seen a change of emphasis in the sector. Rwanda, like other states, has privatised production[6] (Essama-Nssah et al. 2008), pushed both by pressures – global pressure for developing countries to privatise assets, and the need for investment for modernisation of tea production – as well as the need to provide valueable income for cash-strapped governments from sales of these publically owned assets. Thus, tea production has moved from preominantly a state to a market orientation.

> *"Gone are the days when the tropical products sector was anchored by state marketing boards..which arranged sales according to crude quality grades and operated price stabilisation schemes. These arrangements have been progressively dismantled, and into this lacuna has emerged a host of emergent forms of market exchange and coordination." (Neilson & Pritchard 2011 p.2).*

In place, we see the integration of Rwanda into an increasingly marketised, financialised and globalised tea sector which has, with a

> *"rise of sophisticated market institutions, based around electronic data exchange and the internet, effectively globalised the processes of buying and selling tea and coffee." (ibid. p.5)*

To outline the processes of production, in general one could say that production sits closer to what Gereffi (1999) refers to as a *buyer-driven* value chain – a labour intensive chain of production where standards and specifications are determined by large buyers and retailers close to consumers.[7] Rwandan tea is produced by tea estates and smallholders in labour-intensive processes. Consumption is dominated by developed countries where large retail firms are typically seen to exert power downwards to dictate the requirements of other actors in the chain, under threat of retail firms moving their relationships elsewhere (Neilson & Pritchard 2011).

These relationships are outlined in a simplified version of the value chain, as detailed in Figure 2 (with the locations of each process in terms of Rwandan tea production added). The diagram displays the most significant pathways that tea can take as it moves from producers to consumers.

In the first step in the process, the basic green leaf is grown and harvested by farmers, where the logistics of recording and moving green leaf to factories is undertaken by cooperatives. Green leaf is then bought by tea factories. Tea factories then carry out processes to convert the green leaf into 'made tea'. Typically in Rwanda, the 'made tea' is bulk 'black crush, tear, curl' (CTC) tea, which describes the fermentation process that creates the black tea.

Rwandan tea production has been characterised by the ability to produce high quality tea, related to the good climate and soils, particularly in the upland areas. However, these islands of high quality are tempered by limits within the sector concerning quality, yield and costs. The highland environment of tea growing limits large-scale production (IFAD 2011). In addition, some Rwandan farmers have been observed to neglect tea plantations, with little use of modern inputs such as fertilisers (Promar 2012). Further, a lack of national research and development in Rwanda may limit locally relevant strategies to maximise quality and yields (ibid.).

As the value chain moves outside Rwanda's borders, the predominant mechanism for selling CTC tea in East Africa has primarily been through a regional tea auction located in Mombasa, Kenya[8], where tea passes through a number of Kenyan actors. Auction actors include those firms who specialise in buying, blending[9], packaging and/or exporting teas. They may also include multinational firms who deal with many of those processes themselves.

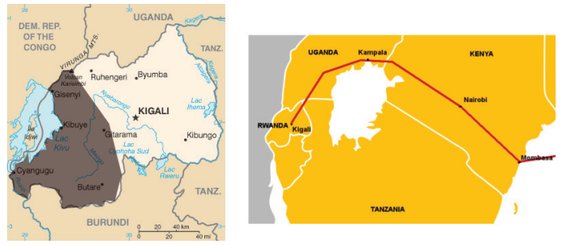

Figure 3: Geography of Rwandan tea: (left) highlighted area shows core Western and Southern tea growing regions; (right) principal export path of tea from Rwanda to Mombasa auction, and then international shipping.
Source: Wikimedia open maps (Wikimedia 2012)

Figure 3 details the geography of this tea value chain in more detail. The core tea-growing areas in Rwanda are in the upland western and southern regions (Fig. 3, left). Given that tea leaves quickly begin to wilt once they are cut, they need to be quickly processed in factories to produce acceptable tea. This means that tea factories are located in close proximity to clusters of tea-growing plantations. Many of the tea factories tend to also have offices in Kigali, where transportation and the marketing side of production is organised. The right-hand figure highlights the lengthy transportation through three countries required for Rwandan tea to reach the Mombasa auction, and ultimately international markets.Value chain perspectives on Rwandan Tea (Figure 4) outlines the Rwandan tea value chain in more detail, and presents some images of the processes involved. In Rwanda the basic green leaf is produced by three different key actors:

- Tea estates – Land in close proximity to, and part of tea factories (see next section for details on factories). Tea is harvested by employed tea pluckers

- Land sharing cooperatives – Three specific locations in Rwanda where groups of farmers jointly share and manage land. These are closed membership cooperatives linked to government land reassignments in the 70s. Farming is overseen by a cooperative association where profit is distributed amongst members

- Smallholders – Smallholders produce green leaf on small plots, where member-funded cooperative associations[10] (with employed staff[11]) organise the aggregation, transport to factories and payment for green leaf. Farmers are paid based upon weight of green leaf produced.

Of the total land producing tea, the majority (66%) comes from smallholders whose land area tends to be very small (<–0.5ha). One can attribute issues around quality and yield mentioned above to this arrangement; diffusing improvements and building-scale efficiencies is difficult with such a large proportion of smallholders. Cooperatives are linked to an assigned factory where green leaf is processed.

On the marketing side, the value chain shows some additional paths; that is, tea can also be sold to direct buyers, thereby avoiding auctions, and also to regional packers who focus on local markets. These two additional paths represent attempts by firms and policy makers to upgrade Rwandan tea, which will be detailed in the next section.

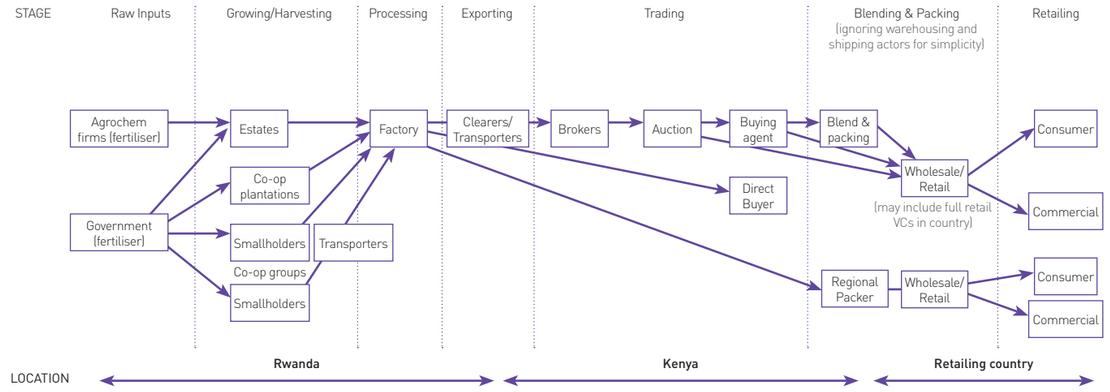

Figure 4: Detailed value chain for Rwandan tea production
Source: Fieldwork

Figure 5: Selected processes in the tea value chain. (top row, l-r) Tea plantation of large factory; local transportation for green leaf from smallholders to tea factories; Rwandan tea factory. (bottom row, l-r) Local packing of tea; storage in Mombasa ready for auction; broker tea tasting of client tea

Level	Value per Kg ($)	Value per Kg (RwF)	% of auction fee	Notes
Price farmer sells green leaf to factory (Farm gate price - FGP)	$0.17	117	-	NAEB specified FGP minimum payment Q4, 2013.
Average farmer income per kg of made tea (a)	$0.60	364.6	22%	Sample farmer costs based on fieldwork: • 25% plucker payment; • 18% fertiliser; • 7% transport to factory; • 10% co-op feed (excludes other costs such as taxes, maintenance)
Warehouse fee	$0.04	27	1.5%	Based on IFAD 2011 – 1.54% of auction price
Brokerage fee	$0.04	27	1.5%	Based on IFAD 2011 - 1% of auction price
Transportation costs to auction	$0.13	90	5%	Based on IFAD 2011 – 90Rwf/Kg
Factory share of auction price	-	-	70%	Does not consider other costs such as taxes, bank fees etc.
Average auction price Mombassa[14]	$2.64	1769	100%	NAEB 2013 stats
Indicative retail price	$9.60			For indication only – retail price of typical 1kg of blended loose leaf tea in UK supermarket.

Note: (a) This figure is included as a way to calculate the farmer income per kg of made tea sold in the auction (given that the farmer is paid per kg of green leaf)

Table 2: Value breakdown in chain in Rwanda 2013
Source: Drawing on fieldwork and (ibid., NAEB 2013b)

Value and risks

Table 2 draws on field data to calulate value along the chain (focussing specifically on actors in Rwanda). This table particularly highlights the low percentage of the final auction price that accrues to Rwandan farmers, and indeed more detailed calculations of farmers' finances have suggested that only around 25% of the farmers' share of the auction prive (the $0.17) is actually profit (IFAD 2011). In landlocked Rwanda the high costs of fertiliser inputs and transportation particularly contribute to reducing small farmer profits due to the remote location of Rwandan tea plantations.[12] Figure 6 shows how value is split in Rwanda in comparison with other East African tea producers. It highlights two key differences. Firstly, in Kenya, where farmers own factories, the value accrued to farmers is far higher in comparison with its neighbours, and we will see this affects how empowered farmers are in production. Secondly, transportation costs become increasingly significant in Rwanda as compared to Kenya,[13] and thus production closer to the Mombasa auction is at a distinct advantage.

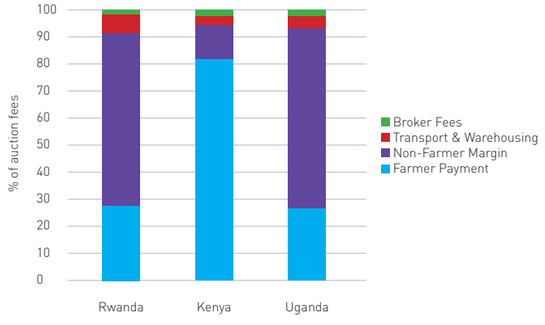

Figure 6: Comparative breakdown of costs in East Africa[15]
Source: Drawing on fieldwork and (FAO 2013a, FAO 2012, IFAD 2011, NAEB 2013b, UTA 2012)

Beyond the low share of value there are also other risks for Rwandan actors selling CTC tea. Firstly, as outlined by a 2007 Rwandan advisory panel for the tea sector, CTC tea consumption is growing very slowly, but at the same time there is increasing worldwide production (OCIR-THE 2006). Thus, oversupply of generic black tea in the market is likely, resulting in a long-term reduction in prices of black tea. Secondly, tea farmers face instabilities around market fluctuations of this commodity when it is sold in the global market. Fluctuations have been particularly marked in recent years, when crises in Egypt – a key buyer of tea – resulted in significant downturns in the price at auction, affecting farmers throughout East Africa.

Given these risks and low value, Rwanda has looked to a range of approaches to upgrading their value in the tea value chain, to improve income and to strengthen the sector against future risks. Given that such elements have been articulated as core to the strategy it is important to understand them in more detail.

Tea upgrading

Through an inspection of policy and traingulation from interviews, the current approaches to upgrading value in Rwanda are outlined in Table 3. Here we employ four ways of understanding 'upgrading', as outlined by Kaplinsky and Morris (2001), in order to clearly separate the nature of these processes.

Given that the upgrading paths outlined in Table 3 encompass the different ways by which actors in the Rwandan tea sector are seeking to improve the income they receive, beyond short-lived benefits from market price fluctuations, these processes of upgrading are crucial to explore in analysis of changing connectivity. Has changing connectivity enabled upgrading? And for which elements? If this has not happened in practice, then what are the barriers that limited the effectiveness in this sector?

Upgrading	Presence of Upgrading in Rwanda
Process (i.e. improving processes for efficiency)	Ongoing modernisation of the sector includes initiatives to improve process at a farmer level in terms of yields, factories upgrading of machinery and production as part of privatisation
Product (i.e. new or improved products and/or marketing of products)	Moving beyond bulk CTC tea to produce: • Speciality single estate or premium branded Rwandan tea • New production such as orthodox and green teas. Key focus of 2005 strategy (OCIR-THE 2006) • Tea conforming to certified standards (Fairtrade, Rainforest Alliance etc.)
Functional (i.e. capturing value by performing new activities within value chain)	Moving to higher value roles in value chain. Key mentions in policy and interviews related to: • Packaging of tea, in Rwanda for international sales, to increase value • Increasing retailing of packaging tea in East African region • Development of direct sales to buyers thus Rwandan tea becomes more involved in marketing and retailing roles
Chain (i.e. moving to associated or new value chains)	Little evidence, government mandates around factories and growers mean it is difficult to move to new value chains. Only examples found were a few tea factories offering tourism services related to tea, but these were minimal

Table 3: Upgrading in the tea sector
Source: Policy review, Fieldwork

5c. Global production networks and Rwandan tea governance

Outline

As outlined in the literature review, adopting a production network perspective allows an analysis of a wider set of networks (locally, within sectors and globally) which orientate the value chains of Rwandan tea production. In particular, two aspects are considered. A close analysis of *power* can help to integrate a clearer perspective on how chains are orientated, and the sources or barriers to change. *Embeddedness* highlights how production is embedded within specific networks and territories that exert influences on activities.

Power

As mentioned in the previous section, power in the tea sector is unequal, and developing country producers and processors tend to be orientated by the buying power of large retailers and buyers (Fairtrade Foundation 2010, IFAD 2010). For instance, a Mintel report (2007) suggested that in 2006, 58% of tea bag sales in the UK came from only three brands. With such a small number of retailers and a diverse and large number of producers, power is inevitably being concentrated in the buying power of these firms (Fairtrade Foundation 2010).

Focusing on this type of power is especially important in Rwanda; particularly when it comes to Rwandan firms wanting to sell quality and certified teas. For producers to be successful, they need to follow closely the needs of the retailers. For instance, one large firm, Unilever, is increasingly committed to 'Rainforest Alliance' (Rainforest Alliance 2014). After 2015 it has pledged to solely buy certified teas, and thus Rwandan producers have little choice but to adopt these standards, given the size and importance of this buyer. Adoption of standards can bring extra costs in terms of reforming production processes, training and auditing, which may accrue little increase in profit to Rwandan actors at the end of the day (over and above the fact that they are still able to sell to the same buyers). In addition to dictating activity through buyer power, there is a growth of shareholdings in Rwandan tea factories by large tea buyers (for example large Indian tea firms such as McLeod Russell and Jay Shree). This is liable to lead to control by these firms not only over products, but also in how processes, distribution and divisions of labour are organised.

Yet, the industry is not solely characterised by strong buyers. Looking more closely at the production of tea in Rwanda, we can see that it contains a complex mix of market exchanges (e.g. the Mombasa auction), state-defined relations (e.g. rules compel Rwandan cooperatives to sell to only one specified factory and define the price of this exchange), and somewhat more captured elements (e.g. smallholder farmers need to be part of local cooperatives to sell their green leaf). From a GPN perspective, as we outline later, these provide additional sites and actors from which power can be substantiated as well as highlight possible cleavages in power from tea buyers. It is important to explore these more complex flows in our analysis (Coe et al. 2008, Ponte & Gibbon 2005).

Following this notion of more complex compositions of power within tea networks, we highlight two additional sites of power; the regional network structure around tea production, and national institutions. In terms of regional networks, in East Africa the East African Tea Trade Association (EATTA), which regulates the Mombasa auction for tea, is able to orientate some activities of tea in Rwanda. For example, forms and rules that orientate auction activity set out the common ways of trading in the region, defined by the activity of a small number of firms with a long history in the tea sector, located in Mombasa. As highlighted in discussions with one tea consultant based in Kenya, the agendas and priority of such actors can diverge somewhat from that of buyers,

> *"these are long established companies and contacts we have. Since I have been in tea, these companies are in tea ... this is the legacy from the British people who left some laws and rules, and with EATTA you cannot operate if you are not a member of EATTA. Before you become a member of EATTA[they] must look at you and find if you will not mess the system, and you come in after [here referring to the membership process for EATTA]. You don't just produce tea and suddenly you are in the market.*

> *"...For you to get in, I have got to know you, I have got to introduce you and a second person has to second you. It is like a clan!"*

Given that the majority of Rwandan tea is still traded in the East African auction, Rwandan actors have little choice but to be part of these networks. In one sense, these established networks align with the goals of retailers and buyers by allowing trade to be undertaken with trust, and to ensure that market transactions are efficiently completed. Yet the politics of EATTA is driven by well-established brokers and buyers in Mombasa who act as gatekeepers and who introduce other agendas into the tea sector. They tend to be interested in self-preservation, both of their roles and of the auction, and in defining regional rules and regulations that may align more closely with Kenyan agendas for the tea sector (as by far the largest tea producer in the region) as opposed to wider East African tea production.

