

Digitalisation and trade: what hope for lower income countries?

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1. Introduction

The idea of digitalisation, the growing use of digital technologies and digital data as part of firm activities, is an area that is attracting considerable interest. Digitalisation is seen as a key way to improve firm practices and enable integration of production data between interacting firms.

With the rapid expansion of digital technologies in lower income countries, digitalisation is also relevant to firms in these countries. For some firms, moving from lower value local markets to international trade has been an ambition to support improved income and profit. Use of digital ICTs appears to offer the ability for firms to become more integrated internationally. For others, international trade is already being undertaken but via intermediaries and brokers. Online platforms appear to offer direct linkages that could allow firms to increase their capture of value without the constraining conditions associated with traditional intermediaries (World Bank 2016a)

Ideas of digitalisation have also been embraced by politicians and policy makers in lower income countries (as well as global bodies) interested in supporting wider economic development. Economic paths that allow better global integration, offer new sources of economic growth and by supporting small firms, appears to be a path for building more efficient and dynamic sectors in lower income countries (Graham et al. 2015).

Yet, discussions of digitalisation in lower income countries often remain around future hopes and ambitions. There is little systematic analysis of firm activities with digital technologies and platform use, and what can be learnt from attempts to use digital technologies to undertake international trade. Further, work on digitalisation has frequently ignored the underlying context of firm activity and the dominant forms of global value chains, which orientate every aspect of export activity. At a policy level, there is also knowledge gaps around the role that governments might play in supporting ambitions around digitalisation and trade to support macro-level impacts.

Drawing on an extensive review of the literature, this paper explores these knowledge gaps with the goal of producing a systematic policy-relevant understanding of digitalisation in lower income countries. The paper is arranged as follows. The next section draws on macro-level statistics and economic analysis to highlight the current state of digitalisation in lower income countries. This particularly highlights that impacts of digitalisation appear to be highly variable across firms, regions, sectors and technologies and thus more sectoral analysis is appropriate. Section 3 highlights value chain models as an analytical model that provide a clearer understanding of international trade in lower income countries and the impact of digitalisation. Section 4 conducts a detailed analysis of digitalisation, particularly highlighting three key modes of digital participation in lower income countries – ‘thintegration’, platforms and full chain digitalisation.

The main findings are discussed in section 5, highlighting potential gains as well as challenges from digitalisation in lower income countries. Value chains in sectors with a concentration of powerful firms on the buyer side (such as garments and commodities) tends to lead to digitalisation driven and controlled by these lead firms. In these value chains, digitalisation can lead to reduced value and instability. However, a more optimistic picture may emerge in other "less captured" sectors (such as newer agricultural sectors, services, and those linked to certain final goods). In such cases, platforms can improve value chain coordination and provide the potential for smaller firms to participate and gain from trading globally. These differing sectors necessitate different sets of policy direction in order to maximise the potential and capture of value from digitalisation (section 6).

2. The potential for digitalisation in firms

2.1. Definitions

Given the broad field of research around firms and digitalisation, it is worth detailing the overall scope of the paper. Firstly, in terms of digitalisation, a broad range of digital ICTs and online resources are examined to understand how they are used by firms. This departs somewhat from the current focus of the Global North, where particular emphasis has been placed on automation, big data and implications of 'hyper-connected' firms (see for example The World Economic Forum's (2017) digital transformation initiative). Whilst some examples in this paper fit such frameworks, in lower income countries gains from digitalisation potentially emerge from different uses of digital technology.

Beyond this broader definition of digitalisation, the analysis focuses on changes in sectors where trade relates to both *tangible goods and services*. Sectors where goods and services are mainly digital (such as business process outsourcing and IT services) have been subject to much interest in lower income countries, but these sectors are still highly emergent and the nature of trading and relations is different (Mann et al. 2015). The main emphasis of this paper is on entrepreneurs, small producers, micro and small enterprises in lower income countries. These broad groups are likely to see the greatest impact of digitalisation on development. They have also frequently been the target of improved ICT and Internet access in lower income countries (Foster et al. Forthcoming).

Finally, the terminology of 'lower income' countries needs to be defined. Focus is on firms in countries that are 'catching up' in terms of the use of ICT and digital data. As outlined in the data gathered below, this means a particular emphasis on those countries classed in 'Low' and 'Lower-middle' income brackets (World Bank 2016b). Yet, given that marginal firms and entrepreneurs in emerging nations may experience similar conditions, a wider net is cast to highlight insightful literature on digitalisation.

2.2. Analysis of trade and digitalisation

Various studies have explored topics around low income countries, trade and digitalisation. There is a growing debate about the impact of the internet and digital access on economic growth. In balance, the outcome of this debate is that there is some modest measurable impact of the internet, given an appropriate wider set of conditions and institutions (Galperin & Viacens 2014, Kenny 2006, Minges 2016, UNCTAD 2015). Seeking to explore the processes that link internet access of economic growth, further work has explored how the internet might enhance international trade flows from lower income countries. Thus an improvement in international trade could be a key contributor to this growth (Clarke & Wallsten 2006, Meijers 2014, Osnago & Tan 2016).

As part of this literature, there has also been more detailed analysis to understand who is impacted when internet facilitates international trade. Correlations between more expansive internet use and exporting firms are evident (Paunov & Rollo 2016). However, there are questions about the direction of causality. It is conceivable digital technologies have limited impact on more productive firms who export who are better disposed (financially, managerially) to export (World Bank 2016a). Indeed, some research has been sceptical about the direct development impacts of the internet. As Kenny(2011 p.11) argues for example, “enterprise surveys carried out in developing countries suggest that concerns about telecommunications rank far down on entrepreneurs’ own analyses of barriers to their firms’ growth”.

Given these debates, a preferable approach to explore links between digitalisation and trade is to think of digitalisation as potentially leading to new opportunities in trade but only alongside a wider set of conditions and policy challenges (what the World Bank(2016a) refer to as ‘analogue components’). Further research highlights some of the wider conditions that might influence the effectiveness of digitalisation on trade. Investments in infrastructure needs to go hand-in-hand with sufficient institutional quality within nations which facilitates these trade flows (Bankole et al. 2015, Paunov & Rollo 2015). Firm-level econometric analysis also suggests that digitalisation may have skewed impacts across firm types. Provision of internet access tends to have more impact on single product and non-exporting firms (Paunov & Rollo 2016), but for those firms already involved in trade, internet does not appear to greatly impact on their levels of trade (Clarke 2008).

There are also debates about the value of specific digital technologies and platforms on trade(Chung et al. 2013). Earlier work on platforms, for example, highlighted that adoption amongst firms in emerging countries such as South Africa was limited (Molla & Heeks 2007). However, evidence from platform data suggests growing use of platforms in some e-commerce segments and that this applies as much to emerging countries as it does in more developed countries(Hortaçsu et al. 2009, Lendle et al. 2016). Thus, there is need for further analysis to explore the specific technologies, and the groups and sectors that they impact upon.

2.3. Firm export data and ICT statistics

If the literature on macro-level impacts of digitalisation and trade shows varying impacts across technologies, firm type and sector, it is useful to explore the nature of international trade in lower income countries, as a way of understanding key sectors and flows. International trade is important in many lower income countries, supporting economic growth, foreign exchange and employment (Meijers 2014). Table 1 and 2 highlight the key goods and sectors in which lower income countries are involved.

