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Innovation for Inclusive Structural Change. A Framework and Research Agenda*

Tommaso Ciarli†, Maria Savona‡, Jodie Thorpe§, Seife Ayele**

Abstract

The paper proposes the foundations of an analytical framework to map different innovation pathways and explain how innovation leads to inclusive structural change in low-income countries. Innovation pathways depend on how actors, interactions, and variables affect the origin of innovation; the uptake of the innovations (adoption and diffusion); the impact of this diffusion on upgrading, structural change and inclusion; the complementarity between these processes; the potential trade-offs between structural change and inclusion. The paper offers a set of novel applications to test the proposed framework, through different examples of innovation pathways: (a) international technology transfer, based on an extensive systematic literature review; (b) product and process innovation in the dairy sector in Kenya, based on a secondary case study; (c) an organisational innovation in the provision of antiretroviral treatment in Mozambique, also a case study; (d) a systematisation of metrics and indicators of innovation, structural change and inclusion and an empirical exploration of their relationship. The learning generated will support a multidisciplinary, multi-methods research agenda to map the dynamics around innovation, structural change, and inequality and generate an integrated platform of evidence on these processes. In doing so, we respond to the recently increasing demand coming from international institutions, inter-departmental research funds, NGOs and national ministries, for better knowledge to shape a more effective innovation policy for sustainable and inclusive development in low income countries.

Keywords: Innovation; Technological Upgrading; Structural Change, Inclusion, Low Income Countries (LICs)

JEL codes: O1; O13; O14; O33; Q13; I15.

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1. Introduction

Innovation is the creation of new (to the country) products that satisfy existing, unmet needs, or new needs; and the introduction of new production processes that result in more affordable products or employ more people. Innovation induces structural change in economies and societies, and might lead to (economic) development (Syrquin 1988; Cimoli and Dosi 1995; Verspagen 2004; Hidalgo et al. 2007). In this context, innovation and structural change might have inclusive or exclusionary outcomes. On the one hand, economic growth and structural change tend to reduce poverty (Ravallion and Chen 2003), but the extent to which they do so depends on how income gains are distributed (Bourguignon 2003). On the other hand, innovation might increase productivity and growth, but is often disruptive (Schumpeter 1934), and may have distributional consequences (Aghion et al. 2015; Lee 2011; OECD 2015).

The potential trade-off between innovation (INN), structural change (SC) and inclusion (INC) are stylised in Fig. 1. The x_n represent a number of **variables** which may significantly influence the impact of innovations on structural change and inclusion, such as capabilities, characteristics of the technology such as capital intensity and scale, sectors, final demand, geographical characteristics, and institutions. Beyond variables, the actors that are responsible for carrying out, channelling and adopting different forms of innovation and the way in which they interact, may also significantly influence the impact of innovation on structural change and inclusion. They do so not in a vacuum, but within a context affected by the **variables** above (x_n).

The creation of new goods and services through new processes and organisations is by all means a "destructive" phenomenon, in the Schumpeterian tradition. **The outcomes** of these processes entail the creation of new activities and the obsolescence of existing ones; the need for new skills and others to become redundant or not fitting any longer; a set of winners and losers as some segments of the society benefit as their needs are newly satisfied, while others remain excluded. Depending on who wins and who loses, innovation may therefore have inclusive or exclusionary outcomes. At the same time, innovation may lead to more or less structural change at the national level, for instance by increasing productivity across sectors, or increasing the share of employment in productive sectors. More structural change, though, may be related to more exclusion if, for instance, large parts of the population do not have the skills to be employed in highly productive sectors, and remain un- or under-employed. Structural Change and Inclusion as depicted in Figure 1 might therefore be conducive of pathways of higher inclusion but lower structural change or of more disruptive change that results in exclusionary outcomes. However, there may be also conditions (determined by variables, actors and their interactions) under which innovation leads to both structural change and inclusion, which may reinforce each other in a virtuous circle. For instance, when including more actor in the innovation process, with more access to technological capabilities, also increases a country's opportunities to innovate, the productivity across sectors and the share of employment in productive sectors.

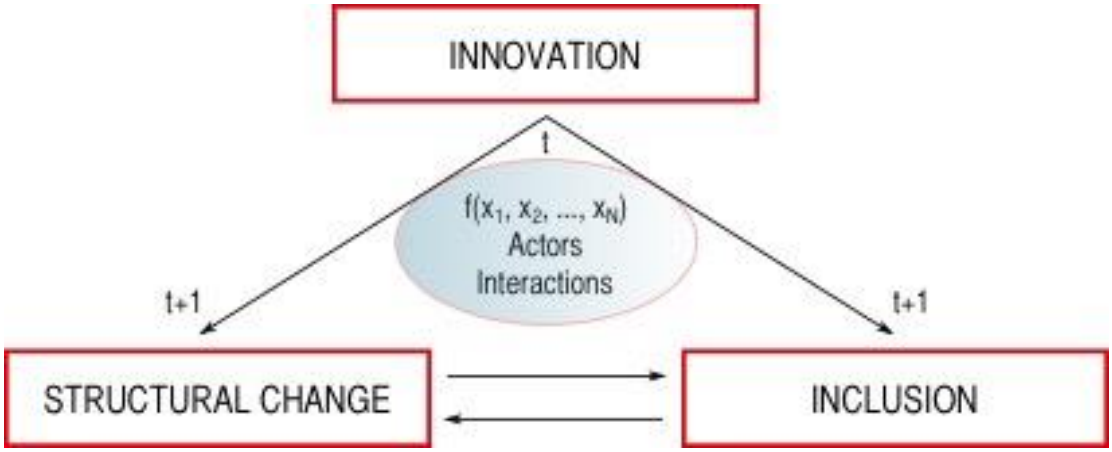

Figure 1: The main variables and relationship

We still have a limited understanding of which technological (and non-technological) innovations, in which context, lead to learning, technological upgrading, and further to structural change. Also, the concept of inclusive innovation is still loose and the understanding of how it can be achieved is limited (Chataway, Hanlin and Kaplinsky 2014; Cozzens and Sutz 2014). There is limited evidence on who is included or excluded from innovation and development, and even less is known on the reverse dynamics, that is how inclusion and inequality influence successive phases of innovation and structural change.

Also, the theoretical and empirical literatures behind the blocks in Figure 1 have rarely been bridged together in a unique framework, which is able to identify variables x_n, which are relevant to explain the effect of innovation on inclusion, structural change, and both (inclusive structural change) and disentangle their effects on the directions of the arrows in terms of virtuous/vicious outcomes. Who is responsible for innovation? How to ensure access to technological (and non-technological) opportunities to develop it? How does it adapt to the contexts in which it is created and/or in which it diffuses? What are the mechanisms by which it leads to structural change of economies and societies? How does this lead to inclusive (or exclusionary) outcomes?

The aim of the paper is to propose the foundations of an analytical framework that unpacks the theoretical blocks in Fig 1 and supports testable hypotheses to understand how *innovation leads to inclusive or exclusionary structural change in low-income countries*. The framework has two main objectives: first, one of mapping the dynamics around innovation, structural change, and inclusion and identify regularities behind scenarios[6]; second, it serves the purpose of setting up a multidisciplinary, multi-methods research agenda on this topic, one that is able to feed development policy more at large. In doing so, we respond to the recently increasing demand coming from international institutions, inter-departmental research funds, NGOs and national ministries, for an effective innovation policy

[6] For instance, a virtuous high INN/SC/INC or vicious low INN/SC/INC; or intermediate outcomes of high INN/SC and low INC or low INN/SC and high INC.

for sustainable and inclusive development, particularly within the context of Sustainable Development Goals (SDGs). [7]

The framework builds upon the large literature on the *determinants of innovation*. We therefore do not focus on *how innovation occurs*, but rather on *the aftermath of innovation*. [8] We lay down the theoretical background of our framework in **Section 2**, by reviewing selected blocks of literature, in particular on the role of International Technology Transfer in the accumulation of capabilities to innovate and change; on structural change and inclusion; and on the missing links between innovation, structural change and inclusion. We then put forward our analytical framework in **Section 3**, where our definitions of INN, SC and INC are used to unpack the dynamics between actors, processes and outcomes. Our contribution aims to be both conceptual and methodological: our *analytical framework that can be tested empirically*, based upon measurement and indicators of inclusive structural change and qualitative evidence from selected cases.

First, we identify relevant indicators to measure the extent to which innovation is related to structural change and inclusion, and the extent to which structural change and inclusion are complementary or substitutes. We discuss results from a cross-country econometric analysis testing for the relation between innovation, structural change and inclusion, and the role of a number of mediating variables (**Section 4**). We find that, while a virtuous circle between INN and SC in general occurs, the strongest result is the positive effect of INC on both INN and SC, while INN might relate differently to SC and INC depending on whether it is based on informal, firm level or ICT).[9]

Second, we explore how innovation is related to different pathways of structural change and inclusion by studying the interactions of different actors and variables in different experiences of innovation: product and process innovation in the dairy sector in Kenya; and organisational innovation in the provision of antiretroviral treatment in Mozambique (**Section 5**). We find that much of the inclusive or exclusionary outcome of innovation and structural change is attributable to the types of institutional and initial economic conditions that lead to balancing or reinforcing mechanisms and, in turn, to parallel, non-competitive pathways of INN, SC and INC and competitive pathways where INN and SC have not achieved full INC.[10]

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[7] See new UK research councils Global Challenges Research Fund (http://www.rcuk.ac.uk/funding/gcrf/) and work by the OECD (Paunov, C. (2013), "Innovation and Inclusive Development: A Discussion of the Main Policy Issues", OECD Science, Technology and Industry Working Papers, 2013/01, OECD Publishing) among others.

[8] A full-fledged version of a literature review on inclusive structural change that focuses particularly on international technology transfer, upgrading and structural change is offered in P. Marques, T. Ciarli and M. Savona (2017).

[9] A full-fledged analysis of indicators of INN, SC and INC and how they dynamically interact in the case of a few developing countries over the last 13 years is offered in Ciarli and Saha (2017).

[10] A full-fledged analysis of the case studies in Kenya and Mozambique is included in Saha, Thorpe and Ayele (2017).

Section 6 concludes on implications for theory and policy, with a particular attention to proposing a long-term research agenda that can feed into the political economy of inclusive structural change for low income countries.

2. Literature Background

The relevant blocks of the selected literature reviewed here focus *on the aftermath of innovation*. Rather than the determinants of innovation, we are interested in why and how innovation is adopted, diffused and used; whether and how it scales up; whether and how it induces structural change; what are the outcomes in terms of inclusion.