In terms of national actors, the Rwandan tea sector is defined by its history and the rules that govern it. Albeit within market structures, the Rwandan government follows quite an interventionist approach to production, in line with Rwanda's wider planned market strategies. This approach positions the Rwandan National Agricultural Export Development Board (NAEB) as a central policy actor in how the tea sector operates locally.[16] As outlined throughout our interviews, market actors tend to have flexibility within certain parameters (e.g. production, competition, selling of stakes) but the guiding strategy driven by NAEB is never far away (e.g. tea-factory building programmes, minimum prices for farmers' green leaf, allocated regions of land assigned for tea only). Again, such national agendas may diverge from tea buyers and retailers.

Embeddedness

The concept of 'embeddedness' allows us to highlight details of the specificities of production networks and places that shape activity, and indeed support or diffuse power. In the tea sector, we argue that embeddedness is a significant factor in shaping activity, given that many processes of tea occur outside lead firms in the value chain through arm's-length exchanges.

There are a number of rules that East African tea firms follow to be part of the tea supply chain. These link to the work of EATTA to ensure fair markets, but they also are embedded in the history of tea in East Africa and old colonial institutions, as well as historic structures such as tea boards and trade groups.[17] While tea markets may have evolved since then, these elements have been more resistant to change.

There are also less tangible forms of network embeddedness that fit less well into GPN models, but that are vital in regulating activity in tea. One important example relates to the norms of tea blending and consumer preferences in terms of what is regarded as "normal" tea. Again this is grounded in the history of tea production and consumption, and the relative resistance to change orientates the types of blend, country of origin, production processes and branding in the sector. In Rwanda this embeddedness is particularly important, as it creates limits to how Rwandan tea might upgrade.[18]

A second level of network embeddedness relates to the notion of 'value-added' tea - that is, higher quality teas, including 'ethical' or Fairtrade teas – that allow producers to extract higher prices. For firms to be embedded within value-added networks, they need to both build new links, particularly with standards bodies such as ISO and Fairtrade, and to abide by an increasing number of rules and regulations concerning quality and standards. Tea customers, retailers and buyers are demanding these standards and thus there is growing demand in the Mombasa auction (and through direct trade) for teas that are certified or that have achieved set quality standards. Thus in Rwanda, gaining certifications and standards is crucial to being economically viable. All the factories we visited reported they were in the process of gaining certification, and five of the Rwandan factories had a certification of one form at the time of research. However, as Nelson and Pritchard describe

> *"Entwined within these developments is a new politics of audit, whereby the ability to export is predicated on the ability to document and authenticate." (Neilson & Pritchard 2011 p.6).*

In this new 'politics of audit', standards and quality needs require firms to embed within new networks linked to standards bodies, quality auditors and field training staff, and these orientate many norms of activity. Such processes can bring benefits by improving practices and quality, but they also extend control of production to a minute level, without buyers needing to direct micro-management of processes (Dolan 2010, Neilson & Pritchard 2011, Ponte & Gibbon 2005). Thus, how standards are enforced has great relevance to understanding the power relations in the network.

In terms of territorial embeddedness of firms, there are also nationally defined rules and processes that orientate activity and value in the tea sector. One example is the separation of farm and factory ownership in Rwanda, something that emerged as an outcome of the form of privatisation of the sector[19]. This discussion of division of labour was emphasised in several interviews where this division was compared to Kenya. As outlined by one cooperative chairman, advances in grower technology link to ownership and willingness to invest,

> *"[in Kenya]...they advance in technology because all their industries belong to growers. Imagine if we could have that factory, all benefits and advantages would go to the grower. You see that we have 15% of shares whereas in Kenya 100% of shares belong to tea growers."*

We can highlight two additional elements of territorial embeddedness. First, some Rwandan actors interviewed discussed the problems around getting loans in Rwanda for expansion (both at a factory and cooperative level) and this difficulty highlights the role that financial actors play in how GPNs evolve in Rwanda. Multinational firms tended to be able to access more advantageous loan rates in global markets, whereas local firms tended to have to rely on local finance, where interest rates were high. In a sector where financing modernisation and upgrading is crucial to future competitiveness, unequal access to finance can constrain the ability of local investors to compete. Second, and interlinked to the previous point, is the role in Rwanda of external and aid support in tea. During the field research phase it was found that a huge number of what seemed like local initiatives – irrigation, certification training and audits, seed nurseries, factory purchases, road building – had actually been funded and set up by international aid agencies and donors.[20] Aid and its presence in Rwanda has significant implications on why GPNs might be favourable to linking into Rwanda. Further the evolution of aid and bilateral support in countries like Rwanda (i.e. increased or reduced support for agricultural production) might lead to future risks of GPNs relocating away if the sector develops less favourably to them.

A production network perspective on Rwandan tea

In sum, global production network perspectives highlight further considerations for empirical analysis of connectivity. As will be outlined in the next section, the expectation for changing connectivity is that it is a crucial element in improving organisational activity, reaching markets, and thus supporting policies for process upgrading in the tea sector. However, production network perspectives highlight varying sites of power and ways in which firms 'embed', which may reduce, resist or redirect these processes. The key components discussed around power and embeddedness are summarised in Figure 7 which will be used to understand wider activities as changing connectivity emerges.

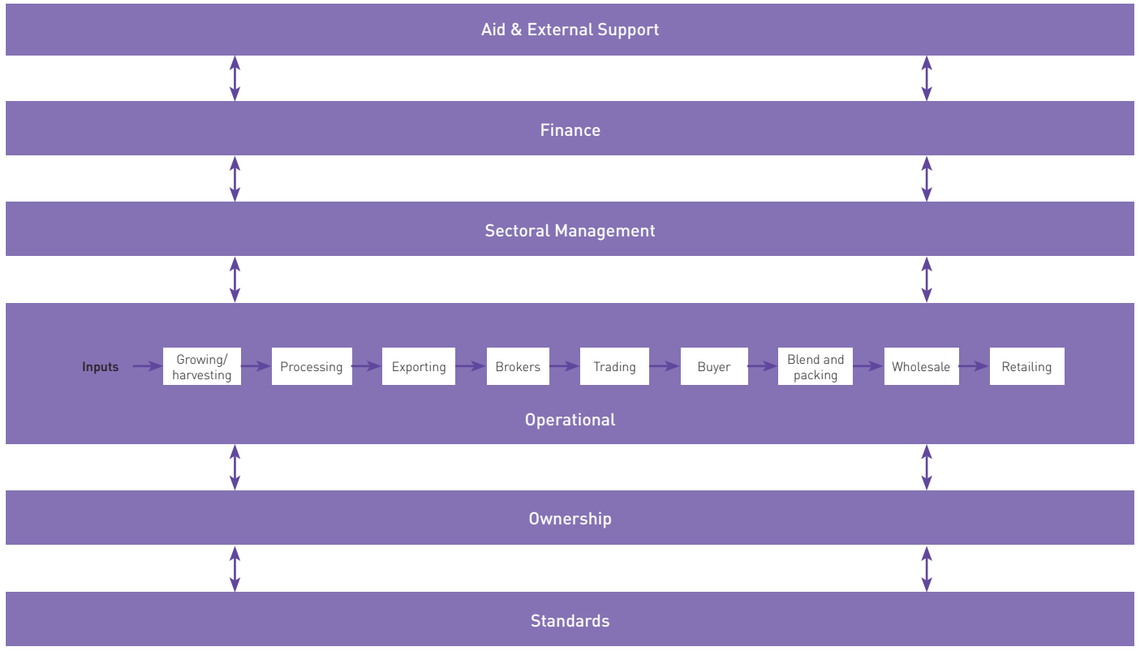

Figure 7: Extended elements involved in the tea sector[21]
Source: Fieldwork and insights adapted from (Dicken 1998 chap.3)

6. CHANGING CONNECTIVITY

To begin to understand the effects of changing connectivity in the tea sector, as part of interviews we investigated the ways that interviewees connected to the internet. Table 4 provides an indication of the typical types of connectivity split down by tea value-chain roles. Nearly all actors in the value-chain use the internet in some form in their operations, but access occurs in a variety of ways as summarised below:

- Higher-spec mobile phones – It is possible to connect to the internet using high-spec mobiles. Factory managers and private firm owners often had such connections, but these were generally secondary to higher-speed wired connections in their work places.

- USB wireless modems (medium but inconsistent connection, prepay, low cost) –When connected to a PC these provide portable access through 2.5G or 3G mobile networks and were popular due to the simplicity of access (they use the same pay-as-you-go credit as for mobile phone calls). The high level of coverage is particularly relevant for rural cooperatives where other internet access options are unavailable.

- Broadband (medium/high connection, postpay, medium cost) – This denotes higher speed 'always-on' networks in Rwanda. This can be through WiMAX networks which connect into an ISP's dedicated wireless network. A few interviewees in urban areas in Kigali (and also larger firms in Mombasa) reported to also connect directly into fibre linked to municipal fibre.

- Custom links (medium/high connection, postpay, high cost) – This access enables broadband internet connection in more remote areas. It was used by large rural tea factories, through custom WiMAX or microwave links from towers in the factory grounds, which transmit the last mile to core fibre networks of mobile ISPs. Custom services can be provided by ISPs but due to their custom nature, set-up is expensive and thus only possible for the largest factories.

At the producer level, cooperatives nearly universally used mobile USB modems connected to their PC. Even in larger cooperatives with a more substantial number of staff, staff tended to share one or two USB modems amongst a larger number of PCs for access.

At a factory level, some factories had internal local area networks within the factory buildings, and these linked into broadband offerings that are emerging in Rwanda, but many factories were too remotely located to be able to receive this service. In this situation some had paid for expensive custom WiMAX connections with large transmission towers located within their grounds. However, others continued to use modems.

It comes as no surprise that the larger actors upstream in the value chain, those involved in Kenyan operations, were almost universally connected directly into broadband connectivity. Such firms are far larger, urban located, and more globally connected into buyers.

One can see a double disconnect in terms of connectivity. Larger firms in the value chain, typically located in urban centres of Mombasa and Nairobi, operate in more connected environments, and have consistent broadband. Rwandan factories, particularly those owned by larger investors, are looking to invest in higher-speed technologies such as rural WiMAX, and with well-connected offices in Kigali that allow higher-speed connection. Other factories and cooperatives are typically forced to survive on less consistent and lower bandwidth wireless modem connections. Finally, tea farmers rarely connect to the internet, where costs are high and seeming utility of the internet is low. Distant communication is thus done through mobile.

In Rwanda, the introduction of fibre-optic links has brought about a reduction in costs of internet access, and the ownership of modems and use of the internet attests to this reduction of costs. Some cooperatives interviewed were quite small in terms of resources, but even here PCs and modems were present within their offices, even if PCs were still mainly used for offline purposes for financial data around tea production. The tea sector by its nature is spread throughout the country, and faster connections are still too expensive for some factories and cooperatives; even those that are well organised and that employ multiple full-time staff. As highlighted by one large factory owner:

"We have tried with fiber-optic and it is very expensive...we wait till the cost will come down."

In terms of quality, internet users were somewhat satisfied by the fact that connections are now affordable, particularly those who had only recently started using modems. However, there was quite a large number of complaints around inconsistent connection with wireless modems as accounted by two factory owners located in more rural Western locations:

"..at peak hour at 5 o'clock when everybody is on internet. That is where internet becomes very slow.

"There are times when it goes slow and it delays you when you have an urgent report to send. This is due mainly to the climate and you have to wait a bit and when the climatic conditions are good, you retry."

Such problems can affect all connections that have wireless components (point-to-point, WiMAX, modem), stemming from weather conditions, terrain, network saturation, power outages or ISP inconsistency. Indeed, a significant minority of the interviewees had sought to try multiple different providers in an attempt to improve consistency and speed. This tactic did provide some back-up when a particular ISP was having problems, but comparative gains in terms of speed or consistency seem to be small between firms. Thus, whilst improved backbone connectivity has been beneficial to diffusion, the geographical spread of tea highlights the 'last-mile' problem, where even connected firms experience problems in the linkages between the backbone and their PC.

The discourse in the popular press meant that the majority of respondents were well aware of the coming of the new 'fibre-optic' connection into Rwanda; however, with the prevalent inconsistencies and 'last mile' problems, many assumed (mistakenly) that the new fibre had nothing to do with their connections, as highlighted by comments of actors in the Rwandan tea sector:

"Internet is important and we use, though it is still a problem because we do not have access to fibre-optic." (tea factory, modem user)

"I always expect it [internet] to be better and faster than this with this fibre-optic but it is not yet good and it is money invested but not used."(tea factory, WiMAX user)

"We should have access to this fibre-optic which will help us to get information from our competitors." (cooperative chairman, modem user)

More problematic, inconsistency in some types of connection meant that some actors elsewhere in the value chain did not believe that Rwandan factories were connected at all. For example, a manager of a tea warehousing firm in Mombasa stated,

" if you go to a farm in Kiringi in Rwanda or Sorwarthe in Rwanda, or in Uganda ...they don't have the internet, so that slows down the communication network, because of lack of easy reach of the internet."

These auction actors require coordination and communication as tea is transported to the auction. Thus, perceived lack of connection can reduce the prospect that factories can compete against those better connected (say in Kenya).

In sum, variation in connectivity comes from multiple conditions. Costs, perceived usefulness of the internet, and geography determine the type of connection adopted in the value chain. Together with different levels of connectivity, inconsistencies and problems in the operation of connectivity can be seen to exacerbate this variation. Notably, modem connections are more prone to dropouts and saturation than more costly connections (although this is not to discount the importance of dropouts where high-speed connections are used in more critical applications). These disconnects affect the types of activity and create barriers to using connectivity in production, and determine the types of communication, systems and the flows of knowledge that occur.**r** summarises this by relating typical connectivity to the mapping of value chains. It also provides a basic summary of how connectivity is being used with respect to these roles, which will be expanded in later sections.

Role	Best connection type					
	None	Mobile phone	Modem/PC	Broadband/LAN[a]	Custom[b]	Not stated
Cooperatives[d]	1[c]	0	12	1	0	0
Factories[d]	0	0	5	2	4	2
Private Owners[d]	0	0	0	4	0	0
Brokers[e]	0	0	0	4	0	1
Warehouse/Blenders[e]	0	0	0	4	0	0
Buyers[e]	0	0	1	6	0	2

Notes

a)"Broadband" category in the tea sector typically related to higher speed connections through WiMAX networks

b) "Custom" category refers to rural WiMAX links that enable remote factories to connect at higher speeds than modem.

c) One cooperative reported a broken modem for the previous several months.

d) Located in Rwanda

e) Located in Kenya

Table 4: Connectivity by role[22]
Source: Fieldwork

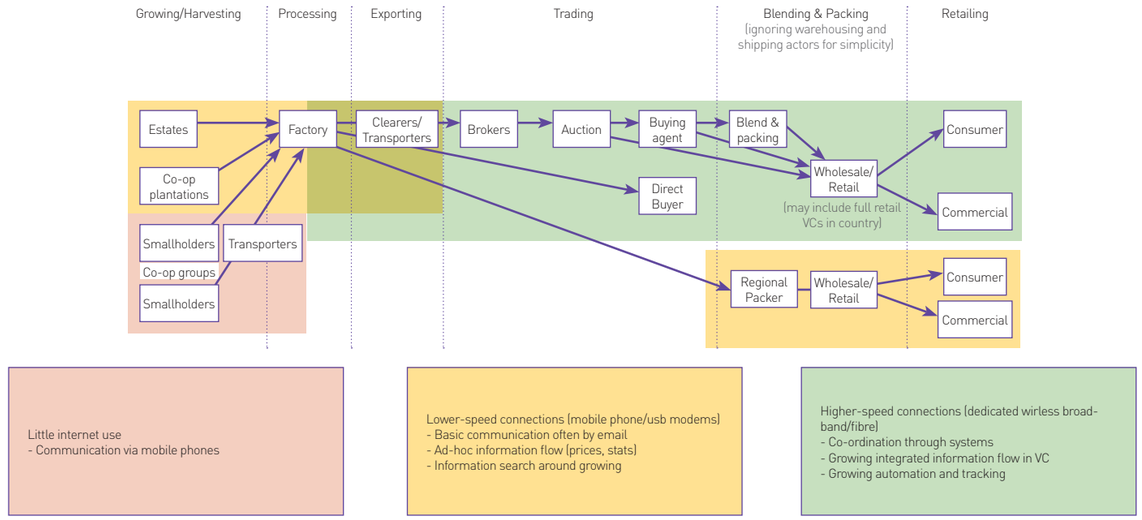

Figure 9: Value chain of tea, overlaid with typical internet levels and use.
Source: Fieldwork

7. EFFECTS OF CHANGING CONNECTIVITY ON PRODUCTION

Drawing on empirical work, we now examine in more depth how changing connectivity links into the networks of production. In particular, we do this through examining four key aspects of the potential of connectivity that were highlighted within the media and political expectations: *visibility, information and communication, new services,* and *knowledge provision.*

7a. Visibility

A key aspect of improved connectivity is that it can potentially allow firms to improve their visibility and thus better sell their products and/or attract new interest in their goods. Hence, we examine tactics around how connectivity has been used to make firms visible.