HS3 Code	Frequency	Description
0901	8	Coffee
1207	6	Other oil seeds and oleaginous fruits
5201	6	Cotton.
0713	5	Dried leguminous vegetables
0902	5	Tea
1701	5	Cane or beet sugar and chemically pure sucrose.
2401	5	Unmanufactured tobacco; tobacco refuse.
0801	4	Coconuts, Brazil nuts and cashew nuts, fresh or dried
1511	4	Palm oil and its fractions
2402	4	Cigars, cheroots, cigarillos and cigarettes.
2523	4	Portland cement, aluminous cement, slag cement, supersulphate cement
8703	4	Motor cars and other motor vehicles
8704	4	Motor vehicles for the transport of goods.
0802	3	Other nuts, fresh or dried, whether or not shelled or peeled.
1006	3	Rice.

*Table 1: HS3 codes that appear most often in the top 10 exports of low income countries
Source: Based on 2015 COMTRADE data (UN-COMTRADE 2017)*

For countries classified as low income countries (in table 1), the principal goods that are traded are agricultural commodities - coffee, cotton, tea and cane sugar. Firms involved in international trade in lower income countries are likely to be part of the production side of supply chains which later reach into consuming countries. Lower-middle income statistics (in table 2) highlight that commodities are still important to trade in these countries, but there is a wider range of significant sectors - from simple garment production to value-added food activities such as fish and nuts.

HS3 Code	Frequency	Description
8544	9	Insulated wire, cable and other insulated electric conductors
6203	8	Men's suits, ensembles, jackets, blazers, trousers, bib and brace overalls, breeches and shorts
6109	6	T-shirts, singlets and other vests.
6204	6	Women's suits, ensembles, jackets, blazers, dresses, skirts, divided skirts, trousers, bib and brace overalls, breeches and short.
0901	5	Coffee.
5201	5	Cotton.
8708	5	Parts and accessories of the motor vehicles
0801	4	Coconuts, Brazil nuts and cashew nuts, fresh or dried
0803	4	Bananas, including plantains
1701	4	Cane or beet sugar and chemically pure sucrose.
1801	4	Cocoa beans.
8703	4	Motor cars and other motor vehicles principally designed for the transport of persons.
0303	3	Fish, frozen, excluding fish fillets and other fish meat.
0307	3	Molluscs; smoked molluscs; flours, meals and pellets of molluscs.
1005	3	Maize (corn).

*Table 2: HS3 categories that appear most often in the top 10 exports of lower-middle income countries
Source: Based on 2015 COMTRADE data (UN-COMTRADE 2017)*

The key point is that international trade in these countries principally revolves around the production of inputs or basic processing, linked through extended supply chains to international markets. This idea orientates the remainder of the analysis. It addresses international trade in lower income countries primarily by exploring the ways in which firms act as exporters within global value chains (defined in the next section)¹. As highlighted, even though commodities remain the dominant sectors, participation in value chains that move beyond agricultural production to value-added production roles may also be viable in some lower income countries.

¹ Later in the discussion we will highlight some potential other modes of international trade that may be of interest, such as value chains linking into emerging country and value chains that look to growing consumers in lower income countries. However, at present, these are not the dominant forms of international flows, particularly related to smaller firms involved in international trade

Whilst there is a growing number of surveys on ICT use in lower income countries, there is little coverage of enterprise use of ICT in these countries. Results from the multi-country World Bank Enterprise Survey(2017) give some indication of ICT use by firms lower income countries.

Figure 1 and Figure 2, show the two main questions in this survey that concern digitalisation and trade. They ask if firms use email or websites “in communication with clients and suppliers”. In the two figures the proportion answering affirmatively is broken down: by firm type, firm size, location and by specific country categorisation.

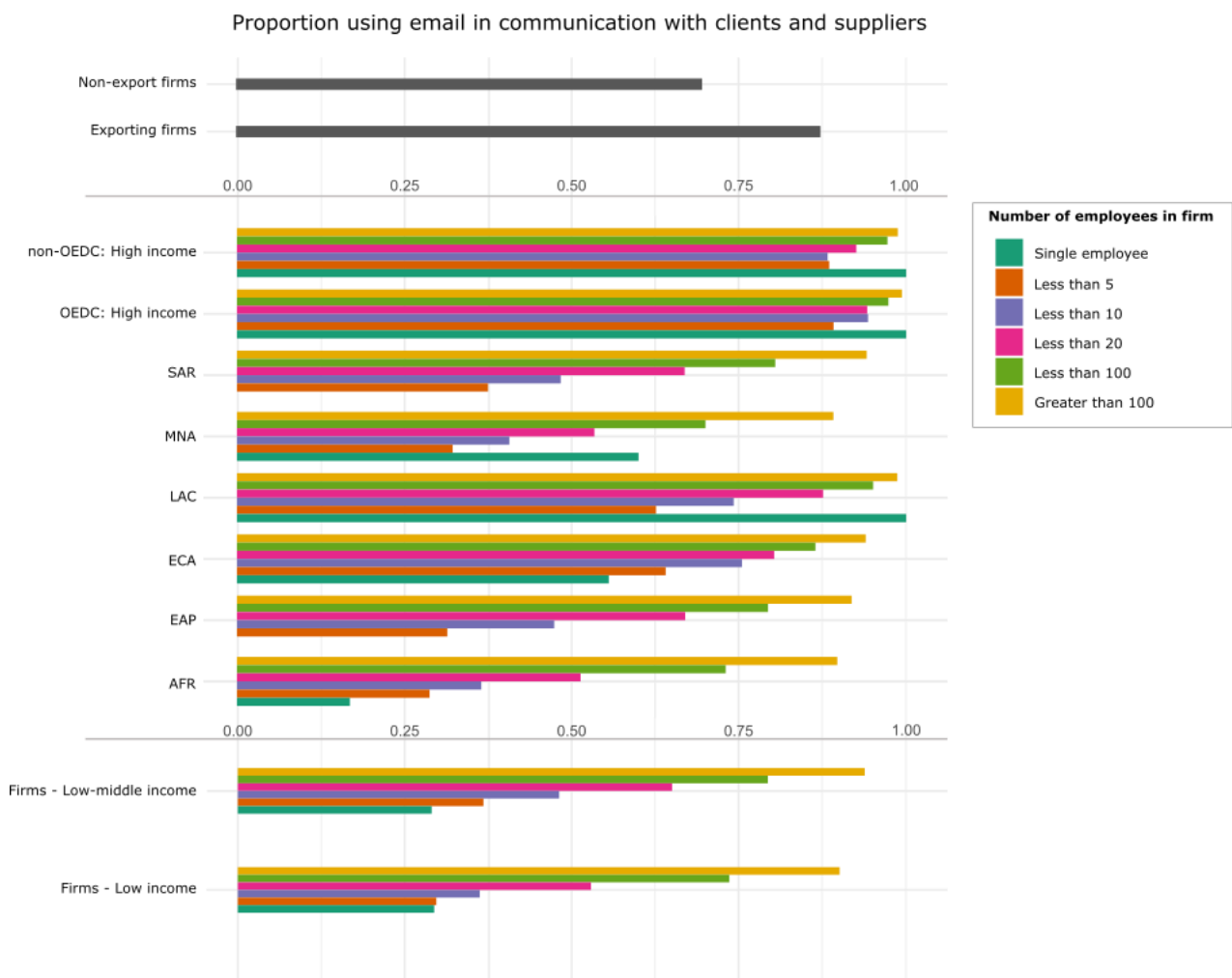


Figure 1: Proportion of firms who use email in communications in interaction with suppliers or clients, broken down by firm export type, firm size, firm region and firm area
Source: (World Bank 2017)

The graphs highlight that use of digital resources is widespread. However, there is a particular drop in firm ICT use in small and micro-enterprises, and this is particularly marked in Africa, South Asia and the Asia-Pacific. That exporters are more likely to use ICT than non-export firms is unsurprising. The small difference between firms in low and low-middle income countries, by contrast, suggests that both groups still lag other parts of the world.