2.1 The Role of International Technology Transfer

2.1.1 The received wisdom

Traditional theories of economic growth emphasise the crucial role of manufacturing over other sectors (see Ciarli and Di Maio (2014) for a recent review). Countries that rely on commodities and other goods with low elasticity of global demand, tend to fail to gain from trade (Prebish 1950; Singer 1950), and suffer from market and system failures leading to low-income traps (Cimoli, Dosi and Stiglitz 2009). Even if the relevance of trade specialisation is still hotly debated, economists agree that economic development is usually accompanied by processes of transformation of the economy from agriculture to manufacturing and services. More capital intensive activities (compared to land intensive) are less subject to decreasing returns to investment (Collier and Venables 2007), are sources of technology which spills over to other sectors (Gault and Zhang 2010; Cornwall 1977), and can sustain demand by diversifying.

Recent works from Hausmann and Hidalgo have condensed some of the debate on the relation between changes in trade specialisation and development. The bottom line from their findings is that low income countries need to accumulate capabilities in order to move away from basic goods (for instance, natural resources) towards sophisticated goods that form the export basket of high income countries (Hausmann and Hidalgo 2011; Hidalgo et al. 2007).

The aggregate level of analysis, though, does not allow the authors to say more on which are the specific capabilities that would allow individuals and organisations to innovate and move towards more sophisticated or productive goods. Hausmann and Hidalgo's analysis is silent on how the outcomes of the innovations prompting the next step of sophistication are distributed among the population, or how different initial income distribution influences the capabilities and therefore the probability to move towards more sophisticated goods. We are left with a series of questions on the matter:

How does the process of capability accumulation occur and self-sustain? Do innovations always entail a higher degree of sophistication? Would a higher degree of sophistication be necessarily beneficial to satisfy domestic needs? Assuming that innovation entails a higher degree of sophistication that is beneficial to both the domestic economy and trade specialisation, what are the processes governing the distribution of these benefits among the population? How

to ensure that these processes are able to (re)distribute access to capabilities formation?

2.1.2 The Accumulation of Capabilities

The most intuitive and linear relationship among innovation, capabilities and structural change relies on the opportunity for LDCs to source technology from more advanced countries. This would ideally spark a process of learning, and accumulation of indigenous capabilities, eventually create opportunities for innovation, that finally disrupt existing status and lead to structural change. The full mechanisms behind this process are however relatively unexplored, most especially those that unpack what happens after the technology transfer and that depends on the **sources** of transfer; **channels** of diffusion and technological upgrading; and the potentially different **outcomes** in terms of structural change and inclusion (Savona and Bontadini 2016).

Sources and channels of ITT are relatively uncontested in the literature, as shown below. More often under-explored are the micro, meso and macro variables that influence the way the transferors, transferees, local firms, and public actors benefit from ITT, most especially in terms of *capabilities building* as a result of the processes of adoption and diffusion.

Different actors are **sources** of ITT, among which foreign firms (Bell, 2009, Fu et al 2011, Gereffi et al 2005, Hanlin and Kaplinsky 2016, Sasidharan and Kathuria 2011, Saliola and Zanfei 2009, Yeung and Coe 2015, Zanello et al 2015); foreign universities and research centres located in LICs (Li 2011, Lundvall 2007); technology transfer offices (Fu and Gong 2011) and intermediate services, among which are those that provide metrology, standards, testing and quality services (MSTQ) (Pietrobelli and Rabellotti 2011). Domestic firms are recipients of ITT but also actors for intra-national technology transfer. These actors contribute to different relevant outcomes, depending on the channels by which the transfer occurs and the variables that affect this process, its scalability and its effectiveness.

Typical **channels** of ITT that connect foreign and domestic firms include technological licenses (Amsden 2001, Hoekman et al 2005, Li 2011, Lundvall 2007, Pack 2008, Şeker 2011); intermediate outputs (Amsden 2001, Fu et al 2011, Li 2011, Hanlin and Kaplinsky 2016); foreign direct investments (FDIs) (Sasidharan and Kathuria 2011, Savona and Bontadini 2016; Fu et al 2011). When universities and research centres are involved, usually channels of ITT extend to international collaboration on research projects and international mobility of students, researchers and scholars, and obviously migration of labour force within and across countries (Hoekman et al 2005; Lundvall 2007; Rodrik 2005). ITT is traditionally associated with (often non-defined) spillover effects, which can usefully be characterised as imitation and demonstration effects, labour mobility, informal networking, backward linkages within supply chain and reverse engineering (Fu et al 2011, Gorodnichenko et al 2014, Sasidharan and Kathuria 2011).

We have identified several types of relevant **variables** in the empirical literature on ITT. **At the firm level**, alongside firms' characteristics such as size, age, sector, whether they are exporters or foreign owned, what matters for ITT is the absorptive capacity of recipient firms (Li 2011); the level and compatibility of in-

house R&D of recipient firms (Sasidharan and Kathuria 2011); the appropriateness of the technology transferred (Hanlin and Kaplinsky 2016) and the technological capabilities of suppliers (Saliola and Zanfei 2009). When looking at **the contexts in which firms and other actors operate**, particularly relevant are the presence of export processing zones (Fu et al 2011); the existence of IPR protection laws (Altenburg 2009, Zhou 2006) and market structure and competition levels (Sasidharan and Kathuria 2011). Importantly, the **governance modes of the GVCs** are of dramatic importance when it comes to the effectiveness and benefit of ITT (Gereffi et al 2005, Pietrobelli and Rabellotti 2011, Saliola and Zanfei 2009; Savona and Bontadini, 2016). The **quality of institutions** characterising the LICs would then affect the way these variables are affected by the degree of informality, the types of entrepreneurship; the government credibility and effectiveness of public action.

2.1.3 From Capabilities to Technological Upgrading

The actors, channels and variables mentioned in the previous section in turn affect the **diffusion of innovations and technological upgrading**. A selected empirical literature finds that foreign technology alone does not increase domestic firms' innovativeness but that in-house R&D investments must accompany the reception of foreign technology, at least in the case of Chinese, state-owned high-tech enterprises (Li, 2011). The presence of foreign firms by itself does not seem to entail tangible "spillover" effects (Li, 2011). While a substantial amount of contributions finds that FDI and in-house R&D in local firms are complementary, in other contexts it has been suggested that they might also be substitutes, or, that no convincing evidence on the direction of this relationship has been found (Sasidharan and Kathuria 2011). There is high variation in the complementarity between foreign technology and domestic adoption, depending on the equity ownership of foreign firms in local contexts and the sector in which they operate. Firms relying on a combination of learning from foreign technology partners and internal learning by planned experimentation make most progress in terms of technological capability (Hansen and Ockwell 2014). However, evidence shows that foreign firms in export processing zones, usually established in LICs to attract FDIs, mostly seek cheap unskilled or semi-skilled labour (Fu et al 2011). Higher quality FDI (measured as FDI from firms that are wholly foreign owned or from advanced countries) does not produce more spillovers (Gorodnichenko et al 2014).

Technology upgrading depends fundamentally on existing local capabilities: the capacity for learning, absorptive capacity, the opportunities to upgrade capabilities, from production to innovation capabilities (Amsden 1991; Amsden 2001, Bell 2009), and the existing innovation capabilities (Bell 2009).

A substantive scholarship has documented the successes and failures of emerging countries in accumulating the capabilities needed to produce more sophisticated products (Lall 1992; Katz 1985; Katz 2001; Bell and Pavitt 1993; Bell 2009; Amsden 1991; Amsden 2001). In the case of the East Asian economies, the capacity to learn was a crucial variable at the early stages of development, because firms in these countries lacked proprietary technologies and had to import them from foreign sources (Putranto et al 2003). Opportunities for horizontal and vertical spillovers are partly influenced by the existence of social capital or trust

relationships that facilitate interaction and knowledge exchange between partners or competitors (Giuliani and Bell 2005, Pietrobelli and Rabellotti 2011, Storper et al 2007). Dense interactions help to close the productivity gap between pioneer firms in the adoption of technology, early adopters and late adopters, which is essential to raise productivity levels across the economy and generate structural change (Lundvall 2007). Also trade in general pushes domestic firms to become more efficient and to increase capabilities, productivity growth in existing sectors and employment shifts towards more productive sectors (McMillan et al 2014)

Technological upgrading also depends on the way in which the **public sector** interacts with the private sector, either domestic or foreign firms. Traditional literature argues that incentives created by the government might encourage entrepreneurship that facilitates production and innovation capabilities (Acemoglu and Robinson 2012, Acemoglu et al 2005, Farole et al 2011, Bell 2009, Rodrik 2005).

At this point, one of the crucial, possibly less explored question is what type of technological upgrading is more likely to lead to **structural change,** and one that is **inclusive**. Arguably, the literature reviewed so far has not gone into this specific link, we revert to a different stream of scholarship below.

2.2 Technological upgrading, Structural Change, and Inclusion

The scholarship that looks at the dynamic relationship between technological upgrading and structural change on inclusion and the other way around – let alone the three-way link – is relatively much smaller.

At a micro-level of analysis, inclusion might result from ITT and technological upgrading, depending on a set of further variables and contextual characteristics. We have identified these as the appropriateness of technology (Hanlin and Kaplinsky 2016, Kaplinsky 2011a); measurable standards and enabling rights (Barrientos et al 2016a, 2016b, 2011, Bernhardt and Pollack 2016, Brewer 2011, Lee and Gereffi 2015, Milberg and Winkler 2011, Tokatli 2013); user involvement (Foster and Heeks 2013, Kaplinsky 2011a, Zeschky et al 2011) and institutional inclusiveness (Acemoglu and Robinson 2012, Acemoglu et al 2005, Altenburg 2009, Farole et al 2011).

However, the mechanisms that regulate inclusive outcomes of technological upgrading and structural change are comparatively less explored. The literature has highlighted that labour intensive, cheaper and lower quality intermediate outputs produced by firms in 'Southern' countries are more appropriate for firms in other countries in the South. For this reason, they are more accessible for SMEs and for disadvantaged groups such as women (Hanlin and Kaplisnky 2016). Economic upgrading following structural change does not necessarily generate **social upgrading**, (i.e. access to better work opportunities, including measurable standards, wages and conditions, and enabling rights such as freedom of association and non-discrimination). For instance, the position of firms and workers within the value chain, the type of work performed, and the status of workers within a given category of work will influence the capacity to link both

(Barrientos et al 2016a, 2016b, 2011, Bernhardt and Pollack 2016, Brewer 2011, Lee and Gereffi 2015, Milberg and Winkler 2011, Tokatli 2013).