There is little evidence that many firms in Rwanda have been able to harness better connectivity to build any significant amount of visibility or build new or stronger relationships. The majority of actors in Rwanda, and even some of the larger brokers and warehouses in Kenya, did not have any form of web presence. No cooperative was found to have a website, and tea factories tended to integrate into their parent firm's global websites, with only minimal coverage of Rwandan tea. Intermediaries such as brokers, when they have websites, are mainly informational, with basic firm information and contacts as shown in Figure 10. With all these actors, social media use was also very low.

In comparison, a cursory examination of the online resources of retailers from wealthy countries that are involved in Rwandan tea (such as Birchall Tea and Taylors of Harrogate) shows that they include websites with a range of material around the estates and narratives of farmers and ethical activities, some examples of which are shown in Figure 11. It is therefore, interestingly, the end-retailers (who are furthest from the sites of production) rather than producers themselves that seem to be most interested in telling stories and visually representing those sites of production.

Many factory managers do see a potential in having more of a web presence. However, it tends to be a low priority, even for factories who are looking towards product and functional upgrading. For example, the director of one of the larger, more independent tea factories, who was involved in upgrading and would seemingly be a candidate for more direct online linkages to consumers said

> *"[W]e do not have a website. We are looking on how to build it. We came up with proposals but have not gone in deep."*

The low interest in building online presence reflects the specific form of markets, where relationships between tea producers, intermediaries, buyers and retails are static and well known. This is illustrated by an IT manager in one intermediary involved in a number of elements of trade in Mombasa:

> *"... they said let's have a website, then they started saying we know each other, and there are things like that in tea ... the thing in tea is that in tea everybody knows each other and talks to each other, so, you might find that someone is not even on the internet or they don't even have a website but they are a big tea company."*

One would imagine that this actor, heavily involved around logistics, warehousing, blending and exporting would see potential in being at least visible in some form. But in markets where consumers use a few well-known retailers of tea, and where these brands are themselves owned by an even smaller number of food retail firms[23], there is very little perceived benefit for producers in online visibility and promotion.

Within the literature around tea, the focus has often been on European and American buyers, yet the existence of buyers from other markets outside these regions seems to offer some potentials, particularly in terms of the buyers in large Middle-East and Asian consuming countries, such as UAE and

Figure 10: Examples of homepages of two broker websites. Both provide some firm information, but clearly this is focussed on business transactions, and some information is out of date

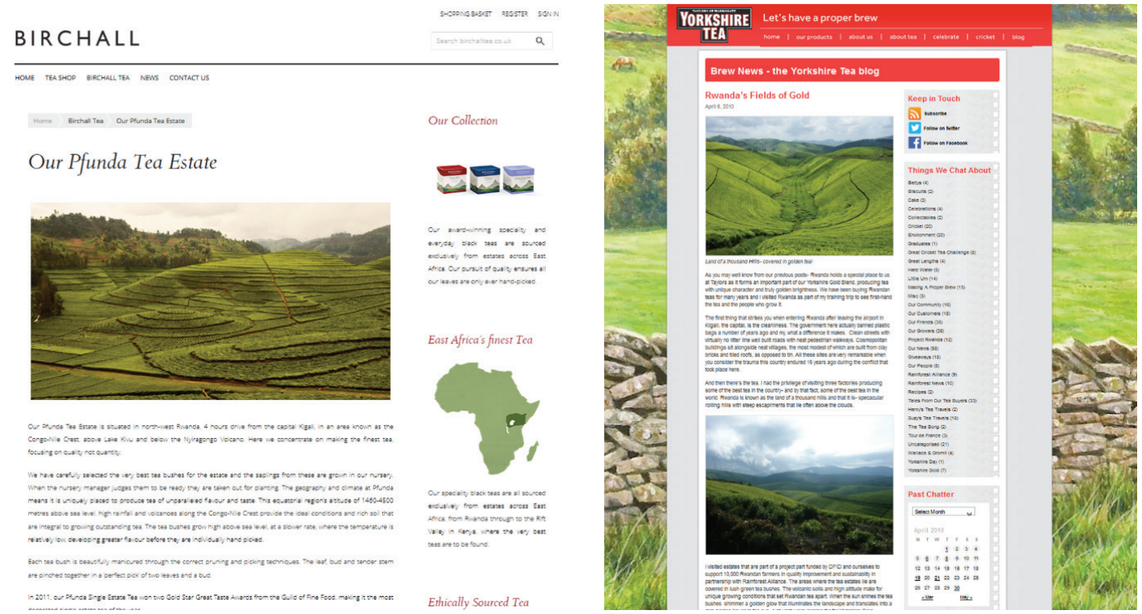

Figure 11: In contrast to Figure 10, two retailers with some focus on Rwanda include more image-heavy and customer-focussed pages on their website

Pakistan. Thus, tea producer websites, where they did exist (even basic ones), did generate some enquiries, and some even resulted in occasional direct sales around these markets.

However, whilst buyers may receive enquiries, more consistent trade is liable to come through the tea auction. For instance, one private owner of a Rwandan factory outlined how the emergence of new buyers do result in direct enquiries. Whilst this interest may increase sales it is more likely to come through the auction than through direct sales.

> *"I mean over years we have for example a new country like Kazakhstan, some of these people come to Mombasa and they have talked to EATTA and seen who are the main exporters and then they contact you. So sometimes there is a part that is not familiar with this market and I contact them or you get a new company."*

Another Rwanda-located factory owner said that they received regular online enquiries, but that direct sales are limited by material activities such as tasting

> *Interviewer: "You said you had a website..Do you actively market to these buyers online?"*
>
> *Interviewee: "The tea sector is a bit different yeah, people need to taste. They don't trust you because you say it's good. What we do, we send every truck that comes in. We send samples to our buyers. From that way, they can just taste and see it."*

What these quotes highlight is that there are norms around tea selling in the region – auction buying, tea tasting, becoming approved by EATTA (i.e able to purchase from the auction). Thus, even in these cases where producers might receive direct approaches, networks structures lead towards activity going through the auction system in the long run, rather than by direct selling.

There were some exceptions in terms of visibility online, with some actors in tea beginning to have a more active web presence. More active use was specifically found in the cases of tea packers and sellers who were selling into less established markets such as East Africa. When building markets where there are no clear channels and gatekeepers, the internet and social media were seen as one crucial channel within marketing. Yet, given very modest growth in local consumption of tea (NAEB 2013a), only a very few firms were focussing on local consumption.

Where many actors felt that web visibility had been beneficial, was for East African tea in general. By increasingly being online, visibility has contributed to improved recognition of East Africa as a viable source for tea production (as opposed to India or Sri Lanka). This is as exemplified by the comments made in interviews outlined below:

> *"I think it has been a good tool in making us, Mombasa, Kenyan and African tea more accessible. I think it has been a good way of opening us up a bit and that is it." (broker with trade in Rwanda)*

> *"At least people can look on the website and know that Rwanda is producing tea and it's going to go into market research tools....A few years ago when we used to go to tea trade and people would start thinking, 'Rwanda producing tea? Never heard about it' But people are coming informed." (Rwandan manager of tea factory owner)*

Online visibility has not only put the region on the map, there were also some discussions that showed that buyers who traditionally might have sourced tea from elsewhere were becoming more aware of the benefits of East African tea (such as all-year seasons) through research online. As one Kenya-based tea policy actor suggested,

> *"..Mombasa is playing a great role that is an attraction for the producer in this region to bring tea in one place and for the world to come to Mombasa. So, this is a global tea auction, it is not a Mombasa tea auction."*

This potential of country/regional visibility, implies that alliances of sectoral actors might usefully play a stronger role in online visibility. One Rwandan regulator who had some responsibility around tea marketing was asked about this potential.

> *"Of course when it starts as private sector it becomes difficult to bring it all together as a single government brand....The challenge I'm finding here is having privatized the factories and the production. It's becoming difficult*

to bring people back together to understand the importance of a national brand.

"...they already have parent companies that are already doing the marketing for them, that are well established in the market place, and they may not see that much value in bringing in Rwanda at that point in time"

As outlined, there are elements that limit coherent visibility. Privatisation and fragmented ownership of factories have reduced the potential of more collaborative national marketing.

In sum, there was little evidence of Rwandan firms or even their private owners using online visibility as a way to increase their customers. There is some evidence to suggest that online benefits come more from interaction with lesser known or niche actors, and building awareness and marketing of East African tea as a whole rather than for a specific firms, or tea plantations. It could be beneficial if policy could guide a more coherent approach to visibility and branding of tea production.

7b. Information and communication

Two areas around connectivity and information flows are explored in this section. In terms of tea factories we explore the ways in which information and communication flows offer possibilities for larger tea factories in Rwanda to more directly interact with buyers in the "global marketplace". In terms of tea smallholders and cooperatives we examine if new information flows allow them to become more responsive to the needs of markets and improve their value from production.

Information and 'the global market'

In the case of tea factories, we examine two key flows of information and communication into global markets: communication from factories related to the Mombasa auction, and flows of communication from tea factories to their owners and onto retailers. Each will be dealt with in turn.

In terms of information flows related to the auction, auction brokers have traditionally played a central role. These are firms who are the factories' representatives in the tea auction, making money through commission.[24] They are therefore the ones who link producers to buyers by sending samples of tea for tasting, and the ones who deal with the logistics around the auction. Intuitively, with changing connectivity and new flows of information and communication online, one might imagine that the role of brokers might decline. Connectivity in factories and private owners has led to a growth in online information and services – online tracking of tea movements, online auction e-catalogues of traded tea lots, and digital payment (outlined in the next section) – which would seem to be providing new ways for factories to communicate without brokers. Together with these flows, changing connectivity has afforded Rwandan actors better email contact with warehouses, clearers (dealing with cross-border and export papers), shippers, and buyers in Mombasa. Thus, changing connectivity implies a reduced role for these brokers in the auction, and (in the longer run) more direct communication between factories in this globally orientated market.

However, brokers have sought to defend their role around the auction in several ways. First, they continue to emphasise the importance of the auction's face-to-face exchange and their own value, as outlined by one manager in a brokerage firm who was directly involved in auction activity.

"...my business is much better when I can see physically, I can know whether you are giving 2 or 3$ but if I can sit here I can't know your body language to know if by looking at you I can get that 1 more dollar. I think that this is something we're going to lose if we go that way."

Sellers and buyers (factories, retailers) around the auction, whilst valuing some activities of brokers, remained less convinced of brokers' arguments. This was best put by a manager of one of the largest exporters in Mombasa, who implied that these arguments are overplayed:

"...they were saying the human factor, negotiating a price cannot be replaced. They want the human factor to be there and also they get the feeling of the value of a tea in a room when they are doing an auction.

"Like you would find if you are selling a piece of art and everyone is raising their bids or people are looking excited just from the facial expression you would think that this piece of art is very expensive and they would give probably a very high bid on it, so they are using the same kind of logic."

Being an established actor, brokers have built on their contacts to evolve into an 'infomediary' role, providing a whole gamut of market intelligence that factories are demanding. Infomediary activity includes sharing information such as auction price and comparisons, suggestions of market needs, and feedback on tea quality from factory tastings. This type of information allows them to build new roles, as described at length by one manager of a brokerage firm directly involved in selling tea from several Rwandan factories,

"..they [tea factories] want to know who has bought their tea and [from] which market ... they want to see which gardens [plantations] are benchmarked against them, and whether they have performed better this week or worse.

"And then they might want a comment from us, either separately to say why, and we say these guys are actually making cleaner tea, here it is more attractive and I think that is why they are getting 5 cents a kilo more.

"They may want to know how do we compare this to this time last year, what are the averages, last year in July what were the average prices, ooh $3.22, this year $3.38, okay why is that, yeah so any kind of comparison."

As described by this manager of a brokerage firm, provision of information, which draws on brokers' knowledge and connections, is beneficial. Yet, there are issues here that these established actors are able to exploit the auction, and their advantageous access to information, to retain their role. For example, one policy actor in Mombasa closely involved in the auction highlighted how certain price information resides with brokers, which make it difficult to reform the process.

"... when we are seated here and we think there is some data we don't have, we have to call these players [brokers], each individually, because if we need to get KTDAs [Kenyan umbrella tea producer] information we have to call all the brokers because all the brokers deal with a number of KTDA factories ... You know they have to start by looking at their sheets of data so that they tell you that Mununga [Kenyan tea factory] was USD 3.10 or Mununga had these packages which had this net weight, or we start now checking on 10 catalogues for different lines."

Here the policy maker highlights that in the auction, tea factories sell through a specific broker and sales information is not kept centrally but by each brokerage firm for their own 'auction lots'. As the quote reveals, this silo-ing of information is problematic when those not directly involved in the auction want aggregated information or comparisons. Without good social networks with the appropriate people it may be difficult to track down this information.

Brokers do provide appreciated services in linking between tea buyers and sellers, by playing a liaising role through supplying tea samples to buyers and ensuring that payment is undertaken. Indeed, as can be seen in the value calculation in Table 2 previously, the level of value they extract (1.5% of the auction price), whilst significant, is never mentioned as one of exploitation by tea sellers, given that they do offer and undertake useful services. However, there are also problems. The whole process of the auction in Mombasa leads to tea produce being transported and stored in an intermediary location, which is costly. According to the value chain calculation in Table 2, this is a minimum of 3% of the price (brokerage and warehousing costs), but once less visible costs are taken into account this is likely to be higher; probably in the region of 5–10%.[25] Further, as the need for transparent information grows, it is important that auction and surrounding actors are able to fulfil the demands of buyers and sellers. Yet the infomediary role of brokers partially rests on their privilege to access particular types of information and historic knowledge. This access strengthens their economic position and makes it difficult for them to be fully disintermediated. However, their presence and privileged position breeds mistrust in the auction in other parts of the chain. Many buyers consider some elements of the auction 'backwards' or 'quaint' in a modern market, as outlined by one large exporter in Mombasa

"For me they [brokers] are a complication... what is happening is we cannot buy directly from the producer at the auction, we have to buy, we have to buy from a broker, so the brokers are the only people who sell tea at the auction, so they actually control the auction that is why there is that perception of a cartel.."

Further, when information is less freely available, those producing and processing tea may question the information from their broker representatives. For instance, during the very recent drops in prices in the tea auctions, tea producers were communicating with brokers to understand the reason for price decline in the auction, so they could remedy it. But, as outlined by one private tea firm manager in Rwanda they mistrust the information they get back from brokers:

"No, no. It's nice to know what's happening in the market. But unfortunately ... the last two years have been bad. Last year's been very poor and it's going further down this year. So, I wonder why. We do keep getting information from people, but sometimes I think its rubbish that comes. What everybody does is justifies his position."

In general, the auction as an institutional process for tea has a number of positive aspects. For sellers it provides the ability to reach a global market, and it provides transparent prices based upon tea quality, as opposed to based on any other networks or linkages with retailers. As one Rwandan tea policy maker highlighted, in terms of the auction:

"They don't give us low prices ... They don't favour Kenya, they don't betray foreigners because for them what the market wants, they buy.

"When the best teas are from Rwanda, they give best prices. If you make the worst tea they don't care, they give you the lowest price. Today, I don't have any other consideration besides the quality."

For buyers, such as a general manager of a tea buyer based in Mombasa, it provides convenience to have a range of tea grades in one place, and fair pricing.

"the good thing about this old auction is that everybody is there and you know what's being sold and it's transparent."

However, when the auction is resistant to change -- particularly in terms of the presence of brokers -- buyers and seller see it as slow, inefficient and with problems in information delivery. With the problems in information flows, both buyers and sellers of tea are beginning to see direct sales as a more viable way forward.

Beyond information flows around the auction there has also been growth in the use of connectivity in the tea sector in other ways, for example in organising production. As described by a Rwandan factory manager located in the south of the country,

"Internet only helps us to communicate with the headquarters, it has not yet been used in tea production system."