In smaller firms across the world, use of very simple tools such as email is reasonably common, but with more complex ICT activities such as website creation, there is a marked drop in use, as highlighted in Figure 2. Whilst similar trends around firm size, country and region are also observable as in Figure 1, the difference between regions, and between small and large enterprises is more noticeable.

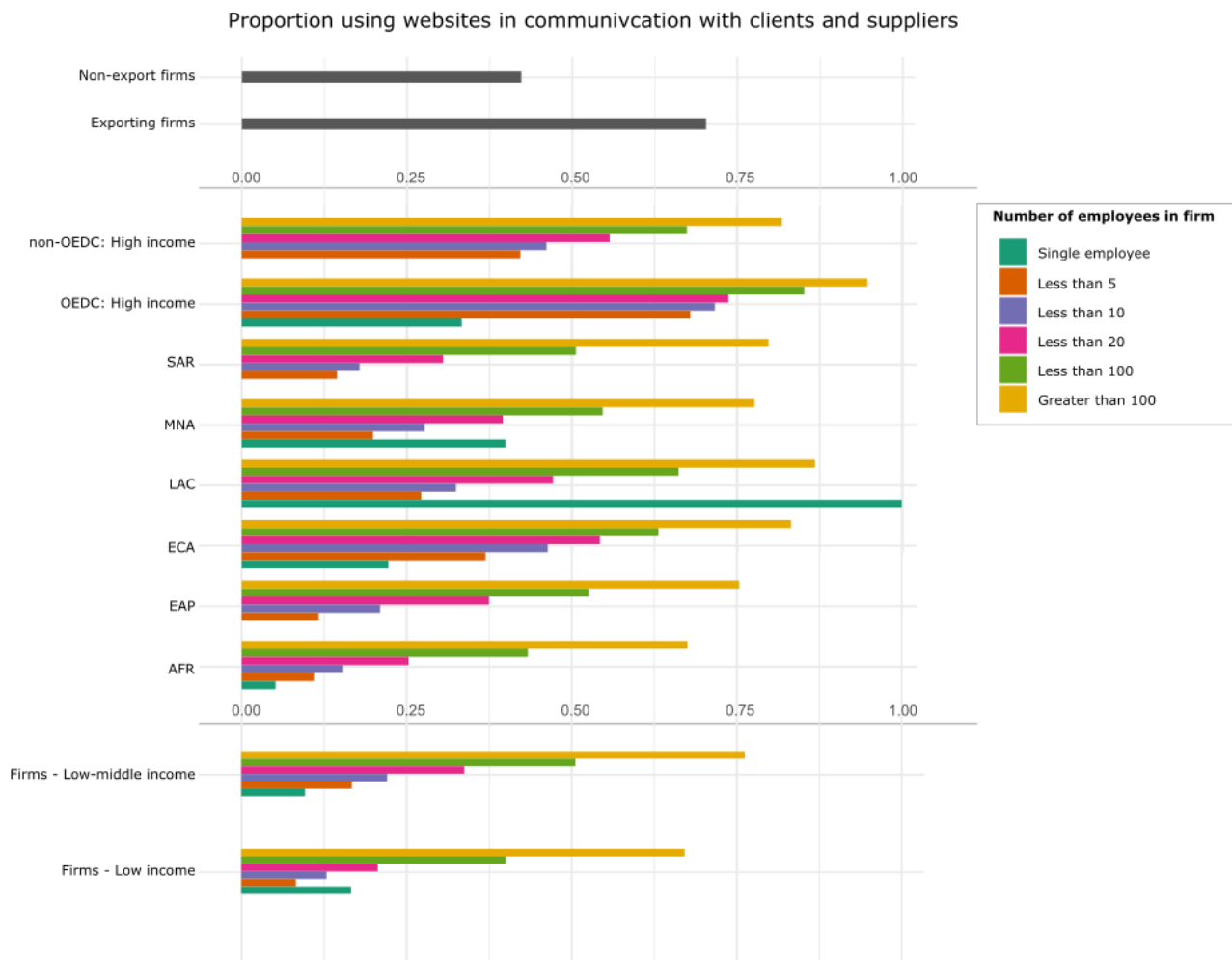


Figure 2: Proportion of firms who use websites in interactions with suppliers or clients, broken down by firm export type, firm size, firm region and firm area
Source: (World Bank 2017)

These results highlight some concerns about digitalisation in lower income countries. Clearly, there is some use of ICTs such as mobile phones and the ability to access the internet and use basic tools such as email. However, more demanding ICTs and systems may be beyond the ability of smaller firms in low and low-middle income countries. This highlights issues about the extent to which digitalisation will be effective in value chains, many small firms are liable to be small. Given the evidence of significant drop off in use in lower income countries, there may be challenges around ICT implementation, costs and awareness that need further exploration

In sum, this section provided some macro-level analysis on digitalisation to set up the problems explored in this paper. While some analysis has suggested that digitalisation might enhance trade flows,

others have highlighted limits in terms of specific groups, specific technologies and national conditions. More in-depth and cross-sectoral analysis is necessary to explore the opportunities and challenges, and to examine the appropriate institutions necessary for digitalisation to be impactful on trade. Data analysis has highlighted that firms are likely to be involved as exporters in certain value chains, and that there are likely to be a number of potentials and challenges around digitalisation.

3. Models of trade and digitalisation

In the previous section, trade in lower income countries was argued to align with exports into extended supply chains of production. There is a multitude of different models that have been used to explore these types of activity, including value chains, production networks, transaction cost models, information/knowledge chain models as shown in Table 3.

Model	Description	Role of information and digitalisation	Use to explore digitalisation in lower income countries
Transaction cost models	Used in understanding and modelling economic exchange between two parties, and the costs involved in such transactions.	Information considered key in supporting transactions.	ICTs supporting exchanges. Focus on the details of specific transactions. (e.g. Jensen 2007, UNCTAD 2011, World Bank 2016a)
Data, Information and Knowledge	Closer analysis of the forms of data, information and knowledge within firm interactions.	How information is made available to actors and what types of knowledge are codified.	Focus on information flows, determining potential information lacks or blockages. (e.g. Foster et al. Forthcoming, Heeks 2010)
Global value chains	More holistic focus on firm relations in chains of production. Focus on the capture of value and governance by firms in value chains.	How digitalisation changes value chain relations and linkages	Analysis of impacts of information with a stronger consideration to specificities of sectors and outcome (e.g. Gereffi 2001, Sturgeon & Zylberberg 2016)
Global production networks	Close to GVC models, but explores the regional implications of globalised production.	Digitalisation and the way that this facilitates firms to embed and disembed with regions	Potentially wider analysis of the regional development and policy implication around digital technologies (e.g. Wrigley & Currah 2006)

Table 3: Summary of typical models that have been used to explore digitalisation and firm exports

3.1. Value chains

This paper focuses on value chain perspectives to explore lower income country firms and exports. Empirically, there is also growing support that ‘global value chains’ (seen as a specific form of globally fragmented supply chains), are the principal way by which low income countries trade in products and services. (Gereffi 2014, Gereffi & Lee 2012). The value chain literature also helps to address a conceptual gap in the literature on digitalisation. There is a growing wealth of studies in ICT for development that have explored firm interactions in lower income countries using models related to transactions costs and information flows. However, such work tends to pay less attention to the specificities of particular sectors. Taking international production as simply a set of networks where digitalisation can easily reconfigure relations is problematic. Value chain perspectives are useful in that

they highlight a range of conditions, power relations, as well as product and process requirements that need to be considered together with the trends of digitalisation (Graham 2008).