On the distribution of the returns to innovations, and how the initial distribution of income influences innovation, a recent scholarship has studied how market and technological innovation create new opportunities to include poor and marginalised people from low income countries in the global economy (Prahalad and Hart 2002; Porter and Kramer 2011; Chataway, Hanlin and Kaplinsky 2014; Heeks, Foster and Nugroho 2014). Paunov (2013) suggests that innovation relates to inequality in three ways: first, through direct impact on income distribution (e.g. innovation favours the highly skilled and risk takers); second, by offering solutions for improving the welfare of lower and middle-income groups (frugal innovators); third, by allowing lower-income groups innovate themselves, choosing the directions of welfare improvements (i.e. grass-roots and informal sector activities).

At a **meso-level of analysis**, scenarios of growth and structural change still entail a substantial heterogeneity in terms of inclusiveness and inequality, depending, amongst other things, on the **institutional configuration** of nation-states. Acemoglu and Robinson (2012) distinguish between inclusive institutions, which promote learning and shared prosperity, and extractive institutions, designed to extract resources from society to benefit elites (see also Altenburg 2009, Farole et al 2011, Hickey et al 2014, Papaioannou 2014, Rodrik 2005, Teichman 2016).

At a **meso-macro-level of analysis**, the relation between economic development (usually accompanied by structural change) and *inclusion* has largely been studied as pro-poor growth, (Atkinson and Bourguignon 1999; Anand, Saurabh and Peiris 2013): the rate at which the income of the poor rises for a given increase in national income (absolute), or with respect to the growth of the rest of the population (relative). According to Ravallion and Chen (2003), growth is distribution-neutral, and has always a positive impact on the poor, raising their income. Early stages of economic development, though, are often accompanied by changes in the income distribution (Ravallion 2004; Kuznets 1973), which follows the economic transformation. Poverty reduction eventually is a combination of income growth, changed income distribution, and the relation between income growth and its distribution (Bourguignon 2003). Some authors would argue that economic growth is always inclusive because of its effects on poverty reduction, but the degree of inclusiveness (how much poverty is reduced, if we use poverty reduction as a macro indicator of inclusion) depends on how equitably the increased income is distributed.

Since inequality (which is another possible macro indicator of inclusion) may directly affect economic growth economists have attempted to explain the negative effect of inequality on economic development as an outcome of political economy (Acemoglu, Johnson and Robinson 2005; Alesina and Perotti 1996), capital, insurance and/or labour markets imperfections (Banerjee and Newman 1993), commons, and conflict (Esteban and Ray 2011). Lower levels of inequality measured as equal access to productive assets, economic opportunity, and voice, is believed to have a positive effect on economic development (World Bank 2006). However, a wealth of empirical tests, though, has not provided conclusive

evidence on whether economic development leads to more inequality, at which stage of economic development, and even less on whether lower inequality leads to more or less economic growth.

2.3 Innovation for Inclusive Structural Change: Narrowing the Gaps

All in all, structural change is a crucial component of economic development, which is in general poverty reducing. However, these processes may be relatively inclusive or exclusionary, depending on the initial income distribution and on whether there are sustainable opportunities created for the poorest.

Innovation and the accumulation of technological capabilities affect the extent to which structural change can be inclusive or exclusionary; however, the bulk of the literature is limited to emerging (rather than low income) countries, the manufacturing sectors, and a few successful firms or clusters of small firms. We therefore identify gaps in the literature that our framework aims to fill.

First, we know little about **which innovations, in which contexts, lead to learning, technological upgrading, and further to structural change**.

Second, the understanding of the relationship between innovation and inclusion has gained from conceptual developments and definitions of inclusiveness, **but the concept of inclusive innovation is still quite fuzzy and the understanding of how it can be achieved is limited** (Cozzens and Sutz 2014; Chataway et al. 2014; Foster and Heeks 2013). There is also limited empirical evidence on **who is included/excluded from the innovation and a given development process**.

Third, the understanding of **how inclusion and inequality influence successive phases of innovation and structural change** is even less developed. Also, the **evidence** on the effect of inclusion on structural change is far from conclusive. This relation is based on rather aggregate measures of inclusion, such as poverty and inequality, with little attention to exclusions based on ethnicity, geography, gender, and other non-economic dimensions. Most fundamentally, **exclusion might occur at the level of access to information and participation to decision of investments and processes**. We also know little about the **direction of structural change**, which is likely to depend on which innovations endure or dominate and which are replaced and disappear.

Our ambition is to address the gaps identified above. Going beyond a macro-economic accounting perspective our framework should be able to investigate *how* the main driver of growth (innovation) influences the transformation that accompanies growth (structural change), the (re)-distribution of the gains from innovation (inclusion/exclusion), and how the three dynamics are influenced by different conditions (variables), actors, and their interactions. We lay down our framework in the next section.

3. Inclusive Structural Change: The Analytical Framework

We develop an analytical framework to understand how a number of variables, actors, and interactions affect (i) the diffusion of a given innovation in the system, (ii) a number of outcomes of structural change and inclusion, and (iii) their trade-off. The different outcomes and their relations are the results of different

development pathways. We envisage pathways which may lead to mainly exclusive structural changes, mainly inclusive changes with little structural impact, or to a combination of inclusion and structural change: inclusive structural change. We first define these elements before summarising the macro relation between innovation, structural change, and inclusion in the form of our analytical framework.

3.1 Building blocks: Definitions and System Dynamics

Innovation is defined as "*the implementation of a new or [...] improved product (good or service), or process, a new marketing method, or a new organisational method in [manufacturing or delivery], workplace organisation or external relations.*" (OECD, 2005, pp. 46) The innovation could be new to the world, the market, or the producer. In our framework we do not assume that the innovation needs to be new to the world, but to the local market and user. In this framework, we also assume that innovation occurs exogenously (technology transfer), and leave it for further research to investigate the integration of feedback from inclusion and structural change to innovation. The way in which innovation occurs is described by a number of variables, actors and interactions, as discussed below. In future developments, we plan to relax this assumption and consider the influence of past structural change and inclusion on innovation.

Variables characterise the innovation (e.g. source, channels, drivers, type), and its adoption and diffusion (e.g. innovation system, property rights, capital intensity). The *actors* are individuals and organisations that are involved in any part of the innovation process or in its diffusion/adoption. The *interactions* are the relations among the different actors, which may be market-related, social, and/or political.

We describe the flow from the innovation process to diffusion to the outcomes in terms of structural changes and inclusions as *pathways*. We use the concept of pathways as defined by Leach, Scoones and Stirling (2007): "the particular directions in which interacting social, technological and environmental systems co-evolve over time" [p. 18]. Such definition embeds the circularity discussed below, to be reprised in future works – changes in the outcomes (structural change and inclusion) at time *t* influence innovation at time *t+1*. However, in this paper we will use pathways as linear directions, conditioning evolution of outcomes, but not the co-evolution. For the sake of readability, henceforth we refer to innovation as INN.

We define *structural change* as a shift of production towards assets based on higher knowledge and skilled labour, organisation towards more efficient structures, exports towards knowledge intensive goods and services with high elasticity of demand, and consumption towards "luxury" goods and services. These first order processes are accompanied by a number of outputs. At the organisation level, increased technological capabilities and technological upgrading; upgrading in Global Value Chains (GVCs); managing GVCs; increase in the organisations' average size and productivity, accompanied by more complex division of labour, and new occupational tasks and categories. At the meso level, technology is internalised, necessity entrepreneurship is replaced by opportunity entrepreneurship, informality reduces, and activities agglomerate spatially. Institutions also evolve, become more complex, establish regulations such as

labour, environmental, and technological (e.g. IPR), and the innovation system evolves. For readability, henceforth we refer to structural change as SC.

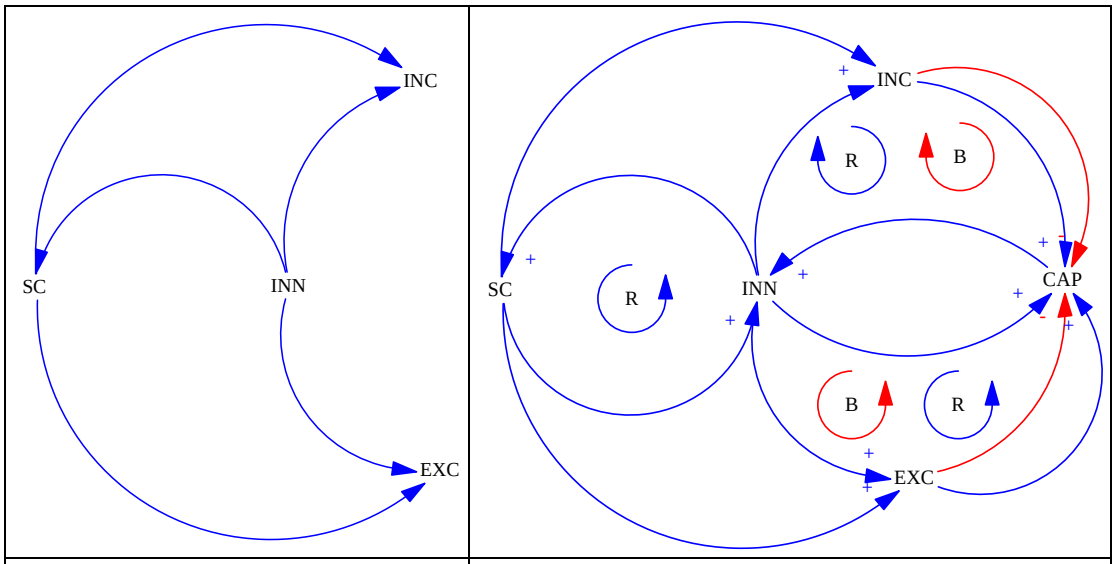
Our definition of *inclusion* encompasses elements of relative pro-poor growth, and equity, beyond economic differences. We define inclusion as the result of a process to (re)-distribute benefits and losses, as well as power and decision-making, such that those who are currently marginalised have a prominent role in deciding about the pathways to follow and in turn reap net benefits from these changes.[11] An innovation is considered to be inclusive when individuals who are currently excluded or marginalised from decision making and the gains accrued to previous innovations are included in processes of economic development (as employees, producers, consumers), and their needs are explicitly addressed as a result. An innovation is also considered inclusive when individuals from excluded groups are involved in the processes through which it happens, such as the design and development of new goods and services. For readability, henceforth we refer to inclusion as INC.

We acknowledge that the relation between innovation, structural change, and inclusion is non-linear, and subject to a number of feedback mechanisms. Figure 2 plots these relations in a system dynamics framework. In panel (a) we reproduce the same relations as in Figure 1: innovation in time *t* influences structural change and inclusion/exclusion in time *t+1*. In turn, outcomes of structural change are (positively or negatively) related to inclusion.