Much of the flow of information is around private owners tracking activities going on around processing and movement in value chains connected to their factories. In Rwanda there were ad hoc elements to such communication, with flows often non-standard and based around email interactions. Nevertheless, we also perceived a growing trend of private firms beginning to look into system integration with factories – that is, linking the information flows of factories with the information systems of their owners. For instance, two private owners in Rwanda are quoted below, both with multiple tea factories. As can be seen they have integrated their central systems with their factories to be able to track processes remotely.

"Actually, we are recording everything in the system starting from the green leaf to the final product and you can see it linked to our marketing and our sale departments ... You can just look into the system and see what they are doing. It's easy."

"[Tea weighing administration] ... happens at the factory level. It's monitored on a central server system - it is all interlinked."

This information flow and emerging systems integration exploiting broadband connectivity is having significant effects on large firms. For instance, as one private tea factory owner highlighted, it simplifies the way private firms receive information.

"[W]e have been able to achieve a lot of efficiencies in terms like we have integrated our ERP [Enterprise Resource Planning System[26]] ... so once the factory dispatches ... they are able to see it when it reaches Mombasa ... I think that kind of integration has brought efficiencies."

At a tea factory level, as outlined by one factory director, system integration has reduced the need to run separate systems – one in the local factories and another within the head office or private owner.

"... before it was automated, we were running a local copy because of a different software, the link was not good, when the link was good we discarded what we used and joined [the firm's global] system and now that was possible because of the fibre."

There are costs and risks that come from replication of information in multiple systems, which are thus reduced with changing connectivity. These quotes offer illustrations of how systems integration enables large firms to better plan and coordinate activities in the value chain. Further, systems integration enables value chain planning, monitoring and coordination to be undertaken by private tea owners located in Kigali, or even internationally, who now have increasingly granular information about the processes occurring in factories.

System integration also allows for better traceability in value chains, particularly for tea firms selling higher-value and certificated tea where tracking the batches of tea across firms, regions and continents is aided by online systems and resources. The importance of traceability was emphasised by one large buyer of Rwandan tea in Mombasa:

"[T]here is a requirement for all teas to have certain information like garden information and ... so from the producers to the receiving export company they know this tea has come from this particular garden."

For tea firms, traceability was supported by systems that allow tracking of tea movements, as highlighted by a tea factory owner

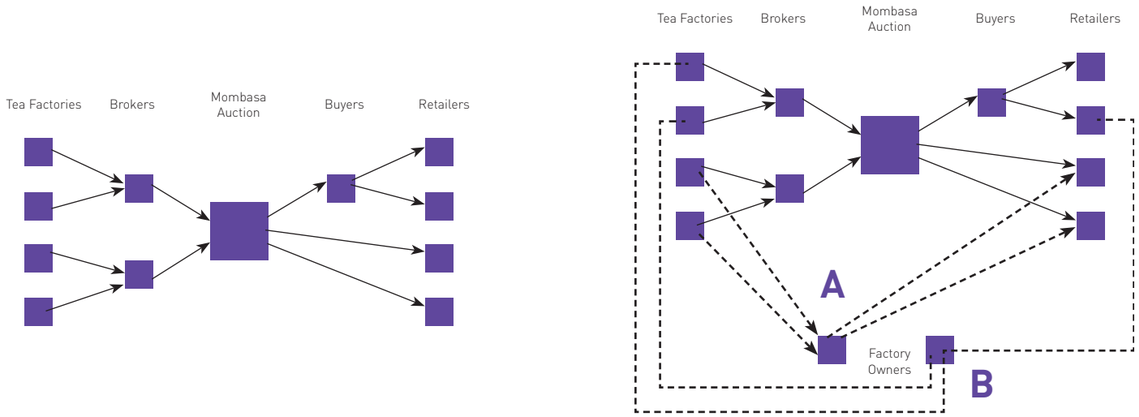

Figure 12: Earlier flows of goods and information in value chain through the auction (left), and growing paths aided by connectivity (right).
Key: (A) – Factory owners are well networked into retailers. Thus a more direct path of information and goods.
(B) – Factory owners are part of one of the buyers or retailers, so information and goods may pass more directly.

"we specialize on production in terms of the ISO process, good manufacturing practices, ethical trade partnerships, fair trade conditions ..."

Interviewer: "Do you think having the internet and software changes the ISO certification?"

"Traceability is right from the supplier back to the factory; we are able to track it back to the guy who plants the commodity."

Thus, beyond providing coordination for private-sector tea factory owners, integrated information flows are not only driven by private firms integrating into production, but also by the more distant needs for traceability linked to buyers and retailers.

In sum, information requirements are changing. Rwandan tea factory owners are increasingly interested in detailed market information – tea prices, market status and comparisons – to inform their strategic and production decisions. Tea buyers need the assurances of traceability of tea to ensure that they meet the food safety, quality and certification requirements as they sell tea to retailers.

As outlined above, there is growing dissatisfactions among both tea buyers and sellers in terms of the information flow around the tea auction. At the same time, commercial private owners of tea are driving new systems integration for better coordination and traceability. Together these two points highlight a shift in the loci of information flows in the value chain, which now increasingly revolve around private firm owners, as outlined in Figure 12.

This shift in loci suggests trends towards more fragmentary value chains. Market relationships between buyer and sellers were previously mediated by the auction, with transparent pricing and selling processes. New trends suggest a movement towards more proprietary relationships between private tea firms and buyers, sharing information and selling more tea directly[27]. In the medium term, these growing relationships may lead to a decline in the benefits of the auction, as this intermediary, if not completely disappearing, nevertheless begins to lose its significance.

Information and linking to farmers

As outlined in the previous section, whilst farmers will tend to communicate using mobile or face-to-face, there was evidence of internet use among farmers' cooperatives. These new flows have not fully replaced previous modes of interaction at a cooperative level, rather they can be thought of as an additional element of the 'information ecologies' (Brown & Duguid 2002, Davenport & Prusak 1997, Nardi & O'Day 1999) which form part of the flows of communication and knowledge in these relationships.

For cooperatives, the predominant use of internet connectivity is in information transmission and communication, involving communication in the value chain such as invoicing factories, receiving initiatives from regulators and submitting tax returns. Below, two tea cooperative managers in Rwanda highlight some examples

"[W]e most exclusively use the internet when we are making monthly taxes declaration to the Rwanda Revenue Authority or when we are merely updating our antiviruses, things like that. We don't normally have enough time to browse online and search for information and things like that."

"We are mostly convened to a meeting because normally information is often shared with the rest of the coops managers through a meeting summoned by FERWACOTHE [cooperative federation], then the rest is informed via emails."

As can be seen, growing connectivity allows convenience, but communication is less extensive, with much of the business of cooperatives still not done online. Tea pluckers get notebooks marked with weights of leaves plucked, and co-ops enter data manually, tending to use custom excel sheets to manage payments between factories, farmers and pluckers. Payments are typically done manually through SACCO accounts.[28] Thus, disconnects in connectivity type between the better connected factories, and the cooperative outlined previously, are mirrored by disconnects in flows of information. Better-connected factories increasingly share production data, coordinated by private owners, but the less-well-off cooperatives remain isolated, and online information flows and integration are still quite minimal.

It is more difficult to implement improvements based on connectivity at a farmer level due to the lower capacities and quality of connections mediated by technology. This is illustrated in discussions with one cooperative leader about the changing connectivity.

"[we use the internet]... in our offices. But it is still a problem because the workers in the fields are not connected and most of them have little or no skills in using internet"

Indeed, another leader of a more advanced cooperative had observed new technology, which might improve farmer activity but which had not yet been implemented.

"[F]rom the visits we learn a lot and some of the technologies we apply them immediately but others are not applied because of lack of capacity ... we found a new [automatic] way of weighting but it requires a strong wireless."

It is unclear who should drive information improvements amongst farmers. Better-financed factories would seem the natural choice as they are the most closely linked to farmers and cooperatives, and they process their own green leaf. Yet, there appears to be a reluctance in factories to invest in systems that are difficult to implement where connectivity is inconsistent and capacities are low. Where connectivity and users are more sporadic, such as among cooperatives and farmers, this can create confusion and problems around information flows in the value chain. One example of unclear information flows is confusion in how cooperative respondents talked about receiving information about farm-gate price. The farm-gate price determines the rate that the farmer gets per kilogram for green leaf. The price has recently been reformed so that it tracks the dollar price that the associated factory sells at in the Mombasa auction (where each cooperative is connected to a specific tea factory). Pricing calculations and market price information are thus essential so cooperatives can verify and track prices, and plan activities in the factory.

One cooperative accountant described the common way that dissemination of price information occurs, through email from the regulator NAEB:

"We receive the list of market prices in our emails because you know farmers from different zones do not have the same fixed prices."

In contrast, the chairman of another cooperative suggested that NAEB provided an online information resource to check prices.

"We can just go on the internet and see what they [NAEB] are saying. Every information about it is available online ... there is a web portal/ platform that was created by the NAEB. Once you browse on that, you access all information you need."

Other cooperative leaders implied that getting further information was problematic. As two cooperative managers outline below, lack of information can lead to arguments between cooperatives and factories, and cooperatives and NAEB, respectively,

"[sharing information] ... That's indeed a problem because the management at the factory differs significantly with the management of the cooperative. Whenever we ask the factory management about this information [market prices of tea], they will always tell us that they also know nothing about pricing at the market."

"[W]e have entered into a row where we argue that we still haven't been able to access that web page [auction price webpage]. I wouldn't state that somebody prevented us from accessing the page at all cost but yet nobody seems pressed to educate us on that matter which would enable us to know what is happening in Mombasa in real time and other markets which are kept relatively confidential."

As can be seen from these quotes, there is an inconsistency in information flows (or lack of) between cooperatives. This is not a trivial concern, as the key goal of the new pricing system was that it was supposed to drive tea growers to improve tea quality by linking them to market prices; but when cooperatives are not able to consistently gauge prices then this policy just creates confusion rather than drives equality (IFAD 2011). This example of communication breakdowns to the cooperative level was not an isolated case. Similar issues were also seen around information related to agricultural research and in fertiliser distribution to cooperatives, and it was not clear that all cooperatives were receiving complete and timely information.

In these cases, information flow issues down to cooperatives and ultimately farmers mean that these activities are being rendered ineffective because the information is not consistently diffusing down to those directly involved in tea growing. It also creates tensions and suspicion between value-chain actors who communicate based upon differing expectations.

Summary

In sum, changing connectivity has enabled a growth in communication and flows of information in Rwanda, particularly around tea factories that are becoming better integrated and coordinated into communication, notably through system integration with their private owners.

We have also identified two points where there are barriers to effective communication flow – around brokers in the tea auction, and around communication into cooperatives (and ultimately farmers). Brokers draw on their experience and advantageous access to information to subvert any attempt to disintermediate them, but this may reduce the effectiveness of the auction. Cooperatives, which are less consistently connected online and which exist in uneven relationship to factories and regulators, tend to receive sporadic or incomplete information, which limits potential growth. In both cases, these barriers to effective information and communication cause suspicion in value chains, which in the longer term might result in relationships being reconfigured.

7c. New services

As can be seen, whilst sporadic at a cooperative and farmer level, digitally mediated information flows are becoming more established. Alongside these flows, is the growth of 'services'[29] that increase efficiency and allow easier tracking of commodities throughout the chain.

'Upchain' services

Most service found in the Rwandan tea sector related to activities 'upchain', that is services that occurred following the processing of tea. Examples of such services in tea include:

- Online logistic tracking services provided during tea transportation, between tea factories and the tea auction in Mombasa
- An online system for banking payment and transfers related to the Mombasa tea auction
- Online electronic catalogues which detail the tea being sold at auction
- Automated sending of tea parameters (weights, grades) to 'head office' post-processing as part of system integration (see previous section)

These new services are beginning to transform flows of information, shifting from human-directed flows of information such as email, to more automated massaging and integrated tracking.

According to Rwandan factories, automation had supported improvement of the professional service and quality of goods. One director of a tea factory outlined how these services allowed his administration to quickly check logistic flows online and anticipate any problems

"We have a system to make follow-up for the tea in processing, in transportation and in the warehouse in Mombasa through the sharing of information"

Automation benefits the bottom line. One tea consultant with a focus on the tea sector recounted how a factory owner in neighbouring Kenya (where services have been longer established) had relied on services to reduce corruption amongst its workers:

"[T]hey wanted to know exactly where are the losing the tea, as a matter of fact it was collusion between some weighing clerks and the drivers and the weighbridge people [automated weighing service during transportation].

"[now] ... they automate and link the weighbridge with the internal systems on the processing end. We now have a weighbridge module in our software that captures everything that has gone through the lorry ... you can actually compare what was lost on the way and you can tell whether there is something that you can factor in."

In this case, services (automation of factory parameters and weighing) combined with integrated systems allow owners to ensure that corrupt practices are reduced. Given the complexity of such activities, organising and transmitting such information would be far more difficult to undertake manually without automation.

Joint initiatives in services around the auction process have also affected the value chain. Two examples are provision of 'e-catalogues' from the auction, in both human- and machine-readable forms; and the creation of electronic payment systems for quick payment of auction costs, simplifying management and logistics. The direct benefit of e-catalogues mainly comes to tea buyers and blenders post-auction, by allowing them to easily access online a list of tea for sale in the current auction, and integrate these into their systems. This integration is essential for ensuring continuing large retailer interest in the Mombasa auction[30] – indirectly supporting Rwandan tea. Tea factories recounted that electronic payments from the auction had led to reduced time for clearing of goods at the auction, resulting in direct savings from lower storage costs of factories. With year-on-year production of tea growing in Rwanda (see Figure 2), information flows, and particularly these new services and automation, are contributing to expansion.

Virtually all of these introduced services have a history of resistance and slow piecewise adoption. Services tend to 'encode' certain rules and assumptions, or privilege certain actors in the value chain more than others, and so these services becomes a site of contestation. For example the online electronic payment system was introduced to allow more secure payment and simplify tracking of tea sales in the auction.[31] Rwandan factories initially refused to use the electronics payment from the auction due to perceived assumptions embedded in the system, as described by the general manager of a Rwandan private tea factory ownership firm:

"People out of Kenya are almost voiceless ... they [the Mombasa auction] have gone on an online banking system, we refused to go; why? Because they brought in a bank that was a Kenyan bank and they decided money from auctions should go to that bank and apparently they could give financial advantages to Kenyan companies and we're not Kenyans ... We didn't see anything for us in it."

As outlined, the electronic payment system was set up using a Kenyan bank, Stanbic, where auction payments would be made. For Rwandan firms, such as the respondent above, auction payments would thus need to be rerouted from this bank across borders to their core Rwandan account, incurring additional charges. For a small producer country like Rwanda, it is difficult for the specific needs of Rwandan tea-sector actors to influence the trajectories of services related to the auction, given their small size. Yet these external changes can result in new demands and challenges for Rwandan tea firms where Rwandan firms have to *adapt to* externally defined services, where some of the idiosyncrasies of the Rwandan tea sector might not be 'encoded' in such services. For instance, in the above case, Rwandans are faced with a choice of opening Kenyan bank accounts and incurring extra costs, or waiting for brokers to receive and then forward payments.

Service automation is also a strong driver of potential disintermediation, leading to resistance. For example, the auction e-catalogue was resisted by many brokers who were fearful of their established positions. As recounted by one policy maker involved in the Mombasa auction

"... you know change is always a big fight and the issue was that those who always wanted to believe that whatever has been sent must exactly look as what has been given by the brokers and for them they believed in hardcopy coming from the auction or broker."

In this case, brokers resisted by suggesting that buyers would be confused if e-catalogues did not resemble the paper 'hardcopies' available at the face-to-face auction. Further, as recounted by one manager of a brokerage firm in Mombasa, at the time some brokers had very low levels of capacity in terms of PCs:

"... I remember one guy saying 'I don't even have a PC' but we told him either you join or you would be left behind."

In the e-catalogue case, with insistence from buyers the service was introduced and brokers adapted to the changes. However, a more disruptive service (a proposed online e-auction at Mombasa) failed because actors were strong enough to contest it. This discussion around integrating elements of online trading into the tea auction has been fraught.[32] As outlined by an East African consultant the e-auction would be particularly beneficial in supporting tea buyers:

"[W]hat will change is that with the online auction it breaks the boundaries so people in the US will be able to access the information ... so they don't have to come all the way to Mombasa to buy tea, they can access our tea from our systems, trading can be done online and [we] will ship the tea and they will wait for the tea on the other side."

For buyers, this service was a crucial step in opening the Mombasa auction to global markets, and ensuring that it remains competitive with other auctions. Regional Indian auctions have already established e-auctions.