Outlining the key aspects of global value chains is important to understand the constraints and opportunities for firms in lower income countries. They are then used as a base to explore the use and impact of digitalisation.

As outlined above, global value chains particularly highlight the contemporary nature of globalised production, as fragmented chains of production. Such chains specifically emerge as lead firms focus on their core competencies and outsource activities seen to be non-core or of lower value (Kaplinsky & Morris 2001, Porter 1998). With improved technology and ICT, it is possible for outsourcing to become more spatially fragmented, often taking advantages of lower labour costs in lower income countries, with networks of production expanding across global boundaries (Dicken 2011, Murphy 2013).

Thus, export-orientated firms in lower income countries are likely to take on low-value roles. However, through technological learning and knowledge, they may be able to 'upgrade'. The well-known typology of upgrading paths highlights product, process, functional (firms taking on new functions in chains) and chain (firms moving to new value chains) upgrading as ways that firms may innovate or exploit their knowledge to capture more value (Kaplinsky & Morris 2001).

3.2. Governance and standards in value chains

Value chains and the ability to upgrade are linked to the notion of governance. This term highlights the ways in which lead firm(s) are able to manage and coordinate fragmented production networks (Gereffi et al. 2005, Gereffi 1999). Empirical research has highlighted a number of different types of governance across sectors. For instance, market-orientated chains (such as agricultural commodities) may emerge with simpler products where firms can buy products in spot markets. In relational value chains (such as apparel), complex requirements of products or services may lead to more interdependence between firms in production (Gereffi et al. 2005).

Whilst value chain governance remains varied, there are trends across all sectors towards their fragmentation, as lead firms specialise. Lead firms and retailers are focusing on the high-value marketing and innovation of products and services (Sturgeon 2002) and this is also leading to a wider range of more complex production activities, chain coordination and control aspects becoming outsourced and globalised (including low-value activities) (Fold 2001, Gereffi et al. 2005).

Following on from the prevailing trends in value chains governance, recent literature has focused on standards and quality. With the growth of hands off co-ordination of value chains by lead firms, standards and quality have become important aspects of how lead firms govern ever more complex value chains (Ponte & Gibbon 2005). As Ponte and Gibbon put it, "lead firms have been able to

embed complex quality information into widely accepted standards and codification and certification procedure”(Ponte & Gibbon 2005 p.3). It is important to note that these new rules define not only product forms but also increasingly orientate how processes are undertaken by firms in value chains.

For firms in lower income countries, achieving quality and standards is vital to be able to sell to export markets. The ability to meet standards and to prove that processes, products (or in some cases the complete value chain) have met certain criteria is now essential in many industries (e.g. produce quality, electrical safety etc). Firms that can prove higher level quality and standards, such that they meet ethical and environment standards, can be used as a competitive advantage and such firms can potentially participate in value-added chains. This is particularly the case in the agro-food sector (Lee et al. 2012).

3.3. Small firms and digitalisation

For smaller firms in lower income countries, there are both opportunities and challenges of participating in global value chains. A growing number of activities are being outsourced². However, there are dangers of being stuck in low-value activities with little opportunity of upgrading. Profits typically accrue at places where simple products are configured and branded and this is unlikely to shift towards lower income countries (Fold 2001). Standards and quality are demanding for smaller firms to achieve and this can be potentially exclusionary. Moreover, achieving standards for value-added production may require significant external support and closer integration with other value chain actors, and this may only be possible for certain preferred suppliers (Lee et al. 2012).

In the past, value chain models have tended to place rapid digitalisation as a background aspect which supports globalisation, but there is sparse literature which focuses specifically on digitalisation (Foster & Graham 2017). This is problematic. Firstly, with the use of digital ICTs in lower income countries, digitalisation of value chains is spreading throughout the chain and offers new modes of management and integration. Second, digitalisation of value chains is uneven and varied across sectors, firms and countries. Thus, the varying strategies and modes of digitalisation are important to consider from both a firm and a policy perspective (Foster et al. Forthcoming).

In sum, value chains are challenging for firms to participate in and to seize significant value from. The use of ICT and digital resource can potentially have significant impacts: changing value chain relationships (Gereffi 2001), and offering ways for smaller firms to overcome constraints related to informational or knowledge deficiencies (e.g chain coordination, improving information flows, knowledge about markets, cutting out intermediaries) (Craviotti 2012).

² This may change in the future. Firstly, there are growing protectionist tendencies emerging globally around trade. Secondly, there are also trends around new technologies such as automation, robotization and digital factories. Together these might reduce tendencies of outsourcing and fragmentation of value chains. However, these are emergent phenomena, and there is a little evidence as yet that these processes are greatly impacting the extent of outsourcing. Moreover, lower value activities in lower income countries are rarely the focus of such initiatives.

4. Sectoral examples of digitalisation

There is a wealth of literature on how digital ICT are supporting firms to become more efficient and better connected. For example, rich literature on mobile use in firms in lower income countries highlights how ICT such as mobile supports firm linkages and information availability (Aker 2010, Donner 2004, Donner & Escobari 2010, Esselaar et al. 2007).

Such literature highlights some of the general benefits that come from use of ICTs and digitalisation of firms, but they tend to focus on transformations happening within local networks and markets, with less attention paid to exporting. It is not the intention to exhaustively review every possible intervention here. Rather, we specifically focus on the ways that ICTs and digital connectivity are supporting linkages into global value chains. Based on the literature we divide discussion into three key categories ‘thintegration’, platforms and full digitalisation. We argue that these categories represent the dominant modes by which small firms are currently using digital resources as part of export activities.

4.1. Thintegration

The terminology of ‘thin integration’ or ‘thintegration’ was originally used by Murphy & Carmody(2015) to highlight a mode of minimal digitalisation that is often seen in value chains (including export-orientated ones) in lower income countries. Aligning with the earlier discussion related to ICT findings in the enterprise survey data, thintegration highlights how ICT is commonly used for firms to link in ad-hoc ways. This use of ICTs provides some tighter co-ordination of value chains but does not lead to significant transformation of relations or increased capture of value. In many studies, thintegration is the dominant form of digitalisation (if one can even refer to it as digitalisation) in value chains.

a) Thintegration in furniture, garments and tourism

In the furniture, garments and tourism sectors there is evidence that small firms are beginning to use ICT. For instance, small furniture producers in South Africa frequently use mobile as a way of coordinating their employees and production. They also go online to look at designs as a way of building market knowledge (Murphy & Carmody 2015). In the garment sector, subcontractors in Asia involved in exports often receive orders and details for products by email (McNamara 2008). Similarly, research in tourism in East Africa found that many firms including small hotels and travel agents have adopted ICTs, using them for aspects such as research of tourism sights, coordination and email confirmations of bookings (Foster & Graham 2015a).

In such sectors, the adoption of digital technologies does not significantly alter value chains. Firms still rely on intermediaries and even with ICT these actor remain important. Reluctance to integrate in more substantial digitalisation can also relate to challenges around exporting and payments (Moodley 2002),

and the lack of channels to build knowledge of trends from consuming countries, which might facilitate upgrading (Murphy & Carmody 2015).

b) Thintegration and coordination in agriculture

In many sectors of agriculture, thintegration can be observed. With growing demands related to quality, yields and logistics in agricultural exports there are needs for growers, farmers and producers to coordinate inputs and resources to ensure they meet the necessary requirements. Examples of coordination demands particularly relevant to exports include coordinating inputs (such as fertilisers and seeds), the provision of finance (loans, insurance) and improved logistics (such as rapid chain storage or cold chains) (Parikh et al. 2007). As farmers move away from commodities to value-added crops these demands are liable to grow.