In panel (b) we plot the dynamic relations that include a feedback from structural change and inclusion in *t+1* to innovation in *t+2*. Innovation (INN) is expected to have a positive effect on structural change (SC) (moving to more sophisticated products), which in turn is likely to generate more innovation. As a result, we obtain the reinforcing mechanism plot on the left-hand side. On the right-hand side, we plot the relation between innovation and inclusion/exclusion (INC/EXC). At the top right of the figure innovation is assumed to be inclusive (INC). The inclusion of individuals and organisations in the innovation process may lead to an increase in their capabilities, which also has a positive effect on further innovation or reducing capabilities by dispersing them. This may lead to another reinforcing mechanism (top-right) or to a balancing one (in the case in which inclusion does not lead to more capabilities favouring future innovation). At the bottom-right part of the figure innovation is assumed to be exclusive (EXC). The exclusion of individuals and organisations from the innovative effort may have a negative effect on capabilities, reducing further innovation. This leads to a balancing mechanism (bottom right). However, in other cases exclusion may lead to increased capabilities of a limited part of the population, which may in turn increase innovation: in this case exclusion also leads to a reinforcing mechanism. Finally, structural change (SC) may also be inclusive (INC) or exclusive (EXC). If inclusive, the positive effect of innovation on structural change further reinforces innovation through inclusion in the next time period. If exclusive, the positive

[11] Those who were excluded or marginalised from previous processes of economic development can be defined on the basis of income, or of discrimination against the social group to which they belong – e.g. gender, ethnic or religious minorities, migrants, or geographical origin.

effect of innovation on structural change may reduce innovation in the next time period, depending on the effect of exclusion on capabilities.



Panel (a): linear relations | Panel (b): dynamic feedbakcs

Notes: INN: innovation; SC: structural changes; INC: inclusion; EXC: exclusion; CAP: capabilities; R: reinforcing mechanisms; B: balancing mechanisms. Blue indicates a positive relation; red indicates a negative relation.
Source: authors' elaboration

Figure 2: Dynamic relations between innovation, structural changes, and inclusion

We then face the following questions: under which conditions does an innovation lead to some form of structural change and to some form of inclusion/exclusion? Which aspects of structural change favour inclusion/exclusion? Which aspects of inclusion/exclusion favour structural change? To simplify, we first remove any feedback and address these three questions (as in Figure 2 panel (a)). Questions about the reinforcing and balancing mechanisms (panel (b)) require replicating the framework for different phases of development, where each phase is shaped by previous outcomes in terms of structural change and inclusion: which aspects of structural change induce more innovation? Which aspects of inclusion benefit or hinder further innovation and which aspects of exclusion hinder or benefit it? We will address these questions to some extent in the analysis, but leave their conceptualisation for future work.

3.2 The Linear Framework: Actors, Variables, and Outcomes

The next step is to identify and map the variables that shape the impact of innovation on structural change and inclusion/exclusion outcomes. As mentioned, in this first stage we refrain from using the system dynamics framework illustrated in Figure 2 panel (b) and assume a linear process from innovation to the outcomes (Figure 3). This process proceeds as described below.

First, an innovation is introduced, which may be indigenous (domestic or local), or transferred from somewhere else – first column *Innovation*. The innovation may be of different *types*: product, process, organisation, or market. Different local, national, and international *actors* may be sources and channels for the innovation,

whose *interactions* may be differently shaped by power relations, governance, physical and social distances, etc. A non-exhaustive list of potential actors and interactions is given in the first column, under *Innovation*.

Second, the innovation becomes part of the system as soon as some individual or organisation adopts it,[12] which may lead to an upgrade of product, process, or the organisation of its production/deliver. It then diffuses as other actors in the system also begin to adopt it. The extent to which the innovation diffuses in the system also depends on a set of actors, interactions, and variables, for instance, the capital intensity of the new technology, its scale, appropriability, adaptability, and cost. A non-exhaustive list of variables is provided in the second column, under *Variables*. We distinguish between two types of variables: some *enable the access (or production) of the new technology*; others *act as an incentive*. Typical examples of enabling variables are capabilities, access to resources, and other individual, organisational, institutional, and relational variables. Typical examples of incentive variables are the demand (domestic or international), scale, factors costs and other institutional variables (such as intellectual property rights).

Third, the diffusion of the innovation may cause different outcomes in terms of SC and INC, also depending on actors, interactions and variables as provided in columns three *Adoption/Diffusion* and four *Variables*. The variables listed between Innovation and Diffusion, and between Diffusion and Outcomes in terms of structural change and inclusion do not differ, for the sake of simplification of exposition but also because we leave for future work to establish which variables are more relevant for diffusion and which are more relevant for structural change and inclusion.

We acknowledge that some of the actors, interactions and variables have a direct effect on SC and INC outcomes, which are not conditional on the diffusion. For instance, negative environmental externalities are characteristic of a rapid structural change, particularly towards manufacturing. The negative externalities are likely to have a stronger effect on the part of the population which is excluded from the transformation to manufacturing, and the adoption of production processes. The extent of both the SC and the negative INC depends on the diffusion of the innovation. The larger the diffusion of the polluting innovation, the larger the SC, and the stronger the adverse effect on those negatively included. In contrast, the participation in the innovation process does not depend on the diffusion of the innovation. In general, SC outcomes are related to diffusion and upgrading, and are therefore shaped by actors, interactions, and variables that characterise adoption. For INC outcomes, the role of diffusion depends on the types of inclusion considered. Following the inclusion ladder (Heeks et al. 2014), inclusion outcomes at the bottom of the ladder (e.g. access to goods) are also shaped by actors, interactions, and variables that characterise adoption. For inclusion outcomes at the top of the ladder (e.g. participation in the innovation process), the adoption of the innovation is not particularly relevant.

Fourth, structural changes and inclusion are not unrelated. Some SC outcomes are complementary to INC, but most tend to be incompatible. For instance, an

[12] The first adopter may be the local innovator.

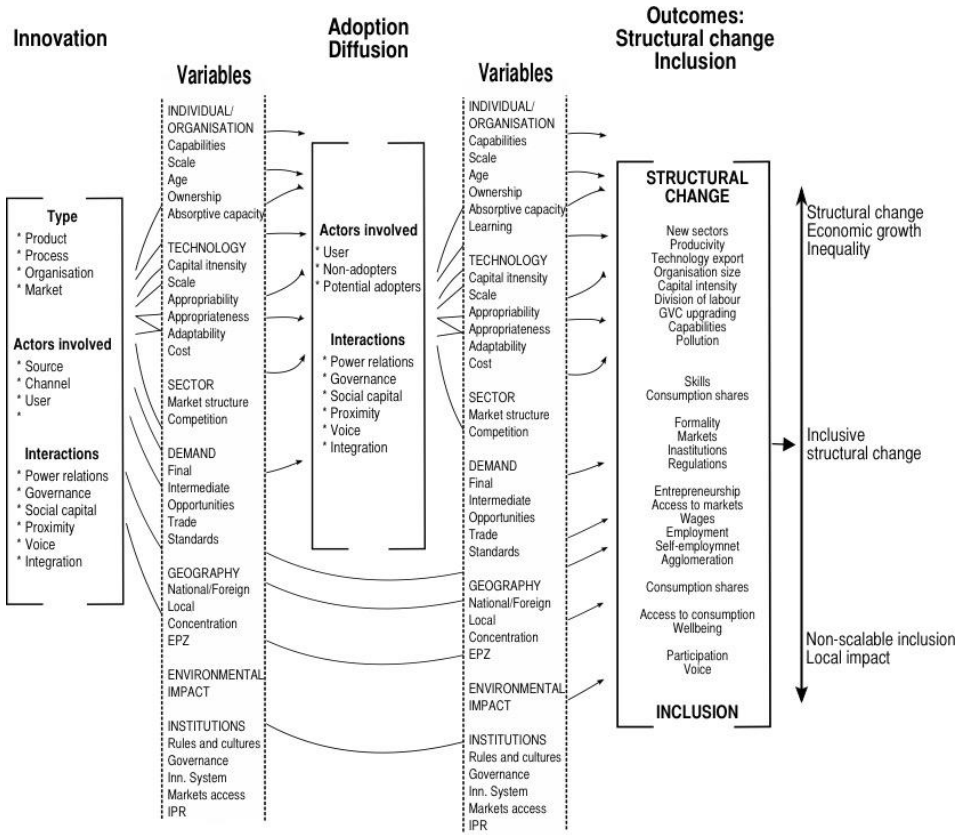
innovation may lead to a decrease in the price of a good that was previously only affordable for a limited part of the population, increasing its access (e.g. milk in Kenya). As a result, we observe a change in household consumption shares, with an increase in the share of categories of goods that used to be limited. This is compatible with increased inclusion (measured as access to goods). On the other hand, in the short term an increase in the capital intensity of production is not compatible with increased employment: only the most skilled workers have access to the available jobs, excluding a large part of the unskilled population. In the next step of this research, as a result of measuring structural change and inclusion (see next section) we intend to measure this complementarity and create a taxonomy of the trade-offs between SC and INC.

Therefore, the main aim of this analysis is to provide a framework onto which we can map innovations, and the relevant actors, interactions and variables that lead to diffusion and to different combinations of SC and INC, in order ultimately to be able to inform policy makers about different directions of development. The direction will depend on:

- how actors, interactions, and variables shape the origin of the innovation;
- how actors, interactions, and variables shape the uptake of the innovation (adoption and diffusion);
- how actors, interactions, and variables shape the impact of the diffusion on SC and INC;
- how actors, interactions, and variables shape directly SC and INC;
- the complementarity between SC and INC.

How do we include feedback loops in this already quite complex framework, and integrate it with Figure 2 panel (b)? Which aspects of SC induce more INN? Which aspects of INC benefit or hamper INN and which aspects of EXC benefit or hamper it? Some of the outcomes of SC and INC have significant effects on the innovation process. In particular, they shape the actors, interactions, and variables that we have just discussed as part of Figure 3 and their impact on the next phase of innovation. SC and INC which favour innovation will induce even more SC and INC/EXC, depending on how SC and INC in period *t* affect the variables shaping the innovation process in period *t+1*. We propose to study this feedback empirically, in future work (see next two sections for examples).

In the next section, we apply the framework to explore how indicators can measure the main relationships described by the framework. This will be followed by two case studies that qualitatively elaborate the framework, and the relevant variables, actors and interactions.