In this case a larger selection of the established actors – brokers, blenders and warehousers located in Mombasa strongly resisted this introduction, because they felt that it threatened their position. Here they again drew on the importance of materiality in tea selling. For instance when one manager of a brokerage firm was asked about this, he outlined how a lack of presence might result in collusion in the auction if actors were not physically co-present

"[T]he resistance [to the e-auction] was based on the fear that the buyers may collude, you know they are seated behind a machine like this .... in an office somewhere. Being traders they may want to buy teas at the lowest prices possible and it is easy for five of them to come together and say, hey you buy for us we are not going to push you and then tomorrow somebody else does the same and the next week somebody else does the same."

Another brokerage firm manager emphasised the importance of brokers in the distribution of tea-tasting samples to buyers, which would be difficult if brokers were disintermediated by an e-auction:

"[T]he producer cannot come from Kericho or Rwanda to come and start distributing samples here, so we do that, he sends us a small sample ... you understand, tea is not sold like coca cola where every bottle is exactly the same as the other, you understand, people like to taste. If you go to Lipton now for example or Unilever on the tasting day of the auction ... all the teas from all the brokers may total 2000 different invoices so they will taste all those 2000 cups of tea."

Downchain services

The services described above are mainly being established upchain around post-processing functions. They affect Rwandan actors externally, but introduction is initiated external to the country. 'Downchain services' in Rwanda, that is services in tea growing and processing, are still in their early stages. However, some factories are introducing services to allow automated tracking of tea processes. For example, there has been factory process automation around weighing pre-processing, post-withering[33] and post-processing that has been fed into information systems to allow both local managers and private owners to monitor the parameters of processing. At a farmer level there is also a growth in portable electronic weighing machines[34] to track individual farms and tea pluckers automatically, as shown in Figure 13, feeding the information into factories and private owners through connectivity.

Figure 13: Example of an electronic weighing machine. Whilst its design and readout are simple, it has interlinked Bluetooth, which allows weights to be transmitted to mobile devices

As with other services, automation vastly simplifies production processes and reduces the volume of manual activities that need to be done. For instance, electronic weighing systems allow tea pluckers to weigh their plucked tea leaves in the local 'weighing station' and this information is stored and (nearly) instantaneously transmitted over mobile internet from the weighing stations into factory systems. Electronic weighing machines reduce the need for manual input of weights of plucked leaves and allow better forward planning in factories through automated mobile transmission of data. During interviews, many respondents throughout the value chain regarded systems as beneficial in that they replaced previous, often manual operations. Private-factory owners find that such services enable simplified payments to cooperatives and farmers, as this data is now available in information systems. As described by one general manager of a firm that owns multiple tea factories:

"It's very easy to know at the end of the month, very quickly, total how much you owe him and you can pay him and you know what has gone into the factory. We used to do it really manually, it's very costly. This is not very costly."

For cooperatives, weighing systems also convey benefits, as outlined by one cooperative chairman who had recently begun to use these systems among smallholder farmers

"The electronic system is, in our opinion the best system ... there are two obvious advantages: You see the data as soon as you have weighed. That means there is no loss recorded on the way as data are seen immediately on both ends. With the old system, we used to record slight differences in what has been weighed in the fields and what has been weighed at the factory but today it is all the same. The new system is much better and the beneficiaries never stop commending its benefits."

Yet, for all the positive discussions of such innovation, there are also indications that service introduction is beginning to have some negative effects. As part of technology upgrading, services tend to allow reduction of staff numbers dealing with processes and administrative matters around these information flows. For example in Kenya, we discussed automated weighing with a manager of a firm that coordinated multiple tea factories. This organisation had pioneered these technologies and where systems were now well established they had reduced the number of staff needed:

"[A]s a result of this solution [weighing automation] we were able to reduce the number of, the amount of labor, we used to have about 30 clerks depending on the size of the factory but now we are able to deal with between 7 and 10 clerks."

Services reducing the labour force in tea is an issue that is still emerging in Rwanda. Rwandan actors are still keenly aware of this issue. One factory general manager who had subscribed to fair employment principles as part of his fairtrade goals was already keenly aware of the conflicts between these new efficiencies and his labour obligations

"[we have become through connectivity] ... more efficient but of course we have need to look at employment, because we are a big employer, there is lots of employment there. We will be taking it easy we not be pushing too much to reduce people, that is not our objective."

Some tea cooperatives even see their goals as going beyond simply increasing profit. This was outlined by one cooperative manager in a tea-growing region marked by high poverty:

"At this stage, we haven't reached the point of using sophisticated machinery because we still need to employ local people who are out of work or simply are unemployed"

Thus, where cooperatives see their key goal as provision of employment as much as supporting smallholders, there may be a limit to the level to which services are adopted. Evidence around service automation at a farmer level also highlights potential negative disintermediation. Whilst these systems do improve efficiency for farmers and factories over older manual-entry methods, services can reduce the role of cooperative associations, by significantly reducing their role within daily operations such as green-leaf collection, weighing and payment, and so marginalise them. One leader of a smallholder cooperative who has adopted new electronic weighing describes the problems:

"... maybe before, we were used to weigh green leaves for ourselves as a coop. But today, the weighing work is done by the factory and they use electronic balances ever since they have been given the responsibilities of weighing

"Weighing is now theirs, and transportation falls under their responsibility as well as any other necessary aspect required by the farmer ... it goes without saying that the payment to the farmer is now also a responsibility of the factory.

"as you can note, the coop is just there doing nothing ... the bonds which once connected farmers to the coop have now shifted to the factory therefore, and as result, farmers do specifically find themselves more directed to the factory than to the cooperative."

In this case, new services that simplify processes mean that responsibility can be transferred away from tea cooperatives when smallholders interact more directly with tea factories. As yet, the use of such technology is in the early stages, but as in the case of the factory and cooperative in the quote above, private owners are interested in combinations of electronic weighing, emerging mobile money payment, and factory automation for efficiency. There is a threat that farmers will become disengaged from the cooperatives, which have traditionally been the main source of advocacy for the rights of growers and pluckers in the tea sector in Rwanda, and that stronger relationships with tea factories will lead to less equitable terms of employment.

In summary, new services mirror many of the changes that were outlined in terms of information and communication flows in the previous section. As with information flow, services contribute towards improved efficiency and transformation of the sector. Evidence suggests that adoption of such services and solutions can be beneficial to increasing the capacity of tea production whilst allowing it to remain manageable.

As the previous section detailed, changing connectivity led to changing flows of information and communication that marginalised certain actors and enhanced others, and the same can be said for automation. Indeed, automation can be seen as more disruptive in the way that it 'encodes' previous manual relationships, making them more difficult to change. Automation that has looked to modernise the auction has occurred, but those services that might remove brokers and auction intermediaries have so far been resisted. Private-sector led investment and support has also begun to push the adoption of services at factory level, but efficiency gains at this level may be at the expense of employment in the tea sector. There is also a suggestion that it will marginalise the role of cooperatives within the value chain in the future.

7d. Knowledge provision

For larger firms, online sources and discussions do have a growing influence in how knowledge is acquired in the tea sector. In the tea production process, for example, online knowledge was used in cases where firms looked to upgrade machinery. Online knowledge was particularly important for newer firms where knowledge within the firm was potentially less. For instance, one director of a local tea packager outlined how they researched new equipment:

> *"We ordered some machines from Brazil that blend the exact quality and quantity."*
>
> *Interviewer: "So how did you find this company in Brazil?"*
>
> *"When you are involved in a business, you do all that research ... we used internet."*

Similarly, in discussions with a general manager of one of the new tea factories in Rwanda, owned by a local investor, the internet was part of the research process.

> *"For suppliers and tea machinery, we have a short list of the serious companies and contact them with email and send the requirements for the tenders."*

As can be seen in these cases, online knowledge aids discovery and decision making, but is often supported by more direct offline approaches and research. However in general, knowledge flows around modernisation and new approaches are mainly coming from other sources. Within tea factories, knowledge flows came when consultants and staff were recruited in the newly privatised sector. One factory director, for example, highlighted that the biggest positive change in the past few years had been the recruitment of experienced staff, typically from other tea-growing regions. In this case they had a Tanzanian general manager, a maintenance manager from India, and a plantation manager from Sri Lanka. Another factory owner of one of the higher-quality producers of tea outlined how they were approaching upgrading processes:

> *"[W]e have a consultant here, who was here yesterday; we're trying for him to make a value added plant tea [Orthodox or green tea production] and to show us possibilities and cost and to try to see what investment in terms of construction, in terms of equipment, in terms of marketing."*

In this case, knowledge of product upgrading came more from an external consultant than it did from internal managers consulting online sources.

In terms of tea growing and harvesting, important knowledge flows were also found. Knowledge needs at this level particularly related to cooperatives gathering information to help solve problems for their farms. These flows were more complicated and often travelled through multiple media, in line with the idea of these actors' embedded changing connectivity within wider information ecologies. Yet, changing connectivity did have some influence. One leader of a smaller cooperative, with highly dispersed smallholders, outlined that the cooperative had been able to support smallholders in their problems by searching online

> *"... if we want to know about any tea illness, you can have a look on pictures on internet ... For example we may download a coloured picture but it becomes a problem when we want to show it to the growers because our printer is a black-and-white one."*

Online visual materials such as those in Figure 14 can provide useful guidance to tea farmers on identifying problems with their tea plants.

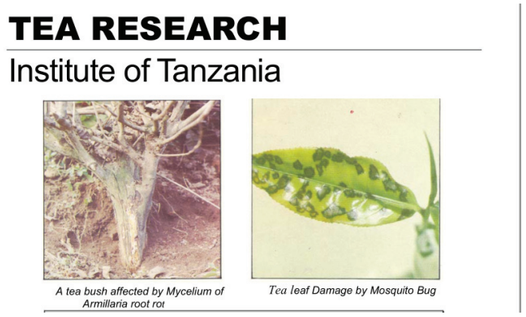

Figure 14: Example of online material on tea pests and diseases. The Tea Research Institute of Tanzania has online resources on tea pests available to download.

In another interview with an agronomist in a remotely located cooperative, online research had also been used to update knowledge on practices:

> *"[W]e do research for the fertilizers to know how this or that kind has been impacting in tea plantation. And we use internet in this to see if what they tell us is what is revealed by the results of our research or others' results."*

Knowledge also flows in terms of how cooperatives communicate with each other. Cooperative employees were often linked initially through attending meetings or visits, and this often began exchanges of knowledge. For example, in the extended quote below one accountant in a tea cooperative described how her approach to accounting and tracking tea payments was developed from working with other cooperative accountants:

> *"[knowledge sharing] ... is something that normally happens between people in same job position [in cooperatives]. Like for instance me, there are people with whom we used to exchange information professionally, we could, you know email to each other or place phone calls to one another in case there is something that one doesn't understand.*
>
> *"I always say that people who long ago had to fill and treat these data manually had a lot to do on their desks ... I went to a study tour and learnt how other people doing the same job as me were handling that case. They had to process where the farmers' data and the pluckers' data was used separately. We used to do it all together and this was difficult to sort out. You understand that was something I learnt from others. It helped me so much indeed.*
>
> *"... if ever I have any other problem that I have difficulty to handle, I may call a colleague from another cooperative and ask them how they would handle the problem in the similar situation."*

In this case, knowledge sharing around how to best record and track farmer activity in the cooperative comes from a combination of online and offline sharing. Accountants within cooperatives first met by attending meetings or training, and ongoing conversations (some online) led to knowledge sharing and improvement in practices.

Another cooperative chairman described how he exchanged information online with other chairmen around the price of green leaf, now that farmers receive prices according to the market value, which embeds more tacit knowledge flows:

> *"[W]e will get in contact with each other after seeing the prices.[...] I will ask them what they are doing, what fertiliser they are using, if they are using pesticide ..."*

In general though, agricultural knowledge for co-ops and farmers comes through value chain links with factories, and connections to regulators and agriculture extension activity. Most co-ops employ or have access to agronomists. Factories can also provide assistance and management help. There are also numerous NGO-led schemes that support new initiatives and knowledge flows, such as seed nurseries and training for certification. Typically, as highlighted in the examples given below, these flows do not make use of digitally mediated connectivity.

> *"[S]ervices are provided by the factory. We tend to share information with the cooperatives. For example we did a full soil relief analysis at the end of last year. We brought the tea research foundation of Kenya they came in the area." (factory closely linked to cooperatives)*
>
> *"We have agronomists who studied and who monitor each and every plantation activity. There is no other special technology except to have skilled and experienced people." (tea cooperative)*
>
> *"In our cooperative, most of our members do not know the importance of internet and think that visits should be a first source of reliable information."(cooperative manager)*

As can be seen in these cases, knowledge comes more through offline networks than online ones.

In summary, for larger firms in Rwanda as they link into global value chains, firms tend to look to external knowledge as central to upgrading, and the easiest way to acquire knowledge is through employing staff and consultants. For cooperatives and farmers with lower access to connectivity and less idea as to where to get knowledge, knowledge typically related to the mandated 'top-down' flows in the value chain (from tea factories and NAEB, to tea cooperative associations, to farmers).

More ad hoc activities, such as self-discovery on the internet for tea factories and informal knowledge sharing amongst cooperatives, were found but at a much smaller level than the use by tea factories. Knowledge flows when online, tended to be one-way and re-enforced the existing structures and norms of tea production (e.g. the uneven relations between factories, and tea cooperatives and farmers).

7e. Summary

To summarise, changing connectivity has had varying effects on tea production. *Visibility* is the least conclusive effect, where established static networks make it difficult for firms to gain from increasing their visibility. In terms of *information and communication flows*, there is an increasing volume of digitally mediated communication, particularly for Rwandan factories, as they become more integrated into the tea sector globally. Integration is further advanced by the way these flows are automated in a range of *online services*.

However, even with the new digitally enabled and increasingly automated flows, not all value chain actors are part of these fully integrated flows. Sometimes avoidance is a wilful choice, for example tea brokers have so far resisted complete sharing of some information and automation around the auction. At other times, such as actors growing tea, lack of information comes from other factors – poor connectivity, lack of skills, and investment. In both these cases, exclusion leads to longer-term changes in the configuration of value chains.

In terms of *knowledge*, knowledge acquisition was predominantly offline and mainly mirrored common operational relations – through consultants and staff from private owners into tea factories, and from policy initiatives down to cooperatives and farmers. Some more vibrant online knowledge processes were discussed which might support improved processes of learning, but these have so far tended to be informal, taking a back seat to more formal structures and managerial and policy edicts.

We have outlined that changing connectivity influences the way that actors in the value chain are included or marginalised, and how connectivity forefronts specific processes and norms in production over others. Ultimately this will result in connectivity being more beneficial for those who are central to these flows, and who are able to dictate online developments (such as private firm owners) than for those who are marginalised and thus excluded from the sector (such as tea cooperatives and farmers). These issues of distribution of gains will be explored in more detail in section 9.

8. INNOVATIVE USES AND CHALLENGES OF CHANGING CONNECTIVITY

Based on the empirical analysis of changing connectivity, and its uses and effects, outlined in previous sections, this section draws out the key findings as the basis for wider discussion around value chains and global production networks as connected to Rwanda. In particular, four key themes are detailed: the challenges of online visibility; connectivity and the growing integration of value chains; discussion of disintermediation in the tea sector; and challenges around rural information, knowledge and connectivity.

8a. Barriers to visibility

Consumer norms and the rigid form of value chain found in the region have had a significant effect on the effectiveness of online visibility for generating demand. Tea, as it is commonly drunk by consumers, is blended to ensure that the taste remains consistent, and Rwandan teas typically need to be blended with other teas. Added to this, buyers are highly concentrated, particularly in Europe, and the networks linking to Rwanda are strongly policed through institutional actors such as EATTA. These sources of power and network embeddedness lead to challenges in terms of online visibility where activity, rules and norms are embedded within global production networks that connectivity does not appear to be overcoming.

This work also highlights some potential suggestions for future directions for tea. One direction relates to promoting East African tea more widely online and particularly in non-standard and emerging end-markets. Such approaches, whilst not completely breaking away from the power flows in global production networks outlined above, at least provide more room for online interaction as evidenced by Rwandan firms in the previous sections. As outlined in Figure 15, the buyer profile in the Mombasa auction is not as UK/EU dominated as other literature suggests (Fairtrade Foundation 2010, Neilson & Pritchard 2011), and with lesser-known buyers there is less knowledge about who key buyers are, and whether they dominate in their respective markets to the same extent as they do in Europe. Additionally, anecdotal evidence suggests that tea buying and drinking habits are also quite different in these locations; for example, there is a lower interest in quality and standards amongst Pakistani buyers and in the blends of tea drunk in the Eurasian and Middle-Eastern states. Further research could investigate these regions in more detail, given that knowing how East African teas can be adapted and promoted in regions where it is less known could be important in maintaining growth.