Typical use of ICT in agriculture can often be seen as thintegration where value chain actors use very simple tools, such as email, mobile and excel spreadsheets as a way to coordinate activities (Foster & Graham 2015b). Previous research suggests that coordination is often costly to farmers and there is potential for more integrated digitise solutions (De Silva & Ratnadiwakara 2008). Sporadic pilots and schemes have emerged that seek to support such coordination for exporters more systematically. For instance, there are ICT-based seed quality testing and burgeoning mobile finance services in places like East Africa which contribute to improving coordination amongst farmers. But these activities are ad-hoc and rarely institutionalised in sectors (Brugger 2011, CTA 2014).

c) Quality/standards in agriculture and thintegration

Beyond coordinating inputs and logistics in value chains, central to the ability to export in agriculture is the ability of farmers and firms in the value chain to satisfy quality and standards requirements. While ICT and digital tools could play an important role in supporting improved quality and standards adherence, activities are currently lacking in this area. Again, smaller agricultural actors may use ICTs in simple ways. For instance, cooperatives may use ICT to share information about improving practices between farming groups, but these uses of ICT do not lead to radical changes in services or farmers ability to achieve standards (Foster & Graham 2015b).

In all aspects of agricultural production, gaining new knowledge and skills has always been important – related to choosing crops, to farm management, to harvesting – is vital. Traditionally such activity has been supported by agricultural extension services, but these are often fragmented, and underfunded (Brugger 2011, Poulton & Macartney 2012).

In light of these limitations, a large number of ICT systems provide important information relevant to farmers, or provide e-learning or e-extension services. These may range from simple messaging applications providing basic advice on crops or weather, through to interactive apps to support farmer skills and education, right up to full decision support systems which have been aimed to help farmers

improve quality and yields based on their specific contexts (Baumüller 2015, Brugger 2011). Research has typically explored information that could be described as ‘general purpose’, highlighting how ICT can support good practices relevant to producers targeting local or export markets such as seed selection, smallholder management, etc. (George et al. 2011).

Reports of ICT in agriculture cite many cases of such e- or m- learning interventions. However, specific aspects relevant to exporting have been less supported through ICTs, particularly learning for achieving better quality and standards. As highlighted by two reviews on ICT and agriculture (by the World Bank and Vodafone) there are limited pilots related to exporting, standards and traceability (George et al. 2011, Kirk et al. 2011). Some recent initiatives such as the International Trade Centres, ‘Trade for sustainable development’ (ITC 2016a) and pilots in the horticulture sector linked to EU market access are promising examples (Ihedigbo 2014). However given the importance of standard and quality to small firm exporters, this could be a stronger area for intervention and consideration of policy makers. Standards bodies, in particular, could play a more central role in providing resources in this area, and consider the how existing modes of audit could be supplemented by ICT to make standards more accessible to a greater number of producers (Foster & Graham 2015b).

4.2. Platforms

A second mode of digitalisation seen in value chains is the growth of platforms. These have quite different manifestations in different sectors, and their impacts have been varied. Below, cases in different value chains are considered.

a) Agriculture and platforms

Finding efficient markets for products, and the ability to get fair prices within those markets, has been seen as a key benefit of the use of ICT. The dissemination of price information through ICTs, whether that be mobile, internet based centres or older ICTs like radio is now well known. Empirical evidence has highlighted that the diffusion of digital technologies reduces market price differentials between scattered trading points, having stronger benefits on prices amongst more isolated markets (Aker 2010, Jensen 2007, Muto & Yamano 2009, UNCTAD 2010, Zanello et al. 2014). Ideas of using ICT to bring better markets have also inspired many more active interventions in agriculture, improving markets through the more active dissemination of ICT-based market prices. Such systems mainly involve commodity goods, where transparent market price information is available, and with the potential to achieve a sufficient number of buyers.

Some interventions have focused on export commodities. A key aspect of exports is that it may not sufficient to solely provide a price, it may need to be supported by the ability of potential exporters to trade those goods with exporters. There are cases of market information supplementing private trade already present, but many systems include the ability for producers to sell their goods based on market

prices, or the ability to offer them in platform-based exchanges (either as face-to-face auctions or online platforms).

In a number of countries, ICT-supported price information and commodity exchanges have emerged as publically orientated systems. In Africa, for example, the Ethiopia commodity exchange and the Nairobi coffee auction both support export trading in coffee (EuropeAid 2012). Whilst these exchanges have been successful in some cases, there tends to be significant limitations. Commodity exchanges have existed in analogue form for a number of years, and are often slow to adapt and digitise to ICTs. For example, the Kenyan tea auction has digitised to some limited extent (e.g. for payments, and some limited price information), but many involved in the auction have been unhappy that it has not become an online platform to facilitate faster trading (Foster & Graham 2015b, Waema & Katua 2014). Without digitalisation, commodity exchanges risk remaining centralised and geared towards local traders and intermediary sellers over producers and processors. In these cases, even with potential open avenues of export, farmers may find that payments and feedback provide little improvement in transparency (Kawuma 2015, Surborg 2009).

With these limitations, potentially more successful models for platform exchanges may come from privately run systems or those which include combinations of private, public and donor firms. Examples include celebrated cases such as eChopal in India, ESoko in Ghana and Novus Agro in Nigeria, which use ICT to provide price information and other avenues for producers to sell goods to exporters (Brugger 2011, GEMS4 2016, Parikh et al. 2007). Some quantitative research suggests that such systems are more dynamic and responsive to market needs, and have led to higher export prices in some sectors (Goyal 2010).

However, there is little peer-reviewed research here and thus need for further research on how effective such interventions are (Duncombe 2016). Recent research suggests that price and export platforms may be problematic for more marginal producers. Exporting farmers selling at market prices are prone to instability - currency shifts, retailer demand, national policy and price changes. This is particularly the case where platforms cover a number of regions and countries, and buyers can rapidly shift across exporters dependent on economic and policy conditions (Kumar 2014). Second, platforms have been found to provide less leeway for farmers on quality, standards and volume requirements and this can be exclusionary to certain sets of farmers. For example, for eChopal, many small-scale soybean producers preferred to continue to trade with intermediaries over using the market system. While intermediaries were able to accept lower quality goods and then spend time sorting them, the market information system did not offer this flexibility (Kumar 2014).

Undoubtedly, digitalisation of market prices and platform trading will play a key role in the future in ensuring scattered producers are able to be better aggregated and organised to export globally. This extended discussion highlights a number of challenges in implementation that will often determine if

these system are viable, and who they may exclude. A key lesson is that lower income farmers are more likely to be successfully integrated where platforms are available to them locally, so they can interact more directly, rather than have to trade through intermediaries. Platforms in agriculture are also more successful when they offer a basket of agriculture support services and systems in addition to price information (Burrell & Oreglia 2013). For instance, they can also support diffusion of agricultural inputs (such as seeds and fertiliser) and logistics (Vorley et al. 2012).

b) Tourism and platforms

Given that digitalisation has become central to all processes in tourism, SME integration into platforms such as online travel agents (OTA) provides potential for reaching international tourists. Analysis of OTA use suggests that many SMEs, tend to struggle to integrate into systems due to problems of technology integration (Foster & Graham 2015a). Further, when hotels want to be involved in customer international payments there are often limitations. In Kenya, it is only recently that international payments have become viable, and exporting firms have often looked to open US or EU bank accounts to avoid complications (Waema & Katua 2014). Even those who have found themselves able to integrate, business coming from such platforms can be highly unstable (see box below) (Foster & Graham 2015a).