Notes: Arrows represent pathways. The variables, actors and interactions define the effect of innovation on adoption/diffusion, and on structural change and inclusion outcomes. Some pathways go through adoption/diffusion, while some variables have a direct impact on structural change and inclusion. Variables define the innovation channels and sources, the type of innovation, as well as meso and macro conditions such as sectors, demand, geography, and institutions. In the extremes, innovation may have a positive effect on structural change, and a negative effect on inclusion (top end of the right axis), or no or negative effect on structural change and a positive effect on inclusion (bottom end of the left axis). The axis measures the trade-offs between structural change and inclusion outcomes. Structural change and inclusion are therefore not intended to represent different options – they are not mutually exclusive – but rather innovation processes may lead to different degrees of inclusive structural change.

Figure 3: Innovation pathways to structural change and inclusion

4. Testing the Framework with Cross Country Macro Variables

To test the main relations in the framework, indicators that measure innovation, structural change, and inclusion are needed. The indicators have advantages and limitations, depending on the aspect of INN, SC, and INC to capture. In general, while SC indicators cover various aspects of the transformation of economies quite exhaustively, INN indicators tend to miss out a large amount of innovations in the informal sector (including agriculture) and indigenous innovations. INC indicators capture very specific aspects of inclusion: in particular, they capture inclusion outcomes (e.g. low-cost goods and services), but inclusion in the design and process of innovation and structural change (that is in the direction/pathway of innovation) is hardly ever captured.

In what follows, we summarise the main contribution of the framework in term of indicators and estimation of the three-way relationship between INN, SC and INC, which is fully detailed in Saha and Ciarli (2017), who build on this work. In particular, we propose the estimation of whether:

1. there is a cumulative, virtuous circle between innovation and structural change
2. this circle is inclusive or exclusionary
3. inclusion leads to more of innovation and structural change or whether it slows it down or sets it back.

INN is proxied in terms of inputs and outputs of the innovation process and includes: Research and development expenditure (% of GDP), firms' capabilities (research, engineers, foreign technologies, and ICTs and societal adoption of new technologies, especially ICTs) for *innovation input*.

SC is measured by changes in employment shares as a % of total employment, which is slower and lengthier; but also in terms of urbanisation, firm size, TFP, gross capital formation as a % of GDP, which are usually more rapid changes.

INC includes as a negative: poverty, poverty gap, poverty head count ratio, and inequality measured by the Gini Index. INC also includes share of employment and gender inclusion. As discussed, INN indicators capture only very formal innovation, which is not very relevant in low income countries; SC indicators capture the main aspect of SC; and INC indicators capture impacts of innovation and structural change on people (relative) wellbeing, but not necessarily their access to or inclusion in the innovation process.

The results of the empirical analysis to tackle question 1 above (i.e. **whether there is a virtuous circle between innovation and structural change**) show that INN has a positive effect on structural change in the mid-term, when SC is measured in terms of employment shares in manufacturing and services; the other way around is also true: in the mid-term, SC as measured in terms of broader socio-economic change, has a positive effect on innovation.

Surprisingly, when we look at **whether INN and SC, which emerge to be positively related, are inclusive or exclusionary,** neither innovation nor structural change have any significant effect on inclusion.

Of particular interest are the findings on **whether inclusion can spur the virtuous circle between innovation and structural change:** this relationship emerges as being strongly positive and significant, with long-lasting effects. Most especially when we look at firm-level innovation and the broad measure of structural change, it seems that **there is potential for inclusive structural change** as inclusion leads strongly to innovation and there is a virtuous circle between innovation and structural change.

To summarise, the virtuous cycle between innovation and structural change that is well-documented in the literature is also confirmed in the quantitative results. Yet, our strongest result is **the positive effect of inclusion on both innovation and structural change**. When we decompose the innovation index (formal, firm-level and ICT), we find that each related differently to both structural change and inclusion. Therefore, different types of innovation react differently in their relations with inclusion and structural change.

While a range of details on the estimations techniques and results are provided in Saha and Ciarli (2017), here we highlight that our framework is testable by means of a large effort of indicators construction, large and longitudinal data sets and the identification of an empirical strategy that allows to test the dynamic relationships between INN, SC and INC.

In conclusion, we suggest that, as we improve **the reliability of indicators** in terms of what they measure (especially which aspects of INN and INC), and in terms of granularity (within countries rather than across countries), it is possible to find patterns of inclusive structural change in the data and for a large sample of developing countries. Also, if inclusion has a strong positive effect on innovations and structural change, it is crucial to improve inclusion across multiple dimensions, beyond simply focusing on poverty and inequality. Directions to make innovation and structural change more inclusive (as they do not appear to be so in current evidence). We will reprise these considerations more at length in the conclusive section.

5. Testing the Framework using Case Studies: Actors and Interactions

The literature that has grounded our framework, revised in Section 2, has highlighted that some variables such as firm capabilities, technology and geography influence the diffusion of innovation through technology transfer and interactions and their effects on structural change and inclusion outcomes. In this section, two background case studies are developed to test and refine the framework, and to explore innovation pathways and the potential for inclusive structural change. These are the breeding practices in Kenyan dairy farming; and the organisation of anti-retroviral treatment (ART) service provision in Mozambique.

5.1 Case Study 1: Innovation in Breeding Practices in Kenyan Dairy Farming

Innovations in the Kenyan dairy sector, particularly improvements in breeds of cows, played a key role in the development of the sector over the past several decades. During the pre-independence period, dairy farming was monopolised by European settlers who introduced exotic breeds from South Africa, Europe and North America. Until the early 1950s, local farmers were prohibited from running commercial dairy farms. However, since independence in 1963, smallholder farmers increasingly adopted cross-bred cows for commercial purposes.

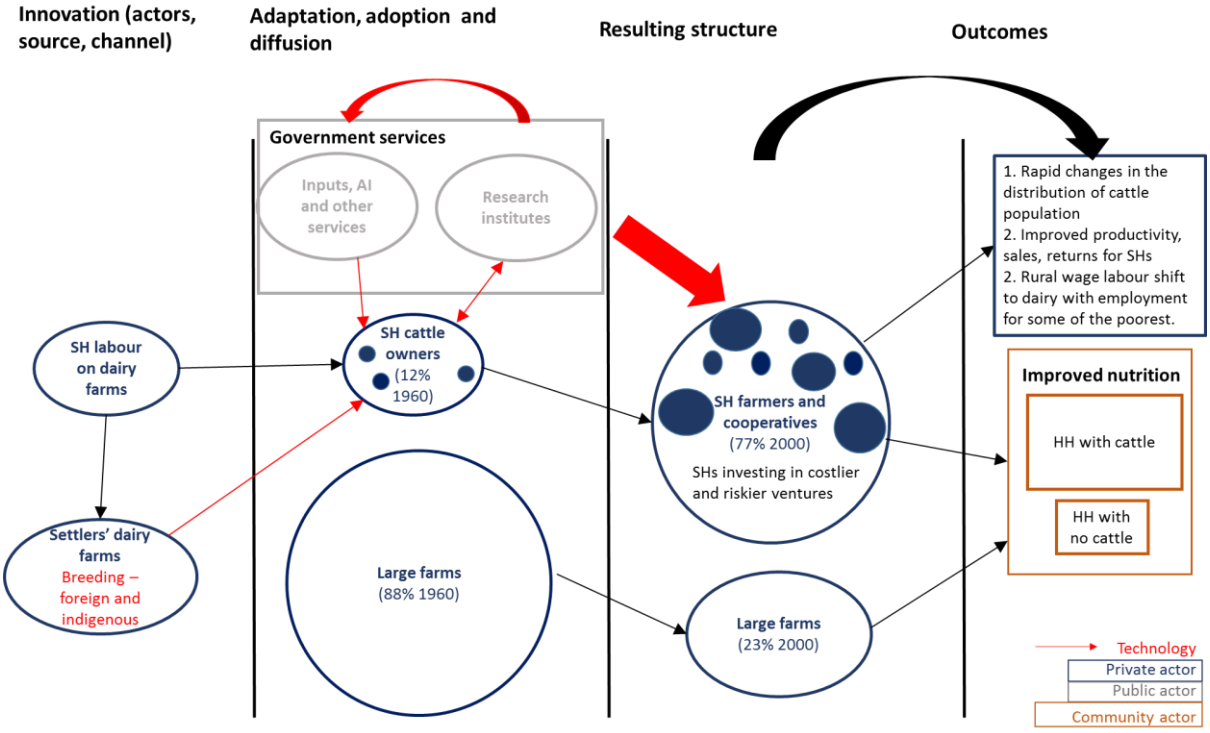
The adoption and diffusion of these new breeding practices, notably cross-breeding between indigenous zebu cattle with exotic breeds, along with the development of supporting inputs and services, supported a structural change in the sector from being dominated by large farms to an increasing proportion of smallholder farms. By the turn of the century, the proportion of dairy cattle on smallholder farms had risen from a mere 12% to 77%; while for large scale farmers, the figures dropped from 88% to 23% (see Fig. 4.1 below). In addition, smallholders' numbers of cross-bred and/or high-grade cattle significantly increased – in some places, such as in the central highlands, this was as high as 96%.

Key elements that influenced these innovation pathways include actors and their interactions, and the institutional arrangements and social networks in place when adaptation and adoption of the new innovations was taking place, which supported smallholder inclusion in both the process and outcomes of innovation. Table 5.1 summarises these actors, interactions and variables that influenced these processes, as well as the outcomes identified.

Today Kenya is one of the largest producers and consumers of dairy products in Africa. With nearly 4 million tons[13] of milk production per year, the dairy sector plays a major role in the economic and nutritional life of millions of Kenyans. A host of other outcomes materialised, including changes in farm practices, commercialisation of the smallholder dairy sector, a rise in per capita milk consumption, and net employment creation.

[13] From dairy cows alone.

Fig. 5.1: Innovation pathways in Kenyan dairy farming



In addition, the case stands as a clear example where inclusion in the first wave of innovations had a positive feedback loop that supported further innovations and later structural change. As labourers on settlers' farms initially, Kenyan smallholders had access to early innovations in the form of cross-breeds of indigenous and foreign breeds of cattle. Smallholder farmers bought cross-bred cattle for their own milk consumption, selecting over time breeds suited to local conditions and supporting adaptation to the local setting.

Government extension and research institutes began to provide dairy extension, veterinary and breeding services to farmers, and in doing so were exposed to farmer preferences, as well as the social and economic constraints facing smallholder dairy systems. As a result, the performance and functional traits of cattle that were developed by these organisations were influenced by household and farmer preferences. This changing dynamic of technology adoption supported the shift to predominately smallholder production.