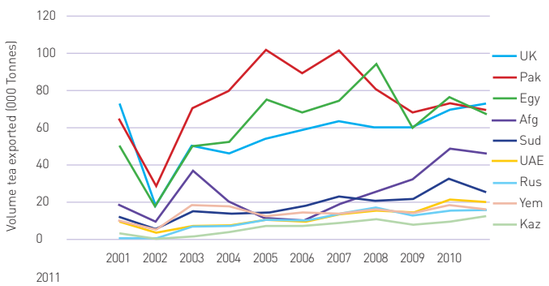

Figure 15: Top exporters of tea from Kenya[35]
Source : FAOStat database(FAO 2013b)

8b. Automation and integration

As alluded to previously, the growing communication, automation, tracking and integration of tea is the major innovation in the East African tea sector. While Rwanda might be a little behind its Kenyan neighbour in introducing these systems, processes of integration and automation are rapidly evolving. Connectivity is the infrastructure that will enable a wider volume of information to flow from Rwanda into factories, private owners, and international buyers within global markets. Development of these connected systems and processes has been driven by private-sector purchasers in factories looking to improve production in Rwanda, and in particular to provide better tracking and traceability as goods move across the world. Processes of integration and automation can be seen as being driven by the increasing financialisation and optimisation demanded by large private owners. Private owners support development of more efficient systems and enable better coordination and planning of value chains.

However, it may be that integration most benefits multinational firms. It allows firms to better manage and "optimise" flows of tea in global production, and such activity may result in volatile markets for tea, potentially leading to new risks being transferred to Rwandan actors (Neilson & Pritchard 2011, Ponte & Gibbon 2005). Specifically, as buyers are better able to plan and coordinate tea purchases online, GPN focus can rapidly shift, for instance from one auction to another, which implies new risks and instabilities in Rwandan tea that firms can do little to control.

Optimisations mediated through better connectivity that have particularly supported relationships between tea factories and private owners can also be seen to support new divisions of labour in the Rwandan tea sector, where strategic decisions around processes, varieties, and investment are defined by actors external to factories. For instance, in a recent article discussing the East African tea sector, former permanent secretary of ICT in Kenya, Btange Ndemo, outlined a number of potential fruitful value-added processes for tea that East African producers might look to as prices collapse, such as new tea varieties like purple tea, tea use as an industrial input in areas like animal feed and pharmacology, and processing tea to ready-made tea granules and other health products (Ndemo 2014). In our research, nearly all the factories interviewed, defined by the agendas of parent firms, were simply unaware of such possibilities. Rwandan factories were implementers, where more time was spent in quality and standardisation processes. Ensuring compliance in process, training and systems adhering to global norms is costly and limits the potential of locally appropriate innovations.

With tea factories being privatised there is also an indication that cooperatives and farmers are less included in information flows (around production, pricing, and agricultural information), meaning they are in a weaker position to be able to negotiate their problems, particularly where information is unclear or contested. Thus cooperatives tend to use the top-down channels and directives as their main information source, resulting in problems where generic advice does not fit. Examples reported by cooperatives in interviews include the type and proportions of fertiliser suited to the soil; inappropriate fertiliser adoption following the norm of Kenyan markets has in recent times proved to be problematic amongst Rwandan farmers in different land areas. Similar discussions were brought up in terms of the types of seed, where those planted for tea in the region were often generic, rather than suited for the specificities of the Rwandan context.

8c. Broadband use outside of core value chain relations

Our empirical work has analysed the increasing disconnect between the flows of goods and flows of information in global production networks related to tea. Growing information flows, supported by changing connectivity are summarised in Figure 16.

- Flow (a) shown in the diagram highlights that pricing information from the auction passing to cooperatives and farmers is problematic, and that they therefore depend upon (sometimes problematic) policy actors for information.
- Flow (b) represents the new information flows related to the close relations between tea factories, private-firm owners and buyers, which tend to route around the tea auction.
- Flow (c) represents new flows of information surrounding quality, standards and traceability, typically between factories, private firms and standards bodies. These flows are crucial in driving the development of closer systems integration and automation and services in the value chain.

In these growing flows, information supports and marginalises actors in production networks in two ways. First, growing paths of direct selling and information sharing are likely to diminish the position of the auction in the longer term. Second, price and market information from the auction tends to reach cooperatives only through intervention from various Rwandan sectoral bodies, and these poor flows of pricing information are liable to introduce tensions between factories and growers. Thus, these two growing flows of information and goods supported by changing connectivity can be seen as a disintermediation of sorts. In these examples, actors (brokers, cooperatives) are not removed completely from value chains, but a shift in roles and/or value indicates a long-term decline in their roles.

Yet this marginalisation of actors (i.e of auction processes and cooperatives) are not necessarily beneficial to tea growers or even factories in the long term. For instance, marginalisation exacerbates the perception of unfair markets amongst farmers, and a lack of interest of tea.

Already some farmers have a very low interest in growing tea, which is seen by them as hard work and yielding low profits. For instance, one cooperative manager located in an isolated region outlined that farmers often withdraw from such global markets, returning instead to local production:

> *"Farmers actually don't like growing tea because they don't yield quick profits and it takes too much of efforts to take care of it. That's why most local farmers prefer to grow Irish potatoes [potatoes for local market]. Obviously this is a very big problem that we have."*

Even the general manager of a better established and organised cooperative was in agreement, where low profits of tea were evident in the lack of young tea farmers

> *"The reality is, young people seem to have other options and prefer working somewhere else and earn because they say, well, they may spend a full day working in a tea plantation and still don't earn as much as they had expected."*

These quotes outline two different manifestations of a declining interest in tea amongst farmers, namely, planting other crops and moving into informal trade. Certainly information lack per se is not the sole source of this declining interest, but nevertheless the way current flows reduce farmers' access to information is one contributor to declining morale in this sector.

In sum, broadband use outside core value-chain relations, whilst not disintermediating, shifts flows of information, knowledge and control in GPNs, where loci have moved away from more transparent auction processes. They also shift control and decision making around production, planning and management of tea away from factories and farmers to private owners who now have such production information at their fingertips. For farmers this perpetuates an uneven system where they are tempted to uproot tea plants or neglect their tea bush, effectively removing themselves from global value chains.

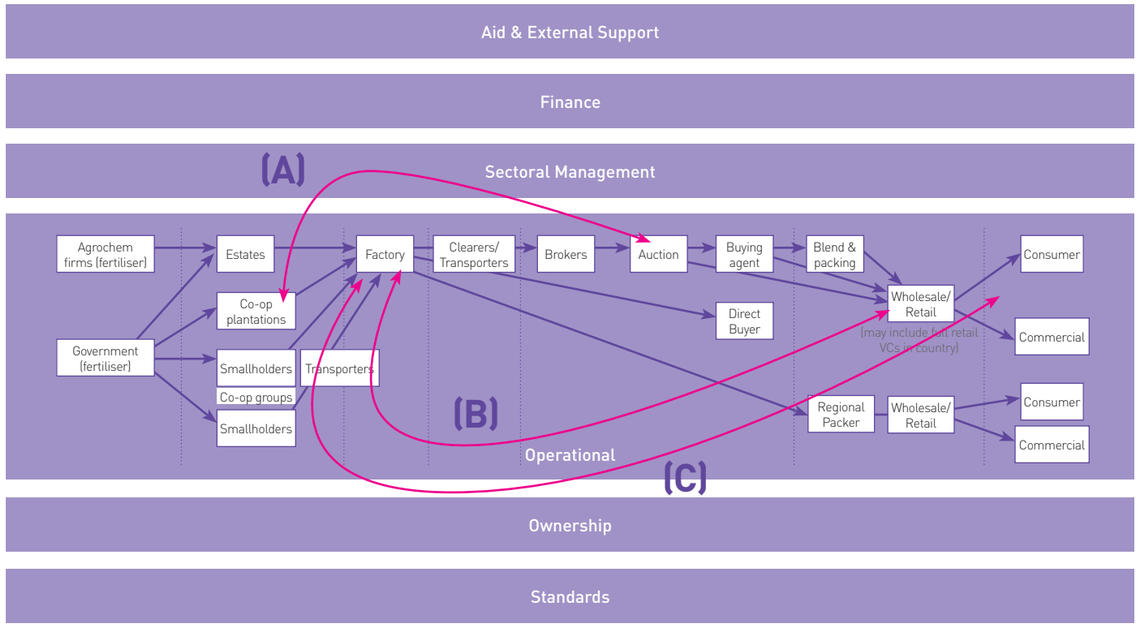

Figure 16: Adapted version of global production network (Figure 7) with new information flows highlighted (in red)

8d. Rural connectivity and flows

Connectivity and information flows tend to enhance more generic globally defined knowledge and practices around tea[36] and thus knowledge tends to *travel down* to tea producer and farmers. Initiatives, advice, knowledge and help are linked to factories, policy actors and/or donor assistance.

What has been neglected in policy and planning has been that there is some innovative knowledge searching and 'horizontal' sharing amongst farmers and cooperatives. Connectivity has supported this limited but growing volume of more informal searching and sharing, and these flows occur using a complementary set of media. As highlighted previously, evidence of such flows includes:

- using the internet as a way to identify and solve problems (e.g. pest identification)
- researching and feeding back information on agricultural research and development bodies (e.g. researching fertilisers)
- sharing internal knowledge and skills for better cooperative operations (e.g. sharing accountancy practices)

These types of 'horizontal' sharing were particularly valued by farmers and cooperatives in that they tended to be more appropriate, linked to needs and existing knowledge, and were shared in terms that top-down flows might not be. However these remain informal with little support through systems, policy or capacity building. Yet, given some levels of support and institutionalisation, these horizontal flows might have a more significant impact on farmer activities.

9. WHO BENEFITS AND WHO DOESN'T

Trends and risks outlined in the previous section lead to a deeper socio-economic analysis of who benefits from this growing connectivity. This section is split into the constituent themes – visibility, communication and services, and knowledge – that were detailed previously.

9a. Visibility

In our analysis of expectations of connectivity, we found that political leaders and media were looking to the idea that being visible online in the global market would drive new and direct trade in global markets. However the effectiveness of such approaches in reality is highly debatable, at least in the tea sector. In our research, it was only developed country retailers who actively drew on Rwandan images and tea branding and made these activities visible online as part of selling their specialist tea varieties. Some other firms – brokers and tea factory owners – did have websites but these were mainly corporate and informational. Thus, there was little evidence that online visibility had helped Rwandan tea firms to reach new categories of consumer in any way. This finding then questions policy approaches and ambitions where Rwandan firms look to drive visibility, when initiatives will be limited by global production networks.

That said, more generally in East Africa we argue that it is important to strive to maintain the presence of an open and transparent auction. Whether it remains located in Mombasa or migrates to become a digital platform, the auction is unique in that it occurs in East Africa, and it attracts international actors. The auction has done much to anchor East African tea into global trade. With the projected growth of the global tea production in the coming years, East Africa-focussed buyers are not guaranteed to remain loyal. With this risk is mind, online visibility both from the auction and from sectoral tea bodies in the region, particularly in provision of information support for buyers, can help to maintain and further enhance the visibility of the region as a key tea producer. Whilst there are barriers, here in terms of national and network fragmentation, these activities can be seen as a zero sum game, in that all actors in the value chain will benefit from regional marketing drives.

9b. Ability to coordinate and communicate

Connectivity is benefitting actors in the tea sector by reducing the cost and difficulty of communication over long distances, and as the tea sector is integrating globally this is becoming increasingly important. As outlined, increasing benefits come to those who can access these flows of communication and information (in terms of better planning, tracking of tea production, and ability to read and respond to market needs), but the unevenness of access can enhance rather than reduce inequality (for instance extending rather than reducing the differences between farmers and tea factories). Media expectations around information and communication were that it would enable firms to reach global markets. Connectivity and services have indeed supported private-sector development in Rwandan tea factories, where factories are increasingly aware of commercial needs (over the previous state-owned production), and where modernisation of production is occurring. However, additionally it was expected that reaching the global market would allow Rwandan firms to innovate and gain from selling their goods. This, however is not the case, and the indications are that the global networks of tea that Rwandan firms are increasingly integrating into support generic producers and standardised processes. Here there is a longer-term risk for Rwandan firms where inflows of knowledge and guidance reduce their ability to adapt to changes and crisis.

9c. Non-proximate services

The effects of changing connectivity most vividly seen in this research were processes of improved communication, and to a growing extent increasing numbers of services in tea that use the internet as a platform. In the Rwandan case, there is evidence that this element has improved the effectiveness and efficiency of production in the region, by allowing Rwanda to integrate more easily into global production. A more efficient and effective value chain supports improving trust between actors and reduces costs and losses; this new efficiency may attract new buyers and retailers.

Global rules, tracking, and assumptions in the sector are integrated locally and 'encoded' into standards and service and thus they support the interaction in the global market, but they also lead to standardised and generic tea production as outlined in the previous section.

Non-proximate services were found to be a particularly significant factor in forms of disintermediation of actors. This work suggests that online activity in the tea sector can push changes that lead to the marginalisation of certain value-chain actors (if not necessarily disintermediation). Increasingly automated information flows outside the auction, along with perceptions of slow and inefficient auction processes, could marginalise brokers in the long run. As yet, however, brokers have been able to resist this disintermediation. More recently, growing interest of tea factories in services related to farmers such as automated weighing highlights the risk of marginalising cooperatives from their role of organising and aggregating smallholder production, and it may be that this reduces the voice of smallholder farmers in production.

Dominant narratives in the media were that disintermediation was part of the processes of large firms linked to global markets and of smallholders improving their position. Our work shows that disintermediation is more complex than this. In the tea sector, certain actors (i.e. brokers, cooperative associations) have been marginalised rather than disintermediated, partly due to cleavages of power within production networks. That is, that being regionally and nationally embedded can provide room for these actors to resist global power (i.e. as embedded with the regional body EATTA and national body NAEB).

These processes of disintermediation are also not necessarily about removing inefficient value chain actors. It is highly questionable, for instance, if marginalising cooperatives (whether intentional or not) will help to improve the position of smallholder farmers in the long run.

9d. Access to knowledge

Media expectations suggested that actors less liable to access markets or who are exploited in their relationships might be able to improve their positions through online access to knowledge, improving their products and finding the appropriate place to sell their products. Connectivity would thus enable new innovation by farmers and new links into markets as lower-income actors exploited their 'latent' resources (i.e. land quality, entrepreneurship, culture).

Yet, there is no suggestion that these processes are occurring in Rwanda. Lower-income farmers are locked into their existing relationships, and there are significant policy and financial barriers that prevent any changes.[37] For these actors, knowledge flows are at the behest of those who they relate to in the value chain.

There were reports in the interviews of more innovative online searching and

sharing approaches to using the internet, using a hybrid of internet and mobile combinations. These findings suggest that low and sporadic connectivity need not negate the improvement that connectivity might make to potential knowledge flows. Further knowledge around tea growing and production should be considered a two-way flow, where bodies supporting agricultural research and development could learn much from tea growing through links to key growers, as they can disseminate themselves, furthering the sector.

The general views within the ICT literature of disconnected, low-knowledge tea farmers does not fit with the reality of the tea sector, where farmers are linked into tea factories but in uneven relations. The types of intervention in agriculture that have stemmed from these perspectives – price finding apps, websites linking producers into international customers – have had little effect on the tea sector according to our research. The global production networks that farmers and cooperatives are part of are not optional or interchangeable, and are defined by rules, norms and powerful actors – and so disintermediation without concerted cross-regional efforts from multiple actors at a political level will have no effect.

Knowledge that will benefit farmers and cooperative staff is that which strengthens their ability to improve yields and quality, and that supports cooperative management and farmer-sharing more actively. However, with policy makers focussed on private-sector elements and visions of connectivity used in vertical (value chain) rather than horizontal (across farmers and cooperative) knowledge sharing, there is a gap here, meaning that the potential for knowledge sharing and acquisition -- and more widely the socio-economic benefit for these groups – has not reached its full potential.

9e. Effects on the most disadvantaged

The most disadvantaged groups in the tea sector are tea pluckers and tea-factory employees, particularly the former, whose job plucking leaves is extremely arduous with long hours, and is paid per kilogram of green leaf plucked. These roles are rarely mentioned in this report, due to the fact that connectivity has virtually no direct effect on their work activities. These actors still work in low paid and repetitive environments with little opportunity of progressing, and connectivity, whilst available in the form of mobile phones, is not significant in their interactions with the tea value chain.