There has been some success in tourism in using platforms to support smaller local firm growth. First, some local platforms and systems provide specific solutions aimed at SMEs in tourism. For example, in South Africa the hotel booking software called NightBridge has been successful by providing more customised systems for SME and is now expanding in other parts of Africa (Foster & Graham 2015a, Murphy et al. 2014). Second, there seems strong potential in niche areas such as ecotourism and environmental travel, where online presence pushed SME inclusion in international markets. In these cases, where firms offer interesting products, online visibility and use of ICTs is an effective way of marketing credentials and facilities both customers and international tourism firms alike to link them, often digitally (Foster & Graham 2015a, Lai & Shafer 2005).

Small hotels and online travel agents in Rwanda

Very high-end tourism trips in East Africa are typically 'packaged' where international tour operators in the home country of travellers arrange hotels and logistics. When this happens, they tend to use hotels and lodges that are well known to them. For small hotels, without good connections and sufficient quality of accommodation, it can be difficult to reach international tourists. Such hotels are keen to integrate into international customers and online platforms which offer new routes to gain international tourist or business travellers.

For smaller hotels, integration with OTAs is a struggle. For OTAs, integration may involve quite complex requirements such as integrating their booking systems with an application programming interface (API) or using specialist 'channel management' software. Many smaller hotels simply do not have the ability to integrate. These hotels will often still run their bookings through a paper diary or a custom solution such as an excel spreadsheet. It is very difficult for them to integrate these ad-hoc setups with OTAs.

One large OTA, keen to integrate a wider range of Rwandan hotels into its system, came up with a solution to this problem. A local firm was contracted to act as an intermediary, and to process and deal with any bookings from the OTA. They would then liaise with smaller hotels to confirm booking and details. Ironically, in this case, platforms that

were supposed to have removed 'inefficient intermediaries' have had to be re-intermediated with this contracted firm in order to provide a viable service for these small hotels.

Small hotels are often sceptical of OTA use so far. To integrate with the OTA they contract with them to block reserve rooms in their hotel to be used only by the OTA. The block booking of hotel rooms is designed by the OTA as a way to avoid double booking, but hotels often find they end up with empty rooms. With still limited information coming from the OTA, it is not clear if this arrangement provides sufficient stability in rooms for hotels to continue in the future. Hotels are also not sure how to improve their booking through OTAs: do they need to do pay for search engine optimisation? Should they use social media to build presence? How can they use websites such as TripAdvisor to drive customers?

Source: Adapted from (Foster & Graham 2015a)

c) **Globalised platform providers**

The above sections noted limitations that can reduce the ability for platforms to be impactful in some value chains. However, platforms are becoming an increasingly important part of value chains, and there is a diversity of goods (intermediate products, gifts, retail food items) that are more suitable to be sold directly into international markets. It is worth considering these trends for exporters in more detail.

Platforms used in trade are not all equivalent. Some can facilitate trade more than others. Early work in e-commerce in developing countries suggested that it was difficult for firms to use these platforms due to difficulties in evaluating trustworthiness and the quality of firms, or where payment approaches were poorly integrated or inflexible (Molla & Heeks 2007, Paré 2002). More recent work has highlighted that the new generation of platforms offers important export opportunities to small firms, and now include increasingly sophisticated ratings, viable payment options, and guarantees that are beginning to provide stronger protection for buyers and sellers (Parker et al. 2016). Notably, for export firms in lower income countries, generic online platforms are globalising, and it is possible for firms in some lower income countries to integrate, for example with e-commerce sites like Amazon Marketplace and eBay and business-to-business sites like Alibaba. These platforms are extending their protections and coverage to support traders in an increasing range of countries (eBay 2013). This globalisation of platforms makes it easier for SMEs to trade using a convenient payment system and often are able to use platforms to their own language. Thus, with more ubiquitous internet access, such platforms are becoming a more important export channel for intermediary or final goods (UNCTAD 2015, World Bank 2016a).

4.3. **Digitalisation and integration**

Recent growth in connectivity in lower income countries is facilitating emerging trends towards full systems integration of value chains. These activities may include aspects mentioned previously such as online trading and chain coordination using ICT. But, they go beyond, these trends by integrating an increasing range of value chain activities into single systems so that value chains are increasingly data driven. These activities are particularly emerging in export sectors governed by large businesses and multinational firms.

a) Full digitalisation in agriculture

In agriculture, fully integrated systems often start in the collection of agricultural inputs. New data integrated devices include mobile data collection apps (Brugger 2011), barcode and RFID-based tracking (George et al. 2011) and field collection devices such as scales and weighbridges (Foster & Graham 2015b). These devices seamlessly integrate with information systems, providing details about every transaction at a level of detail not seen before. As goods move along the value chain, additional parts of the system digitise different aspects: tracking and facilitating payments including integrating with mobile money payments (Foster & Graham 2015b), tracking goods in processing factories (Foster & Graham 2015b), allowing agribusiness the ability to better managed export small-holders, improving data management in value chains (Armstrong et al. 2011), and sending specific informational messages to farmers through SMS (Technoserve 2016).

Such systems are context specific and dependent on the form of value chains. Examples include projects in value chains of nuts using software from system vendor SAP in Ghana, and enterprise resource planning (ERP) software SAGE in Kenya (Franz et al. 2014, Rammohan 2010). NGOs and development partners have created similar systems in partnership with agri-businesses in Kenya and Ghana, providing fully integrated solutions between farmers, intermediaries and agribusinesses (Ashraf et al. 2009, George et al. 2011, IFDC 2015, Technoserve 2016).

Such systems are in their early stages, but indications are that they can significantly improve efficiency in the value chain, reduce costs and open up export opportunities to a wider range of farmers. They are also popular amongst farmers by allowing easier tracking of payments and reducing the risk of corruption (for example, loss from false weighing or loss during transportation). Further research is needed in this area, we need to know more about the barrier to inclusion in such systems When such activities are digitalised they also remove activities previously coordinated by farmer groups, cooperatives and unions. If systems, albeit more efficient ones, individualise farms and sideline co-operatives, this might be create new challenges (Foster & Graham 2015b).

b) Digitalisation in garments

In the garment sector, value chains are increasingly aligned to 'fast fashion' models, which revolve around strategies of low stock in retailers, rapidly evolving custom designs and just-in-time production (Tokatli 2008). The dominant model for exporters in garments is through customised made-to-order production where export relationships occur between producers and retailers who have built trust (Moodley et al. 2003). Trading in garments often relies on the 'feel' of textiles or on closer scrutiny of quality that cannot be done remotely. For SMEs that are involved as subcontractors in export value chains, connections are typically made through intermediaries such as buying agents, and often requires the movement of samples for inspection (Ahsan & Azeem 2010, Thanh et al. 2009).

In these contexts, there may be less potential for more open platforms. Instead, retailers require close integration of supplier firms and this includes trusted contractors being given access to internal information systems of retailers so they can rapidly track stock needs and record their production (Humphrey et al. 2003, Nayak et al. 2015). More advanced firms may further integrate production through the use of RFID and barcodes to track goods and ERPs to monitor stock and payments (McNamara 2008).