Table 5.1: Actors, interactions and variables

Innovation	Adoption, diffusion	Outcomes
• Primary source of innovation was **European settlers'** development of stocks of cross-breeds by upgrading indigenous zebu cattle with genes from European dairy breeds. • **SHs** who worked on settlers' farms bought cattle for own milk consumption. • Later, SHs had a lead role in selecting breeds suited to local conditions (supporting adaption to the local setting). • The **government** channelled knowledge that was created earlier by the settlers, through setting up essential services (input, subsidised AI, veterinary, subsidised agricultural credits and dairy multiplication farms to produce heifers at subsidised prices). • **Research organisations** identified useful production technologies, and resolved social and economic constraints in SH dairy systems, e.g. University of Nairobi, Egerton University, Kenya Agricultural and Livestock Research Organisation (KALRO). • **Cooperatives** provided contact between SHs and research institutions, organised through the farmer groups.	• In the early stages, the **Kenyan government** was instrumental in its support for input services, supplying veterinary and AI services that enabled diffusion, allowing smallholder farmers to adopt the breed varieties. • **Cooperative groups and networks of dairy cooperatives** also offer AI services which support diffusion.	• Rapid changes in the **distribution of cattle population** by 2000, as the proportion of dairy cattle on SH farms rose from only 12% in 1960 to 77%, while for large scale farmers this figure dropped from 88% to 23%. • By 2000s, **SHs were investing in costlier and riskier ventures** with regular extension services and improved feeding, with positive impact on productivity and improved sales. • Dairy farmers on average generated **above normal returns** (compared to other farming types in Kenya) • **Shift of rural wage labour to dairy**. Employment generation included some of the poorest, including landless households. • **Milk consumption per capita increased**, especially from 2000-2013; evidenced by the latest FAO statistics that increased from 218g per capita per day to 246g per capita per day. • Although there is some evidence of improved nutrition outcomes from an increase in milk consumption for the broad (non-farm) Kenyan population, **nutritional impacts are greater for HH that keep cattle**. • A higher percentage of **male-headed HH** kept improved cows compared to their female counterparts. • Benefits have also tended to **accrue to relatively better off households**.

SH=smallholder; HH= household; AI = artificial insemination

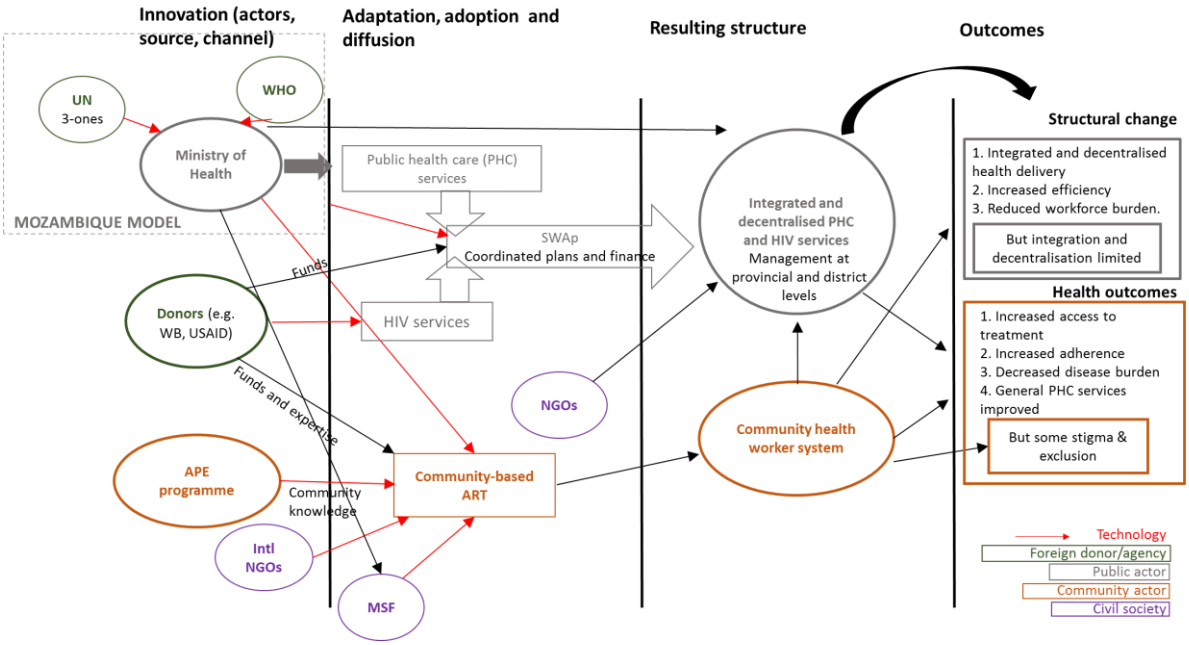
5.2 Case Study 2: Innovation in the Organisation of ART Service Provision in Mozambique

The second example involves organisational innovation in the provision of ART services for those living with HIV in Mozambique. From independence in 1975, the government had provided basic health care through a tiered network of linked hospitals, health centres and health posts. HIV care, including ART, was introduced in parallel to these existing hospitals. However, as the scale of the epidemic rose, there was an urgent need for more services. High levels of foreign assistance

flowed into the country, mostly channelled to NGOs, as the absorptive capacity of the public system was low. With further scale up of ART in 2004, the system, already under pressure, was overwhelmed.

The government of Mozambique at this stage took on the role to coordinate funds from various donors, alongside a reorganised and integrated health system, with new roles for community health workers (CHWs). These innovations represented major changes in the way in which health care was delivered, with decentralisation of service provision and the integration of HIV into the general public health care system, alongside improved ART coverage with wider geographical spread, sustained treatment adherence by HIV patients and reduced disease burden - although inequities remain.

Figure 5.2. Innovation pathways in ART services provision in Mozambique



In contrast to the dairy example, and as illustrated in Figure 5.2, this is a much more top-down process, influenced strongly by the political economy dynamics of the relationship between the central government and international donors over the allocation of funds to support HIV treatment. The government played a key role, asserting the need to protect its sovereignty when dealing with its funders; and pressing for the coordination of funding through the new 'Mozambique Model'[14], which led to structural change in the sector.

Although local communities and patients were also involved in day-to-day decisions and health care provision in the restructured system, particularly through the interactions of community health workers, they are largely recipients

[14] It had hierarchical features of western medicine and the practical guidelines put forward by WHO public health approach to HIV/AIDS, juxtaposed with the organisational demands of HIV/AIDS care in resource-limited countries. MOH advocated 'Common funds', 'sector wide approaches to health' and 'central drug procurement and distribution' as harmonisation procedures in accordance with the UN 'Three Ones' principles, defined as One National AIDS Coordinating Body, One Monitoring and Evaluation Framework and One Agreed AIDS Action Framework.

of the innovation and the positive outcomes achieved in terms of improved service delivery and reach. Local communities and patient groups have not been included in any substantive way in the process of the organisational innovation or decision-making regarding this process; local management capacity remains low.

Other key elements that affected the innovation pathways include the role of history, ideas and narratives in shaping actors' beliefs about the problem and public policy options, and the role of institutions, both formal institutions and social norms.

Table 5.2 summarises the main relevant variables, actors, interactions and outcomes that resulted from the analysis if the historical case of introduction of the ART services in Mozambique. A full-fledged description of the cases summarised here is in Saha, Thorpe and Ayele (2017)

In summary, the two case studies served to test and refine the framework being developed for the study. They allowed for contextualisation, and definitions and redefinitions of the different types of innovations, factors that influence, for example, upgrade and adoption/diffusion as well as the types of outcomes. They helped to redefine and conceptualise non-linear relationships (dynamic and multiple feedback loops) between innovation, structural change and inclusion. More importantly, however, they revealed (and confirmed) serious data gaps. Despite being ongoing for a number of years, there was a lack of systematically developed indicators of innovation efforts (individual/organisation level capabilities, for example, to undertake product or process upgrading). Indicators and measures of outcomes of innovation (our focus area) were also hardly developed. These are some of the challenges that follow-ups of this work would need to address.

Table 5.2. Actors, interactions and variables

Innovation	Adoption, diffusion	Outcomes
• **Mozambican government** asserted the need of sovereignty when dealing with its funders, described as "Mozambique model" of integration of ART provision and PHC, linked to **WHO** "3 Ones" principles • **World Bank** provided knowledge on protocols, M&E, lessons to improve capacity and coordination • The **Sector Wide Approach to Programming** (SWAp) provided a framework for coordination of funding between government and donors, which also provided a mechanism for coordinated planning and investment (infrastructure and people) • The government re-started the **CHW** programme that had existed before independence. Through the CHW programme, health care adapted to suit the immediate needs of HIV patients was provided. • The **MOH** partnered with **NGOs**, particularly **MSF**, and donor groups to redesign the community workers program. MSF and MOH along with the patients, piloted a community-based ART model	• **Government** worked in collaboration with several **NGOs** to support integration of HIV programs into the PHC services • Efforts supported from several (though not all) **donor agencies** towards funding coordination, which facilitated the relatively quick move towards integrating HIV services into the PHC system • **Donors** also brought in supervisors to oversee CHW programmes, while various partners committed funds for initial training, equipment, ongoing supervision • **CHWs** acted as satellites of the healthcare system into previously often inaccessible areas in the community	• Change in the **structure of health system**, transferring management to provincial and district levels; leading to increased coverage and efficiency. • **Reduced burden on health workforce** (which was characterised by low doctor and nurse to patient ratios) • Weak district level management capacity has **hindered decentralisation**. The main decisions about resource allocation remain centralised with MOH • **Improved coverage of ART**; a significant increase in people availing treatment; a dramatic increase in the number of patients initiating ART; improved ART adherence. Marginal reduction in the HIV/AIDS disease burden. • However, **AIDS patients living in distant and marginal areas still generally excluded** • High dropout rates in some areas, due to lack of privacy when picking up their pills (linked to **social stigma**). • Created **benefits for also patients with other diseases** (e.g. TB)

ART = Anti-retroviral treatment; PHC = public health care; WHO = World Health Organisation; TB = tuberculosis; MOH = Ministry of Health; APE/CHW = Agentes Polivalentes Elementares or Community health workers; MSF = Medecins Sans Frontieres

6. Conclusions: A research Agenda on Inclusive Structural Change

6.1. Summary and Discussion of Results

This paper has brought together the results of the work carried out in the first phase of the project "Pathways to inclusive development through innovation, technology and structural change", which has led to the creation and development of the analytical framework proposed here (Section 3). The paper has aimed to go beyond the conceptual advance of a new framework to understand the dynamic relationship between innovation, structural change and inclusion. It has

developed measurement and quantitative and qualitative tests of the analytical framework through applications of it to different areas.