There is no strong evidence that changing connectivity is restructuring the distribution of value within production. Even with an increasingly connected sector, farmers still receive around 30% of the value of the auction price, and with factories now owned by private firms there seem few opportunities for small farmers to upgrade with or without connectivity.

Secondly, one can expect indirect negative effects, exacerbated by the fact that changing connectivity may lead to marginalisation of cooperatives and small-holder farmers that to date have been the largest allies in terms of supporting their lower-income groups. In particular, solutions involving connectivity have barely been concerned about what cooperative or agricultural researchers do in this privatised system. Thus, new flows of information tend to increasingly disintermediate such actors from flows of knowledge and production.

We previously found that connectivity was discussed, particularly by politicians, in ways that avoided grounded specifics of how connectivity would lead to development. We argued that this expectation is liable to orientate the types of support around connectivity driven by private firms over government intervention. In interviews in Rwanda, this meant it was factories that were often seen as the 'modernising' element of tea, and the fulcrum of new efficient market processes. Sporadically connected farmers and cooperatives did not fit into this vision, and requiring more active support for connectivity to be effective were rarely considered as recipients for ICT solutions. There is potential for these actors to benefit from connectivity, but this would require more intense interventions that would seem to be outside the market-driven approaches that are currently undertaken. Thus, on balance, in Rwanda one can argue that this connectivity has had a greater benefit for tea factories than for farmers or cooperatives.

9f. Summary of who benefits and who doesn't

Changing connectivity has had a significant effect on the tea sector. In terms of provision of a more efficient and more managed sector, this element of efficiency has brought some benefits to actors involved in production from farmer up to buyer. However, the benefits are not evenly spread, where large tea firms who are interlinked in multiple ways, through buyer power, through factory ownership, through standards *and now through a growing number of information flows and services* are able to define and direct the sector. These flows and services bring risks. Tea factories become more of a subservient actor in relationships to the global value chain, where connectivity supports the reporting and traceability of the global tea sector. The potential for these firms to become autonomous through more direct online links to customers appears to be limited. Tea cooperatives and smallholder farmers often find that they are more excluded in terms of communication and online systems, where the specificities, needs and knowledge of these actors have not been closely considered. In sum, connectivity does bring efficiency benefits, but it transfers new top-down control and risks to firms in the tea sector in Rwanda.

The task in countries like Rwanda, particularly if the predicted long-term decline in the price of core CTC tea becomes a reality, is how to ensure that Rwandan firms, farmers, cooperatives and the economy in general benefit from these global linkages. As suggested, connectivity can play its part in this change, but only in better-defined goals and visions of what changing connectivity should lead to, and in initiatives that are more appropriate to what is happening in the sector. This is only one key part of a larger puzzle that countries face as they privatise their agricultural assets, that is, a struggle to ensure that the modernisation benefits their economies as much as possible.

10. CONCLUSIONS

10a. Effects of broadband connectivity in the tea sector

To conclude, we return to the research questions outlined in section 2. Here we summarise findings drawing on empirical work in the tea sector and the previous discussions.

Perceptions

Discourses in Rwanda around emerging connectivity have tracked the more optimistic visions of the effects of connectivity outlined in the ICT literature. Established firms can drive economic growth by being more visible in the global marketplace where better visibility and simpler, more direct communication at distance will allow firms to build new customers and markets. Changing connectivity was also perceived to support socio-economic development, where previously disconnected individuals are able to disintermediate exploitative relations and capture better value through the use of connectivity. A third idea that was also found to be particularly prevalent suggested that outcomes would happen endogenously as an almost automatic outcome of broadband availability in a sector where those following established paths towards modernity are liable to better fit with visions.

Connectivity

Our research examining the production in the tea sector and the effects of connectivity provides us with much evidence that contrasts with the generally perceived effects of changing connectivity. In terms of the expectation – that connectivity enables Rwandan firms to becoming better integrated in the global marketplace – our evidence suggests that this vision has some veracity. Tea produced in Rwanda is increasingly closely linked into global value chains. However, the idea of the plucky Rwandan tea firm using connectivity to render itself visible and gain knowledge, and then innovating, is less convincing. Connectivity is one element of reform of the tea sector that is defining Rwanda as part of an increasingly standardised production component in a global network that is producing generic goods under the leadership of international firms and markets. In terms of the expectation that the disconnected individual will use connectivity to improve their access to markets (in the case of tea, perhaps a farmer), there is much less evidence that changing connectivity has brought about any transformation at all. There are some sporadic online information flows, but a plethora of problems was found, particularly around inconsistent levels of connectivity, and exclusion in terms of information and knowledge flows, that mean that connectivity is having only a limited effect. The third discourse around connectivity that we found -- that development was inevitable once basic infrastructure is installed -- is crucial in that it links to a vision of private-sector led development, where there exists little of a balancing hand in order to correct the above problems. The vision of the 'modernisation' of tea production in global networks is celebrated, while no one stops to examine what policies Rwanda will need in order to increase value from this sector.

Uses and challenges

Our research suggests, on the one hand, a number of uses of connectivity and, on the other, challenges to use in the sector. First, the idea of changing connectivity driving Rwandan firms forward through *visibility* is problematic in the tea sector. Our research suggests that firms who have used websites find little benefit in terms of marketing or reaching new customers. Better benefits are likely to come if more regional online branding and transparency can be used. *Automation and integration* through services undoubtedly improves the efficiency and manageability of Rwandan tea. Connectivity simplifies communication and coordination at distance in global production, particularly as firms look to coordinate the movement of goods through the value chain.

But the adoption of services and systems risks narrowing and standardising the sector to be part of a one-size-fits-all in a global production network. Rwanda as a tea-growing region has a number of unique aspects - its highland locations, its quality tea, and a highly coherent state body – which should be seen as benefits and not something to be underplayed, and that is a growing risk as convergence occurs.

If global production network models aid us in understanding one thing in production, it is that global production is increasingly mobile and able to quickly reconfigure itself when it encounters elements that are disadvantageous. Such a movement is at present being driven directly by connectivity barriers within East Africa. Connectivity has led to a marginalisation of key auction actors, with the shift in the loci of information and communication around the auction. This points towards a future where tea production chains will become fragmented and less transparent. As yet, with intermediaries holding power in production networks, this has not lead to wholesale disintermediation. Changing connectivity is one of the key drivers in this shift. Without support for reform, these shifts will drive a reduction in importance of this auction in the long term and potentially a far more closed approach to tea trading.

In terms of information and knowledge flows, not only are there lacks in flows to farmers and cooperatives – linked to silos of information, a prevalence of top-down over local knowledge and unreliable connectivity – but new elements of services and communication show signs of marginalising cooperative actors that support and advocate for farmers. While this might seem like a useful efficiency in the short run, long-term disintermediation risks further disconnection and lack of interest at the farmer, and particularly at the smallholder level, which at the end of the day can make or break the Rwandan sector.

Socio-economic outcomes

Connectivity is important to the tea industry in Rwanda, and certainly we are not advocating that firms remain static and immune to the effects of connectivity. A static sector would be a recipe for complete disconnection from global production, something that would not serve any benefit. However, at present the effects of connectivity in the Rwandan tea industry can be seen as primarily economic. With better access and control for multinationals and increasing efficiency of production for factories, we would expect that changing connectivity would have positive effects on economic and sectoral growth (i.e. income, volume), even if they are liable to quickly move back to private owners located elsewhere. However, moving down the production chain, cooperative were often slow to respond to market needs, and farmers' communication ecologies ignored. Thus, changing connectivity has not appeared to drive any major change in value distribution, and farmers have seen very little change in socio-economic benefit, despite the dramatic changes in affordances of connectivity over the last few years. The predominant story at a farmer level is not of growth, but of older farmers neglecting their tea bushes and younger rural dwellers moving into informal businesses in urban areas, which offer higher and more regular income.

Perceptions vs reality

Thus, it is worth reflecting on expectations about the effects of changing connectivity, and worth offering some ideas of how these might be recast. Looking to global markets is no doubt necessary in Rwandan tea, but the focus has been on global markets as an end in itself, where the shape of transformations is left to the whims of the market. As our research has shown, such transformations may lead less to vibrant and innovative tea sectors than to more generic and standardised ones, and consequently new risks. In terms of the idea of the 'low-knowledge and disconnected farmer', at least in the tea sector these views are inaccurate; changing connectivity leads to new uneven terrains of information and knowledge that often neglect low-income actors, whilst disintermediation processes may marginalise those actors (e.g. brokers, cooperatives) that have the most potential to support smallholder farmers. Again, more active policy enabling more transparent 'vertical' and 'horizontal'

information flows around cooperatives, growers and pluckers is crucial, as is the support of institutions in developing themselves to be part of the coming connected sector.

These two expectations are brought together in visions of how the benefits of connectivity will be felt. Whilst private-sector initiatives have been key to supporting growth of initiatives in the tea sector, without guidance, particularly as linked to low-income actors in the value chain, it is likely that the socio-economic impacts in Rwanda will be small and that the initiatives will benefit only a selected few.

10b. Policy implications

A wider array of policy implications stem from this work. Here we reprise the principal directions that can support economic growth, drawing on the four key changes and challenges that were outlined in section 8, and outlining some important policy implications.

From firm visibility to regional tea promotion

Evidence suggests that regional tea promotion and branding to global markets could potentially drive growth better than on a firm level for Rwandan firms. This also fits with growing East African Community agendas. This promotion and branding particularly links to building the profile of the region as a viable tea producer (in terms of consumers) and the advantages of the auction systems in Kenya for buyers over its South Asian competitors. Indeed as world tea supply grows and the sector evolves, pushing branding is vital in ensuring awareness both for existing retailers and new buyers at a consumer level.

Services with adaptation

The growth of services and automation and their effects in the Rwandan tea sector are the most difficult to tackle in terms of policy. However, there is room for actors to build or promote visions of services that are more inclusive. This will emerge both in a clear evaluation of the unique aspects of Rwanda – soils, production, relations – and in how differences can be integrated into information systems. For example, how can Rwanda encourage developers to build information systems where the needs and problems of cooperatives are better considered in production chains? Are generic factory systems and services appropriate for Rwandan activities and what do these services and systems miss out on? More equitable approaches are likely to include local research and development actors, but also a wider gamut of motivations to ensure that requirements are met

Connectivity and pulling production back to Mombasa

For Rwanda, while the movement of knowledge into direct sales will continue amongst a few high-quality producers, growing direct sales risks moving tea behind the veil of private transactions and direct trade, and delinking those who are less well networked from the global market. Thus a transparent auction is absolutely vital to 'the rest', but the auction will only remain if it becomes part of the increasingly connected value chains. Thus, a policy outcome for Rwanda is to become closely involved in driving the reformation of this institution. The auction does not stand in conflict with the stated goals of value-addition and speciality tea, it complements them. Indeed there is no reason why auctions of the future cannot embed these elements, but in a more equitable way than direct trading.

Supporting more consideration of dynamic markets

At a number of points in this study we have highlighted potentials activity that have not yet been greatly explored in Rwanda. Two examples we have highlighted are in examining new non-European tea markets in more detail, and in looking at more obscure tea niches that may not have been explored. Clearer information provision about market potential and needs, through surveys, online research and other sources could enable tea firms to more coherently consider new potential as markets.

Exploiting growing rural connectivity

Rural actors in tea production chains have made the smallest gains from connectivity. Yet, there is evidence in empirical work that policy support from more institutionalised systems and flows could be vital. This would look to support positive information flows such as cooperative information sharing and farmer knowledge acquisition online through supporting skills and better provision of resources, as opposed to the current more ad hoc and informal communication. To maximise their goals of improving farming, development should be as transparent as possible and consider the importance of multiple media in such setting (e.g PC, mobile, SMS, voice, paper, face-to-face).

Examples of the types of information and knowledge that might be useful include making existing NAEB portals around tea market and farm-gate prices available to cooperatives; a detailed knowledgebase of R&D outputs, particularly in terms of better disseminating the local work of the Rwandan Agricultural Board to enhance knowledge for cooperatives; and shared networks to allow cooperatives and conceivably farmers to share and discuss issues around tea growing.

NOTES

1. Such as factory privatisation, pricing policies and big changes in tea market prices.
2. In this report we use the terminology 'cooperative' to denote the cooperative associations that aid a group of farmers in a region.
3. This table highlights the spread of actors as opposed to the number of interviews undertaken, and thus excludes around 13 repeat interviews to clarify information and to follow up in later stages of fieldwork.
4. Some of the roles are interchangeable. For instance a tea buyer or retailer may also blend tea; a private owner of a tea factory may be a buyer. Here interviews are categorised by their main focus and in terms of how interviews were framed (e.g. one interview was with a private factory owner who also ran a buying firm. This interview was undertaken with a Rwanda-based manager who was thus mainly focussed on factory issues, although the discussion did somewhat link into the firm's buying activities).
5. The actual regressions are in fact only significant at 10%, which within typical economics is considered as borderline significant. Further, as the authors themselves admit, their figures are based upon "poor data availability in a large number of developing countries" (Qiang et al. 2009 p.46) and that there is a risk of reverse causality (i.e. that economic growth causes broadband growth) which could not be rejected. With this in mind, it is perhaps surprising that the data has been so widely quoted.
6. The Government still owns small shares in some tea factories, but this is typically at the level of 10-15%, and the private owners we interviewed were under the assumption that they would be able to buy these shares later if factories met their targets.
7. As opposed to producer-driven chains, where more complex goods are produced and producers have more influence in the value chain.
8. The Mombasa auction is the second largest tea auction in the world, and is used by most global bodies, such as the IMF, as the benchmark to determine the world tea price (IMF 2013). It attracts all the large buyers involved in the tea sector, and the majority of East African tea is sold through this auction including 75% of all Rwandan teas (NAEB 2013a). Mombasa is part of a global set of tea auctions that include auctions in Colombo (Sri Lanka), five regional auctions in India, Malawi and Jakarta (Indonesia).
9. Different varieties of teas (likely from a range of countries) are typically blended in order to give it the desired taste and colour for consumer tastes.
10. These smallholder cooperative associations are also supported by government and NGO initiatives (e.g. buildings, office equipment, training, seed nurseries).
11. Cooperatives charge a set fee for their smallholders and/or farmers. This is usually used to employ a manager and or other staff (larger cooperatives employ more staff). All cooperatives were also found to have dedicated offices to coordinate this work, often in proximity to the processing factory.
12. Some farmers' groups also have shares in factories (typically 10–30%) so will also share some proportion of income accrual here, but it was reported by cooperatives that even here some factories tend to inflate their running costs in their books to ensure that farmers receive minimal dividends.
13. Indeed the Figure 6 calculations only include data in terms of transporting made tea to auction. They do not consider the extra costs in terms of transporting inputs such as fertilisers into Rwanda, which are likely to reduce farmers' profit margins.
14. Typically Mombasa tends to attract higher prices than other auctions, such as those in India, Indonesia, and Sri Lanka (Neilson and Pritchard 2011).
15. Only percentages are presented as we were unable to find calculations for comparable years. This made it difficult to compare absolute values due to fluctuation in tea prices at auction. Indications are that proportions do not fluctuate so much (e.g. a number of the costs tend to be pegged at a percentage of auction price). The figure uses Rwanda in 2013, Uganda in 2012 and Kenya in 2010. The calculation should still be taken to be indicative of percentages, due to issues around moving exchange rates and market prices over this period.
16. A series of strategies exist for the tea sector. The first strategy was produced in 2003 when tea was initially identified as a focus sector. A revised tea strategy was made for 2008-2012 and focuses on private-sector driven growth (MINAGRI 2008). Following this there has not yet been new strategy but rather initiatives have been embedded within wider export development goals, within the 2013 "Economic Development and Poverty Reduction Strategy" (GOR 2013) and the 2011 "Rwanda National Export Strategy" (GOR 2011).
17. For instance, as one interviewee highlighted: "The rules and regulations from this book of EATTA doesn't allow a producer to sell his teas. It is something inherited from the British". The rule in question demands that tea producers use brokers in the auction (rather than selling directly). While the rule has some logic in terms of convenience for factories (having a trusted agent in Mombasa) and aggregation (to keep the auction process simple), it also limits some potential disintermediation. It derives from the origins of how tea was traded between brokers and buyers in the London auction of the previous century.
18. Most importantly for East Africa, according to interviews, the taste, colour and speed of brewing of "normal" tea does not correspond to single estate black tea solely from Rwanda, meaning that nearly all black tea from Rwanda is blended with tea from other countries: as illustrated in discussions with two private factory owners below.
    "Most people they want to buy our teas just to add more flavour and aroma to their tea, so to enhance something like that, too"
    "Rwanda tea actually does get mixed with all the East African teas and they're used as bed enhancers (blending terminology) and all that stuff"
    This diminishes potential upgrading based on local packaging, it also means that national branding around Rwanda and tea is very difficult.
19. Publically owned factories were sold to private firms with only a very low stake assigned to farmers' cooperatives. Thus, farmers have in general been unable to have ownership in processing elements of tea.
20. Examples of such initiatives include UN agency IFAD supporting cooperative development through financing local agronomists; USAID supporting local seed nurseries for tea plantations, and a UK trust purchasing two tea factories from the government to enable cooperative ownership in the long term.
21. Note that layers are interlinked in that one element (such as aid) can both overlap and interlink into another (such as standards)
22. We did not interview farmers directly in this work; however, from interviews it was suggested that from the cooperative onwards, communication is undertaken by using the mobile phone.
23. For instance, tea firms such as PG Tips and Lipton are owned by Unilever; Tetley and Tata tea are owned by Tata Global Beverages; Twinnings are owned by Associated British foods.
24. There are currently ten approved brokerage firms who compete for custom from tea factories
25. For instance, other costs include factory administrative costs dealing with auction processes, and charges and taxes for buyers around the auction which are likely to be reflected in the price they buy at in the auction. For other countries, such as Tanzania, the tea auction is very inefficient, where tea growers would prefer to transport direct from a local port rather than to have to make the often lengthy and costly detour into Kenya and Mombasa.
26. ERP is a type of IT system that allows operational management and planning based upon production data.
27. In 2012, 24% of all tea was sold directly (NAEB 2013b). Rwandan statistics suggest that this has been growing by around 1% per year. There are also strong information flows between integrated firms who are buyers and sellers (i.e. Flow B in Figure 12, but goods are still sold through auctions (mainly for firm transparency or accounting reasons).
28. Savings and Credit Cooperatives that provide simple cash-saving services in rural areas in East Africa.
29. Here services is defined quite loosely. We use it to refer to automation of certain processes that typically can then be accessed by others in the value chain using connectivity.
30. E-catalogues are crucial for tea buyers. Most tea sold in the retail market is blended tea using a combination of different origins and grades of tea. The goal of tea blending is to ensure consistency of taste of tea, and each tea firm will have a number of different blending combinations that will result in similar tastes. Thus, system integration in this stage is absolutely vital for retailers so they can ensure they purchase appropriate proportions of different grades and origins, and calculate the best total prices for each blend.
31. The electronic billboard payment system replaced the previous mode of payment, which was from tea buyers to tea brokers using bank transfers, which was far slower that the new system.
32. The proposed e-auction would allow buying and selling of tea online. Once the price was agreed this would integrate with the payment system, offering more seamless buying and selling, and reducing the levels of coordination requirements in Mombasa.
33. This is the first stage of tea processing, where green tea leaves are dried before further processing.
34. Electronic weighing systems found were produced by one Indian firm, and previously pioneered by KTDA (Kenyan Tea Development Agency) in Kenya. The data produced can be integrated into tea systems such as SAGE and Chai Pro. They are slowly diffusing in Rwanda, and are used by five factories at the time of writing.
35. These figures may also embed some levels of blending and packaging in intermediated countries such as the UAE, nevertheless our judgement is that these figures generally tell a story of end-markets and are not contradictory to FAOstats (2013b) figures on world tea consumption, which support much of this being the place of consumers as opposed to intermediary processes.
36. i.e. more generic knowledge and practices diffusing into Rwanda from global practice related to the tea sector.
37. e.g. privatisation policies which assigned a low percentage of ownership of tea factories to farmer cooperatives, and the ability of cooperatives to get finance.