Further research is needed to map digitalisation in garments in more detail. Indications are that there is a split, between preferred suppliers that are digitally integrated and sub-contractors that are only 'thintegrated'. All firms, however, feel the impacts of 'fast fashion' models. These new forms of activity, facilitated by systems, lead to new risks for firms where risks are transferred to contractors and sub-contractors in terms of stock requirements, unpredictable orders and demand for short turnaround times (Tokatli 2008).

5. Who stands to benefit from digitalisation in terms of trade performance

Following on from the previous section which looked in detail around ICT use and digitalisation in the value chain, this section specifically looks to the impacts of digitalisation across roles and locations.

5.1. Thintegration

The use of the term thintegration highlights a common mode of use of ICT, which is relevant to many involved in exports, where digital ICT use is often *ad-hoc*, and minimal. Firms use ICT in ways to improve coordination and activities in value chains but without significantly changing the overarching relationships in value chains. Barriers to more expansive ICT use vary. In some places, this may be related to digital access issues and/or quality of access. However, as suggested in the earlier quantitative analysis, this does not appear to be the main limitation. In tourism, even with ICT access, skills gaps limit the extent to which small hotels are able to technically link into global systems. In some sectors of agriculture, integrating into platforms only appear viable where firms are supported in many complementary aspects (such as finance and standards). Thus thintegration emerges related to barriers known from well-established models of digital divide— lack of skills, motivation, resources and appropriate systems (Van Dijk 2005). Beyond these barriers, digital systems may be actively used as ways to exclude certain firms from upgrading. For instance, garment sub-contractors or tea associations may wish to better integrate with large buyers digitally, but they are not part of preferential networks. Thus, in some sectors thintegration is the outcome of conflicts around digital resource access.

5.2. Platforms

In buyer-driven chains, more open platforms, where sellers from lower income countries trade with buyers, are present in forms. However, where there is buyer dominance, these digital platforms appear to have limited potential to disrupt sectors (such as agricultural commodities where a few lead firms control the market). Moreover, quality of goods and services in value chains is notoriously difficult to objectively measure, and thus platforms may not be suitable for some forms of exchanges (such as in garments where assessing quality from afar is problematic).

Platforms may offer greater potential in sectors such as some agricultural cash-crops and service sectors like tourism. In sectors where global markets and/or buyers are more diverse, platforms are particularly viable. In such sectors there may also be the ability for functional upgrading in value chains to produce value-added exports to sell through e-commerce, for instance, where producers can use platforms to upgrade into exports such as beer making and food products to be regionally exported (Hinson 2010, Tiarniyu et al. 2012).

Being part of open platforms exposes firms in low income countries to the risk of hyper-competition and unstable markets. For instance, some agricultural small firms have run into trouble when goods prices dropped, tourism firms in East Africa struggled with instabilities around online booking and difficulties in predicting numbers. However, platforms are particularly valuable where smaller firms use them not to compete at a mass-market level, but to specifically isolate segments or niches they can serve. Examples include the trading of niche services in tourism, niche value-added food products and trading into regional and emerging market value chains. Often these segments and markets may seem relatively small on their own, but platforms can provide sufficient income for SMEs to grow and expand. Central to these activities is a coherent business plan and often the use of globalised e-commerce and e-business platforms (e.g. OTAs, Alibaba) which allow new forms of trade, particularly between smaller firms and smaller retailers.

The growth of more sophisticated platforms, particularly in terms of localisation of e-commerce and e-business platforms are providing greater opportunities in some sectors for firms to integrate globally. Essential for maximum inclusion of firms in lower income countries are systems that support appropriate technical integration, facilitate payments and maximise trust as firms trade into more global markets.

5.3. Digitalisation

Sectors such as garments and agricultural commodities are 'buyer-driven' (Gereffi 1999), where buyers and retailers are well established and tend to have more control over value chain. In these sectors there are trends towards digitalisation, which supports buyer-driven strategies to manage, track and improve control of value chains. Value chain data becomes integrated with buyer-initiated information systems.

These systems closely align with value chain notions of 'hands-off' chains, where data infrastructures support the ability of lead firms to monitor, manage, track and trace goods in the value chain from afar. Data are a central aspect firms to achieve standards and marks, fulfilling CSR and legislative requirements. (Foster et al. Forthcoming).

With the expansion of internet and ICT access amongst smaller firms and producers, digitalisation is extending to smaller firms down the value chain, for example, mobile money integration and data based quality and weighing devices. There are indications that such digitalisation could be advantageous but also lead to new challenges.

For small-scale producers involved in exports, increasingly digitised value chains potentially make the value chain more transparent and remove intermediaries. For example, commodity producers may rely on digitised weighing and mobile payment, which improves the efficiency of their activities and reduces costs around corruption and commissions. They also greatly simplify value chain coordination for larger firms and hence potentially make small-scale production more economically attractive. However, in other cases digital integration is problematic. Intermediaries such as co-operatives and local traders and brokers can play significant roles in enabling export value chains - cooperatives facilitate group improvements and advocate for commodity producers; brokers may aggregate, provide loans and informal knowledge around quality and standards. Further, as Ouma(2010) has discussed, at a local level, value chains are subject to many local negotiations and fixes around aspects of standards and quality. These informal norms may not be recognised in digital systems and can lead to systems being more exclusionary. There is thus a danger that digitalisation can marginalise these intermediaries and push smaller firms into even more subservient relationships.

6. Policy implications

Whilst in previous sections, a number of significant challenges around ICT exclusion and how digitalisation is implemented were highlighted, the solution is certainly not to ignore the expansion of new technology and platforms. In a global and increasingly digital economy, such activity is liable to simply redirect trade elsewhere in the world. There are wider sets of policy around ICT and digitalisation at a national level that can support improved and more equitable export participation. Many of these align with the idea of alignment between local systems, institutions and the requirements and expectations of global value chains (Murphy & Carmody 2015). To put it another way, good policy will support norms and environments within a lower income country which make it possible for firms more easily to integrated into global value chains.

6.1. Regulation

There are a number of important first steps which revolve around enhancing infrastructure and providing effective regulation to support ICT services and applications (E-Agriculture 2015). In terms

of infrastructure, strong links in urban areas to allow the use of digitised systems (for example, cloud-based software systems) is important for exporters. Given agriculture is a key export value chain and that many smaller growers and producers may be based in rural areas, it is particularly important that key infrastructure is accessible in rural areas. Provision of good communication between farmers and farmer collectives, and the ability for farmers collectives to be able to communicate begins with sufficient access. The underlying regulation is important, for example to ensure competitive mobile and internet markets as a way for facilitating wider national coverage. There are also more strategic actions that governments might take. With universal service funds being collected but left unused in many African countries (GSMA 2014), one viable strategy would be to invest some of this in ensuring that key regions of potential export-orientated production were well linked digitally.

Moreover, ICT regulation and competition can support price reductions. There are still concerns about costs of digital services provided for small export firms; messaging, internet data usage, mobile money commission may seem quite small, but when actors are repeatedly transacting this can eat into profits (CTA 2014). More widely, state encouragement of IT-enabled government services can also be important, both in making key services more agile and in driving wider ICT adoption. This particularly includes payment of key services online, and simplifying how firms export and import goods. Digitising core e-government services around tax and licencing can also be important at a local level.