Here we have distilled the main results of (i) a systematisation of the extant, relevant literature that grounds the analytical framework (Section 2); (ii) A detailed and visual description of the framework (Section 3); (iii) a review of existing metrics and proposal of new indicators of innovation, structural change and inclusion that help quantifying the relationships among them (Section 4); (iv) two case studies respectively on the dairy sector in Kenya and the ART services in Mozambique that illustrate qualitatively how innovation and structural change processes resulted in inclusive or exclusive outcomes (Section 5).

The main conceptual building blocks of our framework are set out in Section 3. Our ambition was to identify and systematise the main actors involved in these processes; the way they interact in processes of technolog(ies) transfer, capabilities building, innovation diffusion; the (virtuous or vicious) outcomes in terms of structural change, inclusion and economic/social sustainability. Our overarching aim was to achieve generalisable knowledge that would help understanding these processes in different low-income contexts. Ultimately, we have aimed to respond to the recently increasing demand coming from international institutions, inter-departmental research funds, NGOs and national ministries, for better knowledge to shape a more effective innovation policy for sustainable and inclusive development in low income countries.

Our analytical framework can be illustrated through the following narrative. A number of interacting actors (entrepreneurs, managers, local government, national ministries, local communities, workers, households) are responsible for carrying out, channelling and adopting different forms of innovation. They do so not in a vacuum, but within a context affected by a number of variables. The creation of new goods and services by means of new processes and organisations is by all means a "destructive" phenomenon, in the best of the Schumpeterian tradition. The outcomes of these processes entail the creation of new activities and the obsolescence of existing ones; the need for new skills and others to become redundant or not fitting any longer; segments of the society benefitting as a number of needs are newly satisfied and others remain excluded. Structural change and inclusion might therefore reinforce each other in a virtuous circle; or rather be conducive of pathways of higher inclusion but lower structural change or of more disruptive change that results in exclusive outcomes.

As mentioned, the conceptual categories of our framework and the novel way of systematising the actors, interactions and outcomes of relevant processes have then been used to test specific applications of it. Importantly, these applications provide an eminent example of the extent to which the use of mixed methods in a future large research effort on these themes is beneficial. Systematic theoretical effort and the use of quantitative and qualitative empirical analysis with proper triangulations techniques should be at the forefront of any such efforts.

The review of the empirical literature on international technology transfer, for instance, has systematised the large variety of actors that are sources of ITT; the typical channels of ITT that connect transferors and recipient as well as all the actors that are indirectly involved in this process. The complexity of the dynamics

of our framework has been reflected in the way we have attempted to go beyond the "old generation" literature on international technology transfer, which was very much focused on FDI and multinationals and on (potential) productivity increases in local firms as a proxy of technology transfer. We have identified several types of relevant variables in the empirical literature on ITT, that spans different levels of analysis, from the firm level (pre-existing capabilities, absorptive capacity) to the local context in which firms and other actors operate. For instance, the governance modes of the GVCs are of dramatic importance when it comes to the effectiveness and benefit of ITT. Most importantly, we try to unpack the dynamics associated to technology transfer, once a MNC or an FDI occur in a low-income country. Technology upgrading leading to structural change depends fundamentally on existing local capabilities, the capacity for learning, the absorptive capacity, the ability to upgrade capabilities, from production to innovation capabilities, the consumer preferences and needs and not least on the way in which the public sector and public research interact with the private sector within a context of aligned incentives. We have also highlighted that the mechanisms that regulate inclusive outcomes of technological upgrading and structural change are comparatively less explored. These mechanisms are affected by a number of variables, which are usually considered in the realm of the inclusion literature, yet they seem to be disconnected from the one on technology transfer. Our effort has allowed the identification of some mechanisms, such as the appropriateness of technology; the role of measurable standards and enabling rights; the degree of user involvement; and finally, institutional inclusiveness. We have highlighted this as a major area that would deserve further research effort, which we detail further in the next section.

The review of secondary qualitative evidence on the two cases studies on the dairy sector in Kenya and ART services in Mozambique has also helped refine the framework. The review allowed for contextualisation, and definitions and redefinitions of the different types of innovations, factors that influence, for example, upgrade and adoption/diffusion as well as the types of outcomes. We have identified a number of non-linear relationships (dynamic and multiple feedback loops) between innovation, structural change and inclusion and mapped the different degrees of inclusion and exclusion that outcomes of these have resulted in. When mapping innovation pathways in the case of Kenyan dairy and Mozambican ART service, serious data gaps also emerged. Despite being ongoing for a number of years, there was a lack of systematically developed indicators of innovation efforts (individual/organisation level capabilities, for example, to undertake product or process upgrading). Indicators and measures of outcomes of innovation were also hardly developed.

These gaps have been wholly confirmed in our review of the metrics and indicators of innovation structural change and inclusion. Not much advance has been achieved in refining traditional indicators of innovation (such as R&D and patents) or income inequality for instance, which might not bear particular importance when it comes to low-income countries. Indeed, what emerged from our review is that these traditional indicators tend to miss out a large amount of innovations in the informal sector and indigenous innovations that bear a lesser extent of radical novelty but might be crucial to address unmet local needs. While we find that structural change indicators cover various aspects of the

transformation of economies quite exhaustively, indicators of inclusion capture only very specific aspects of inclusion, that tend to be reflected in/captured by access to new products or enjoying lower prices of mature products or services. Rather, extant indicators hardly capture a more general notion of inclusion, the one in the design and process of innovation and structural change (that is in the direction/pathway of innovation) or in the cumulative learning associated to the direct involvement in processes of innovation. A more substantial and refined effort should be devoted not only to the construction of new indicators, but to the collection of the relevant data that would allow for this from scratch. We briefly return to this issue in the next section.

6.2. A Research Agenda to Define a New Political Economy of Inclusive Structural Change

Our novel analytical framework and the applications of it illustrated above have also allowed the identification of a number of gaps. In order to develop a thorough understanding of the areas above, a substantial effort should be devoted to test the analytical framework on further, more systematic quantitative and qualitative evidence. Also, most importantly, more extensive reflections on the political economy of these processes, expressed through the integration of innovation, industrial and trade policy in order to align market objectives that might currently be at odds with each other, is of fundamental importance. Often the policy implications around innovation are targeted to contexts that are at best middle-income countries, whereas acting in LICs represents an obviously different challenge. Generating an integrated platform of evidence to inform development policy in LICs is therefore the core ambition of this research agenda.

A number of policy implications emerge, relevant to the topic of this paper. In addition to the research inputs described here, these implications have been informed through extensive discussions with stakeholders, academics and policy makers that have received and discussed our results, and presented their own views and priorities.[15] The implications thus identified highlight areas that need much further development, both at the analytical and, mostly, at the empirical (quantitative and qualitative) levels, if we are to strengthen policy and improve theory towards a ***new political economy of inclusive structural change***, particularly in low income countries*.*

Innovation and technology transfer for inclusive structural change

We can imagine the innovation space as a continuum that has at one extreme formal R&D and traditional "old generation" technology transfer, and at the other, indigenous, informal and possibly grassroots innovation. Two main issues emerge: (i) R&D might not be as important as one might expect from theory, as it might not affect – in the short term – the capacity to generate change autonomously in local contexts; (ii) traditional channels of technology transfer,

[15] We are very grateful to all the participants of the workshops held in London and Nairobi in February and March 2017, for the high quality and richness of the exchange that took place. We would like to acknowledge specific contributions by Martin Bell, Xiaolan Fu, Jo Chataway, Maureen Mackintosh, Smita Srinivas, Fred Gault, Anke Weisheit, Rebecca Hanlin, Dorothy McCormick, and Richard Mavisi Liahona who have directly informed the agenda presented here.

such as trade, FDI and GVCs, might not be as important as they have been in developed economies, due to issues of governance and specialisation lock in; (iii) however, much of the grassroots, local and informal innovations that might be inclusive locally are likely to lack sufficient scale to ensure sustainable growth enhancing structural change

In this context, it is of crucial importance to start off with a process of local and endogenous change by ensuring scalability, and persistent change. If so, regional and local embeddedness should be prioritised over entering – for instance – GVCs too prematurely. In the context of inclusive structural change in LICs, this calls for a thorough revision of the potential roles of trade, industrial policy and innovation policy and most importantly their integration in a coherent platform of instruments.

Challenges for innovation and industrial policies: The political economy of inclusive structural change

The roles of industrial and innovation policy in these contexts should therefore be first and foremost to *identify relevant opportunities for indigenous innovation* and secondly to make sure that indigenous innovation is scalable and made endogenous to change. In this respect, several challenges have been identified.

First of all, the traditional technology transfer and innovation system narrative should be complemented with a careful consideration of the political economy of the whole process. Potential solutions that support a move in this direction entail either *feeding innovation incentives into existing market incentives that are beneficial to inclusion* and at the same time to fight perverse incentives or, alternatively, create these virtuous (innovation + inclusion) market incentives from scratch. In this respect, the question is how to align incentives of actors as diverse as entrepreneurs, consumers, donors and policy makers, communities, private sector and multinationals. The notion of 'an entrepreneurial state' applied to LICs is attractive but poorly equipped to account for the complexity of the necessary incentives. At the early stages of the creation of necessary conditions for these incentives to be aligned, it would be rather more important to make actors work collectively and with iterative measures to support incentive alignment, which is of paramount importance for development.

A second overarching element that emerged from our analysis as particularly under-explored and that yet would bridge the analytical and policy added value of this work is *the role of demand* in its various facets. Demand links structural change and inclusion: the income distribution that ensues from structural change might (or indeed might not) support the effective demand by more diffuse groups for novel products or services, which might (or might not) then lead to better social and economic outcomes, in either a vicious or a virtuous circle. The political economy of value creation and redistribution as a result of structural change is therefore of crucial importance to ensure that innovation capacity is made sustainable in the long run to redirect pathways of innovation towards inclusive structural change.

Third, and related, is the importance of identifying needs, those that are recognised by local communities themselves but also those that are not. This goes

beyond the creation of effective demand in a Keynesian perspective: creation of demand might not necessarily work towards satisfying needs. It may include, for example, accountability mechanisms through which needs are made known to policy-makers. However, fourthly, the role of public procurement emerged as a fundamental element in any political economy strategy of structural change. This goes hand in hand with our initial reflection on the role of the government in identifying areas of technological opportunities.

Measurement and indicators

Last but certainly not least, the importance of measurement and the development of appropriate indicators that are able to capture all the dimensions in our framework emerged strongly from both our analysis and our interactions with academics, policy makers and other stakeholders.