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12. APPENDICES

12a. Sample questions used in interviews

A: GENERAL QUESTIONS FOR ALL COMPANIES

A1 Do you think that faster internet has had a big or small or zero impact on the way your business operates? In what ways?

A2 What types of internet access do you have? What company?

A3 Have you changed your connection recently? Has it gotten faster? If no, have you thought about changing? How and when has this changed? Do you face any problems getting online?

A4 What do you mainly use the internet for?

A5 Are you disappointed by the internet in any way? For example, are you disappointed by the number of online enquiries that turn into actual sales? Has the faster connection allowed you to convert more enquiries into sales?

A6 How long have you been working in the tea sector? Where did you work before you came here? How did you come into this job?

A7 What made your company successful when you first started your company/ started working in the field? Do you think this has changed over time? And is it harder to do business in the tea industry than it used to be? If so, why?

A8 Do you feel that faster internet changes any of this?

A9 Has your company specifically changed any of the work it is engaging in in recent years?

A9b Can you describe why?

A9c Are these changes connected to a faster internet connection? In other words, has the faster connection allowed you to add new services that you were not able to offer before?

B: MEMBERSHIP AND ASSOCIATONS FOR ALL COMPANIES

B1 Can you tell me about the ownership of the company/organization? International/Rwandese shareholders?

B2 Are you involved in any membership group? Like the East African Tea Traders Association? Or the KTGA (Kenya Tea Growers Association) (Rwanda?)

If SO, Are you an active or passive member? What do you get from participating?

B3 Are you involved in any Rwandan government scheme? Or do you have a relationship with the Kenya Tea Development Agency? (What about Rwanda?)

B4 Are you involved in any certification schemes like the Fairtrade, Rainforest Alliance (RFA), ISO (various) such as ISO 22000:2005, and HACCP etc.? What about the ETP – Ethical Tea Partnership? Is it difficult for smaller companies to meet these standards?

B5 How does the internet change the way these associations or schemes run?

B6 How important is the government's ¨certificate of origin¨ scheme to your business?

C: SCALE AND SCOPE OF BUSINESS FOR ALL COMPANIES

C1a In order to get an idea about the scale of your company, we would like to ask (depending on type). Your annual production volume of black made tea (kg)? Your annual turnover? Sales figures? Number of members / shareholder farmers?

C1b How has this changed over recent years? Is the internet involved in this change/Has the internet allowed you to sell tea to new kinds of markets?

C1c Why has this changed?

C2 How many permanent workers are employed at this firm? How many casual/contractual workers are employed at this firm?

C2b Has (faster) internet changed the number of people or the kinds of work that people do?

C3 How do you search for these different kinds of employees? How important has word of mouth been for you to find the right caliber of employees?

C3b Has faster internet changed the way you search for employees?

C4 What parts of the tea production process are you involved in?

C5 Do you manage all these processes on your own or do you use any middlemen or contract out services to other companies?

C6 What percentage of ... What % of your tea do you grow yourself? What % of your processing is carried out by your own factories?

C7 Does it ever happen that you produce too much tea and that you cannot process it?

C8 How many estates/transportation companies/factories/plants/facilities do you use?

C9 How did you come to form relationships with the companies that you work with or with extra workers?

C9b Do you use the internet to search for them? And does faster internet make a difference?

C9c Do any of them have their own websites?

C9d Are you worried about them cutting you out or changing the way they operate their businesses?

D: WHERE DO THEY SELL THEIR TEA? (FOR ALL COMPANIES)

D1 What grades of tea do you grow/deal in? And approximately how much of each grade? Do you have different brands/lines/types of tea that you sell?

D2 Where do you sell your tea?

D3 How has this changed? Are you selling more tea to direct buyers?

D4 Do you change your profit margins?

D4a How do you use the internet to target these different groups of buyers or do you just use a blanket approach? Does faster internet make a difference?

D5 Do you change your brand or package your tea?

D6 Has faster internet made any difference to this?

E: IF THE TEA GOES THROUGH THE AUCTION, ASK:

E1 Do you take the tea there yourself or do you sell your tea to someone else who takes it there?

E2 If middleman, how did you come to form a relationship with this person/ company?

E3 Does this person/company work with you alone or does it also buy tea from others?

E4 How do you think the Auction has been changing recently?

E5 Do you think that faster internet has had an impact on the number of people who use the auction or the way in which trading is done? Are direct sales increasing?

E6 Have you ever thought about selling your tea in other ways?

E7 What role does the internet play in these strategies?

F: IF THEY SELL TEA OUTSIDE THE AUCTION, ASK:

F1 Do you sell the tea in bulk or as a branded product? What percentages?

F2 What kinds of buyers do you engage with? Big supermarkets? Specialty shops? Traders? What countries?

F3 Do you have any permanent contracts or relationships with other companies?

F4 Who makes contact with whom when finding buyers? Do you search for other companies to sell your tea to? Or do you wait for them to make contact with you?

F5 What has been the most successful way of forming new partnerships?

F6 Have you had any difficulties making contact with new firms?

F7 How do you use the internet to contact new people/companies? Has faster internet allowed you to do this more effectively?

F8 What kinds of companies would you ideally like to target in the future? Do you have any strategies to make this happen? Does changing connectivity have a role in any of these strategies?

F9 Do you think that it is getting easier for smaller companies to sell their tea in new ways (outside of the auction)? Has faster internet changed this in any way?

F10 How do you think the internet is changing relationships between companies in the tea sector internationally? Has faster speed changed this in any way?

F11 Does the internet threaten multinationals?

G: IF THEY SELL TEA INTERNATIONALLY, ASK:

G1 What were the top three countries three years ago, now? More specifically what % of your clients come from each place?

G2 Are there any specific countries that you would like to target in the future? (if so, why?)

G3 Does faster connectivity have a role in this?

H: INFORMATION SEARCHING (FOR ALL COMPANIES)

H1 How do you normally research or gather new information about inputs, processes or market opportunities? (e.g. face-to-face meetings, trade shows, online)?

H2 Do you use the internet to search for this information? Have you changed the way you search online in recent years?

H3 How important is reputation? How do you determine whether you can trust a company?

H4 Do you use the internet to gauge whether someone is trustworthy? Does changed connectivity make it easier or more difficult to trust people?

H5 Have you experienced problems with cybercrime or people trying to be dishonest on the internet? How have you dealt with this?

H6 How does the firm brand itself? Have you tried to re-rebrand yourself in new ways?

H7 Do you use the internet to re-brand yourself? Has faster internet changed any of this?

H8 Do you feel that there are an increasing number of Kenyans/Rwandans creating content about Kenya/Rwanda (e.g. reviews, blogs, videos) and does this affect your business in any way?

H9 Is there any advertising or marketing that you are trying to do, but it isn't working as well as you had imagined?

I: WEBSITE AND SOCIAL MEDIA (FOR ALL COMPANIES)

I1 Did you do it within the company or did you bring someone in? Who are you predominantly trying to target with your website?

I2 Do you have more than one website?

I2b WHY do you have more than one website? Are you targeting different kinds of people?

I3 Do you use social media?

I3b Who are you trying to target? Do you feel like you know how to use it effectively? If they say Facebook, do they use ads on Facebook or do they just have a page? Has it been at all helpful?

I4 Do you use Ali Baba?

Who are you trying to target? Would you like to know how to use it effectively? Do you feel that it exposes you or makes you vulnerable in any way?

I4 Do you know anything about search engine ranking or optimisation?

I4b Do you do this yourself or do you employ someone to do it for you?

I4c If another company, where did you find them? Do you think it has been worth it?

I5 How else do you make your company more visible online?

I6 Do you still visit trade shows or make physical visits to other companies?

I6b Does the internet reduce the importance of these visits or are they still important?

J: INTERNAL PROCESSES (FOR ALL COMPANIES)

J1 How do you keep track of the volume of tea as it moves between different stages?

J2 How has the internet or other forms of technology changed this?

J3 How do you maintain quality control and other standards as the tea moves between different stages?

J4 How has the internet or other forms of technology changed this?

J5 What parts of the process are automated by computers and tracked by ICTs and what parts are more informal/rely on trust? Do you use any software to help you keep track of your processes?

J6 Who benefits from such technology and who loses out?

J7 Has this experience (using technology) made you think differently about what your company can and cannot do? Does it change your current or future strategies in any way?

J8a How do your customers/clients pay you for your services?

J8b How do other companies pay you for your services?

J8c How do you pay others for their services to you?

J9 IF THEY PAY digitally, how they do this? Is it directly though their website or do they use a third party like VISA or paypal or m-pesa?

J10 Does having faster connection change the ease of using digital payments?

K: IF THEY HAVE EXPERTISE, ASK:

K1 How did you learn about websites/social media/search engine optimization/ software/ tracking devices? Where do you go to look for new information or better understanding about these things?

K2 How important is experimentation and 'playing around' with websites and using websites?

K3 Do you feel comfortable trying out new things online, like modifying your websites, using search engine optimization tools, using social media? If not, why not?

K4 Does having a faster connection make a difference in how much you experiment?

K5 Can you give examples of how you might have changed the way you learn about new things online because of faster internet?

L: IF THEY HAVE LESS EXPERTISE ABOUT ICT, ASK:

L1: Generally speaking, do you feel comfortable trying out new kinds of technologies? How comfortable are you with experimenting? Does faster internet encourage you to experiment more in this regard?

L2: Are there things that you wish you could do with computers or with the internet that you cannot do now?

L2: What prevents you from using these kinds of technologies more (computers, internet, software, other ICTs?) Is it lack of interest, lack of skills or lack of equipment? Something else?

L3: What skills do you feel you or your staff lack with regards to the internet and other forms of ICT technology?

L4: What prevents you from getting the necessary hardware or software? What could ease your access?

M: GENERAL INTERNET QUESTIONS (FOR ALL COMPANIES)

M1 Are there any other way that ICTs have enabled your firm to do things differently?

M2 Are there any remaining barriers to communication that you face either in terms of internet access, access to software/hardware or any other technological access?

M3 In your opinion, who most benefits from the introduction of faster internet in the tea sector? Who loses?

M4 Do you think bigger companies like Sorwathe, Lipton, Sassini benefit more than you do?

M5 What are the threats SPECIFICALLY TO YOUR business in relation to the changing internet infrastructure?

M6 Do you think that the internet has enabled other firms to take business away from you?

M7 Are there any ways that your competitors are using the internet better than you?

M8 Does the faster connection change how you perceive geographic barriers? Do far away customers or clients feel less far away? Or is this not the issue? Do you see more opportunities from far away? Does it mean you are able to pull opportunities into your location?

M9 Some people say that 'the internet removes intermediaries': Do you agree with this?

M10 Who are the intermediaries in your line of work? How do intermediaries help you? How do intermediaries hurt your business?

N: GOVERNMENT COOPERATION AND COORDINATION

N1 Has government policy influenced the direction of your business? What criticisms do you have of their policies with regards to your sector?

N2 What are the barriers to better coordination between you and the government? Who have been your key allies in government? Are there any tensions within the government that make it hard for effective policy-making?

N3 What kinds of policies or support from government or other professional bodies would you like to see? What would help you the most?

N4 Do you feel that the education system is doing a good job at preparing graduates for work? Do you feel that universities are getting better or worse over time? Are there any specific skills that are particularly lacking among Kenyan/Rwandan job seekers? Does this prevent you from winning contracts? Do you have any relationships with universities or training colleges in terms of recruitment and internships?

N5 Within East Africa, do you feel any tea companies have a special advantage

over others? Why is this the case?

N6 How do you think this is changing? Does the faster internet change competition in this way?

N7 You said at the beginning that you felt that the faster speed made a big/small impact. Given everything you have said in the interview, do you still feel the same?

N8 Did you expect us to ask you anything that we didn't?

N9 We are organizing outreach meetings at the end of the project. Is there anything in particular that you feel we should address? If you have attended similar meetings in the past, what was helpful and what was a waste of time?

12b. Sample codes for tea analysis

Expectations

- Impact Connectivity – expectations and actual outcomes
- Connectivity – references to conceptual ideas
- Discussion of images and perceptions in press around connectivity
- Culture and cultural explanations around connectivity

Connectivity and tea

- Challenges of connectivity
- Connectivity and communication
- Flows of knowledge in tea sector
- Future ICT uses
- Information and connectivity
- Lack of hardware
- Online presence/visibility

Value chain

- Exploitation
- Inputs
- Intermediation and disintermediation
- Markets
- Relationships and trust (global and regional)
- Value chains relationships
- VC upgrading

Production networks

- Geography (global and regional scale)
- Geography (local scale)
- HR
- Payment and finance
- Policy and state (formal)
- Policy and state (informal)
- Local relationships

General contextual issues

- Colonialism
- Costs within the organization/firm
- Research and development

Grounded codes generated from interviews

- Attracting new clients
- Tea automation
- Certification
- Connectivity – descriptions of practice and use
- E-auction discussions
- Information flows done offline

Oxford Internet Institute
University of Oxford
1 St Giles Oxford OX1 3JS
United Kingdom
Telephone: +44 (0)1865 287210
Fax: +44 (0)1865 287211
Email: mark.graham@oii.ox.ac.uk
http://www.oii.ox.ac.uk