6.2. Value chains and policy

We expand on the three key models of digitalisation discussed (thintegration, platforms and full digitalisation) to understand some wider implications that will be relevant to policy makers. Given the diversity of value chains, we do not always specifically offer specific policy prescriptions, but rather highlight some key challenges that might potentially be solved by policy makers.

a) Thintegration

In terms of increasing levels of ICT integration, a key policy goal would be to make platform or digitalisation aspects more accessible or equitable. A key point to add is that there are a number of schemes and systems already present to support exporters, but their reach is limited. Through ICT use they might support smaller firms in exporting. For instance, provision of standards and quality, and monitoring compliance is already present in many lower income countries, but are often not financially accessible for smaller producers. ICT-based systems could support more efficient diffusion of these skills and monitoring in this area. Given that such institutions are often private, the role of national or regional policy is likely to be a facilitating one, supporting private firms and donor initiatives.

b) Platforms

In some value chains, there is improved ability for firms in lower income countries to trade direct using platforms. However, as shown in the outline there are many aspects around the form and support for platforms which will determine if they facilitate participation in low income countries.

Exporting through platforms, whether that be e-business or e-commerce activities, offers potential. There can, however, be limitations if platforms have not been localised. Large globalised platforms may be localising for countries in the East Asian regions, but in other regions may still have limited accessibility (ITC 2016b). Policy makers in lower income countries can consider how they can build strategic relationships with private providers to push use amongst a wider array of actors in the value chains. This might include strategic relationships with platform providers to ensure that they can be fully localised and fit with existing regulation, or to provide training for SME to push improved usage. Such activities have occurred in lower income countries before. For instance, tourism platform providers have undertaken roadshows and training in East Africa (Foster & Graham 2015a), strategic partnerships and provision of support have been undertaken with Alibaba for use in Vietnam amongst SME (Mai & Tuan 2012), and there has been recent support for use of the Tradekey platform is supporting SMEs in the Middle East (ITC 2015a). Policy directions from China can also be insightful where more expansive partnerships look to small firms joining platforms as a core goal of firm modernisation³. Pushing widespread 'platforming' strategies amongst small firms in hand with local platforms could be a way to digitise and modernise production (Foster & Azmeh 2016).

Regulation and promotion of cross-border payments are another important aspects of platform policy. Without well-established cross-border payment rules, it will be difficult for anyone but the largest firms to be able to trade internationally. Moreover, private payment systems such as Paypal and Visa are less likely to be willing to invest where regulations are poor. These activities also impact on the strategies of large e-commerce platform providers, and influence localisation decisions (E-Agriculture 2015, UNCTAD 2015). Governments need to be aware that the future trajectories of platform payment and cross-border trade imply that many more firms will require cross-border payment facilities, often involving smaller sums than previous exports. Thus, payment regulations including ever smaller businesses are vital (ITC 2015b).

Platform policy is also related to extending export and marketing promotion that has traditionally supported large firms. For example, market intelligence around niche and new markets could complement the growth of new dynamic segments and sectors that would see online trading as the key model of transactions. There are also negative perceptions of online traders from certain countries, particularly in Africa, that require active work by governments to reduce (ITC 2015b)

³ as part of initiative such as O2O (online to offline) and regional integration policies

c) **Digitalisation**

A key aspect of export value chain success in lower income countries is the coordination of the local value chain - the sourcing of inputs, the movement of goods towards exports and the way that these provide information and management for exporters. As part of full chain digitalisation, a number of more integrated systems around market prices, value chain coordination and gathering inputs are becoming digitised. This is important for the development of efficient export-led production. There are challenges in how smaller firms and producers are integrated into such systems and are able to receive suitable information. Frequently such systems are privately led, related to exporters or agri-businesses and policy directions are not clear. Nevertheless, such systems are still likely to intersect with activities of publically orientated institutions (for example, agricultural development commissions) and so there is some potential for influence.

Regulation, support and nurturing of so-called ICT ecosystems can be an important area where policy can support simplified chain coordination. It is no coincidence that many of the most innovative digitised pilots and solutions are emerging in places like Kenya. Mobile money use is now expanding into an array of application and systems such as micro-insurance and system based payment into mobile money.

7. **Conclusions and further work**

In the past, the potentials of digitalisation in lower income countries have often been explored without understanding to the ways by which firms are integrated into international trade. By positioning small firms in involved in international trade as exporters into global value chains, this work has provided detail about some of the potentials and challenges around digitalisation.

Thintegration - The review of the literature has highlighted that digitalisation is beginning to occur in lower income countries, but that there a range of different outcomes. In many sectors, exporters adopt some forms of ICT and connectivity to support efficiency and improvements in local interactions, but this adoption can be described as ‘thintegration’ which fails to make a dramatic impact of the relationships they have or improve profits. This type of common adoption of ICTs, which can barely be called ‘digitalisation’, suggests that many small firms are limited in their digital participation of value chains related to secondary aspects of the digital divide such as skills, motivation etc. Systems and platform designers as well as policy makers should consider how to push for more favourable systems which better consider and intergrate smaller firms.

Platforms - The use of platforms in value chains is growing. It should be noted though that this is more marked for some sectors over others. Value chains which are strongly ‘buyer-driven’, or where quality requirements are more challenging tend to have been limited in use of platforms. The emergence of globalised platforms is, however, facilitating export trade for small firms in some sectors.

Crucial to this is the localisation of large platform providers in lower income countries and there are a range of policies (related to online payments, and cross-border movement of goods) that can support fair and expansive use of these platforms. At a strategic level careful consideration to support of small firm competitive advantages over mass market competition will be an important path for impactful platform use. Digital economies have been marked by their move from mass markets towards a range of 'long tail' diverse goods and services. By more strategically integrating their production into the long tail, smaller firms might best gain from platforms.

Digitalisation - We are seeing demands towards capturing a growing range of digital data flows in all aspects of the chain and the use of complex information systems to manage this data. Such digitised value chains offer strong potential to simplify the ability to integrate a far larger number of smaller firms at a viable cost. There are however, dangers of these tightly integrated value chains in that they impose new challenges and risks on smaller firms. Not least, our review highlights cases of buyer-driven value chains where digitation pushed control to lead firms and imposed new instability on smaller firms and this might also lead to collapses in labour forces in the longer term. From policy perspectives, policy directions that support beneficial digitisation for example, m-payment ecosystems can support a move from more fragmentary digitisation in value chains towards digital integration of existing firms. Reducing the instabilities of digitation often led by private firms are potentially more difficult and highlights a further areas of research around policy.

Further research - There are a number of areas where there further research can contribute to improved understanding and policy making around digitation and international trade. Most importantly, an improved interlinking between value chain research and digitalisation/ICT for development research is important. This particularly the case in sectors such as garments and other non-agricultural export sectors in lower income countries, where research on digitalisation is lacking.

In some sectors, small firm integration into globalised platforms providers has occurred, and these successes are crucial to explore in more depth. Whilst macro-level studies of platforms has emerged, more in-depth qualitative analysis at the nexus between platforms, successful small exporters and policy can provide important insights in understanding the key aspects which have enabled these firms to succeed.

More widely, there are knowledge limitations around effective policy related to digitalisation. Where value chains are led by private firms are using private standards and are in chains which traverse borders, effective policy is difficult to implement. Thus, further research on viable policy making, including comparative cross-country analysis could be vital to provide a broader understanding of the policy directions and instruments available to policy makers.

In sum, it has been well discussed that digitalisation offers interesting potentials for small firms involvement in international trade. This work on global value chains makes a contribution in exploring the more complex demands beyond just digitalisation and connectivity that needs to be in place for beneficial impacts. Thus, by exploring aspects of value chains and exploring quality, dynamic value chains, standardisation and risk, we have been able to build richer perspectives on digitalisation that highlight key compliments and further policy of digitalisation to support impact.

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