Ideally, a radically new approach to measurement would entail including questions in surveys, which allow us to capture the value upgrading and the degree of inclusivity of an innovation, for instance, by including a question on innovation in Labour Force Surveys or in the Census. This has not yet been considered in relevant statistical offices. From the perspective of research and policy learning, devising properly designed mixed methods that bridge data analysis and case studies is a top priority. To move toward this direction, perhaps smaller scale surveys rather than larger ones can at times be more focused, less resource intensive and more effective and informative when researchers and policy makers need to tackle the type of complex issues addressed in this project.

References

Acemoglu, Daron, and James Robinson. 2012. Why Nations Fail: The Origins of Power, Prosperity, and Poverty London: Profile Books.

Acemoglu, D., S. Johnson, and J.A. Robinson. 2005. "Institutions as a Fundamental Cause of Long--Run Growth." In P. Aghion and S. N. Durlauf, eds. Handbook of Economic Growth. Economic handbooks. Elsevier, pp. 385–472.

Aghion, P., U. Akcigit, A. Bergeaud, R. Blundell, and D. Hemous. 2015. "Innovation and Top Income Inequality." NBER Working Paper No. 21247

Alesina, A., and R. Perotti. 1996. "Income distribution, Political Instability, and Investment." European Economic Review 40(6):1203–1228.

Altenburg, T. (2009). Building Inclusive Innovation Systems in Developing Countries: Challenges for IS Research. Handbook of Innovation Systems and Developing Countries.

Amsden, A.H. 1991. "Diffusion of Development: The Late--Industrializing Model and Greater East Asia." American Economic Review 81(2, papers and Proceedings of the Hundred and Third Annual Meeting of the American Economic Association):282–286.

Amsden, A. H. (2001). The Rise of "The Rest": Challenges to the West from Late-Industrializing Economies. Oxford: Oxford University Press.

Amsden, A.H. 2001. "Industrializing Late." In A. H. Amsden, ed. Te Rise of ``the Rest'': Challenges to the West from Late Industrializing Economies. Oxford University Press, pp. 1–28.

Anand, R., M. Saurabh, and S.J. Peiris. 2013. "Inclusive Growth : Measurement and Determinants." IMF Working Paper No. 13/135,

Atkinson, A.B., and F. Bourguignon. 1999. "Poverty and Inclusion from a World Perspective." Paper prepared for ABCDE Europe Conference

Banerjee, A. V, and A.F. Newman. 1993. "Occupational choice and the process of development." The Journal of Political Economy 101(2):274–298.

Barrientos, S., Gereffi, G., & Rossi, A. (2011). Economic and social upgrading in global production networks: A new paradigm for a changing world. International Labour Review, 150(3-4), 319–340.

Barrientos, S., Knorringa, P., Evers, B., Visser, M., & Opondo, M. (2016a). Shifting regional dynamics of global value chains: Implications for economic and social upgrading in African horticulture. Environment and Planning A.

Barrientos, S., Gereffi, G., & Pickles, J. (2016b). New dynamics of upgrading in global value chains: Shifting terrain for suppliers and workers in the global south. Environment and Planning A.

Bell, M. (2009). Innovation capabilities and directions of development. Working Papers, STEPS Centre

Bell, M., and K. Pavitt. 1993. “Technological Accumulation and Industrial Growth: Contrast Between Developed and Developing Countries.” Industrial and Corporate Change 2(2):157–210.

Bernhardt, T., & Pollak, R. (2016). Economic and social upgrading dynamics in global manufacturing value chains: A comparative analysis. Environment and Planning A, (27).

Bourguignon, F. 2003. “The growth elasticity of poverty reduction: explaining heterogeneity across countries and time periods.” In T. S. Eicher and S. J. Turnovsky, eds. Inequality and growth: Theory and policy …. MIT Press, pp. 3–26.

Brewer, B. D. (2011). Global Commodity Chains & World Income Inequalities: The Missing Link of Inequality and the “Upgrading” Paradox. Journal of World-Systems Research, 17(2), 308–327.

Chataway, J., R. Hanlin, and R. Kaplinsky. 2014. “Inclusive innovation: an architecture for policy development.” Innovation and Development 4(1):33–54.

Ciarli, T., and M. Di Maio. 2014. “Theoretical arguments for industrialisation-driven growth and economic development.” In F. A. S. T. Matambalya, ed. African Industrial Development and European Union Co-operation. Prospects for a reengineered partnership. Routledge.

Cimoli, M., and G. Dosi. 1995. “Technological paradigms, patterns of learning and development: an introductory roadmap.” Journal of Evolutionary Economics 5:243–268.

Cimoli, M., G. Dosi, and J.E. Stiglitz. 2009. Industrial Policy and Development: The Political Economy of Capabilities Accumulation. Oxford University Press.

Collier, P., and A.J. Venables. 2007. “Rethinking Trade Preferences: How Africa Can Diversify its Exports.” World Economy 30(8):1326–1345.

Cornwall, J. 1977. Modern Capitalism: Its Growth and Transformation. New York: St. Martin’s Press.

Cozzens, S., and J. Sutz. 2014. “Innovation in informal settings: reflections and proposals for a research agenda.” Innovation and Development 4(1):5–31.

Esteban, J., and D. Ray. 2011. “Linking Conflict to Inequality and Polarization.” American Economic Review 101(4):1345–1374.

Farole, T., Rodríguez-Pose, A., & Storper, M. (2011). Human geography and the institutions that underlie economic growth. Progress in Human Geography, 35(1), 58–80.

Foster, C., & Heeks, R. (2013). Conceptualising Inclusive Innovation: Modifying Systems of Innovation Frameworks to Understand Diffusion of New Technology

to Low-Income Consumers. The European Journal of Development Research, 25(3), 333–355.

Fu, X., & Gong, Y. (2011). Indigenous and Foreign Innovation Efforts and Drivers of Technological Upgrading: Evidence from China. World Development, 39(7), 1213–1225.

Fu, X., Pietrobelli, C., & Soete, L. (2011). The Role of Foreign Technology and Indigenous Innovation in the Emerging Economies: Technological Change and Catching-up. World Development, 39(7), 1204–1212.

Gault, F., and G. Zhang. 2010. "The role of innovation in the area of development." In E. Kraemer-Mbula and W. Wamae, eds. Innovation and the Development Agenda. Paris: OECD/IDRC.

Gereffi, G., Humphrey, J., & Sturgeon, T. (2005). The governance of global value chains. Review of international political economy, 12(1), 78-104.

Giuliani, E., & Bell, M. (2005). The micro-determinants of meso-level learning and innovation: evidence from a Chilean wine cluster. Research Policy, 34(1), 47–68.

Gorodnichenko, Y., Svejnar, J., & Terrell, K. (2014). When does FDI have positive spillovers? Evidence from 17 transition market economies. Journal of Comparative Economics, 42(4).

Hanlin, R., & Kaplinsky, R. (2016). South – South Trade in Capital Goods – The Market-Driven Diffusion of Appropriate Technology. European Journal of Development Research, 28, 361–378.

Hansen, U. E., & Ockwell, D. (2014). Learning and technological capability building in emerging economies: The case of the biomass power equipment industry in Malaysia. Technovation, 34(10), 617–630.

Hausmann, R., and C. Hidalgo. 2011. "The network structure of economic output." Journal of Economic Growth 16(4):309–342.

Heeks, R., C. Foster, and Y. Nugroho. 2014. "New models of inclusive innovation for development." Innovation and Development 4(2):175–185.

Hidalgo, C.A., B. Klinger, A.-L. Barabasi, and R. Hausmann. 2007. "The Product Space Conditions the Development of Nations." Science 317(5837):482–487.

Hickey, Sam, Kunal Sen, and Badru Bukenya (Eds.). 2014. The Politics of Inclusive Development: Interrogating the Evidence. Oxford: Oxford University Press.

Hoekman, B. M., Maskus, K. E., & Saggi, K. (2005). Transfer of technology to developing countries: Unilateral and multilateral policy options. World Development, 33(10), 1587–1602.

Kaplinsky, R. (2011a). Schumacher meets Schumpeter: Appropriate technology below the radar. Research Policy, 40(2), 193–203.

Katz, J. 1985. “Domestic Technological Innovations and Dynamic Comparative Advantages: Further Reflections on Comparative Case-Study Program.” In N. Rosenberg and C. Frischtak, eds. International Technology Transfer: Concepts Measures and Comparisons. New York: Praeger Publishers.

Katz, J. 2001. “Structural reforms and technological behaviour: The sources and nature of technological change in Latin America in the 1990s.” Research Policy 30:1–19.

Kuznets, S. 1973. “Modern Economic Growth: Findings and Reflections.” The American Economic Review 63(3):247–258.

Lall, S. 1992. “Technological capabilities and industrialization.” World Development 20(2):165–186.

Leach, M., I. Scoones, and A. Stirling. 2007. “Pathways to Sustainability: an overview of the STEPS Centre approach.” STEPS Approach Paper

Lee, N. 2011. “Are innovative regions more unequal? evidence from Europe.” Environment and Planning C: Government and Policy 29(1):2–23.

Lee, J., & Gereffi, G. (2015). Global value chains, rising power firms and economic and social upgrading. Critical Perspectives on International Business, 11(3/4), 319–339.

Li, X. (2011). Sources of External Technology, Absorptive Capacity, and Innovation Capability in Chinese State-Owned High-Tech Enterprises. World Development, 39(7), 1240–1248.

Lundvall, B. (2007). National Innovation Systems—Analytical Concept and Development Tool. Industry & Innovation, 14(1), 95–119.

Marques, P., T. Ciarli and M. Savona (2017) *Technology transfer, structural change, and inclusion: a literature review*, Brighton: IDS and SPRU

McMillan, M., Rodrik, D., & Verduzco-Gallo, I. (2014). Globalization, Structural Change, and Productivity Growth, with an Update on Africa. World Development, 63, 11–32.

Milberg, w., & Winkler, D. (2011). Economic and social upgrading in global production networks: Problems of theory and measurement. International Labour Review, 150(3-4), 341–365.

OECD. 2015. “Innovation Policies for Inclusive Development. Scaling Up Inclusive Innovations.”

Pack, H. (2008). Asian Successes vs. Middle Eastern Failures: The Role of Technology Transfer in Economic Development. Issues in Science and Technology, XXIV(3), 1–14.

Papaioannou, T. (2014). Innovation and development in search of a political theory of justice. International Journal of Technology and Globalisation, 7(3), 179–202.

Pietrobelli, C., and Rabellotti, R. (2011). Global Value Chains Meet Innovation Systems: Are There Learning Opportunities for Developing Countries? World Development, 39(7), 1261–1269.

Prebish, R. 1950. The Economic Development of Latin America and its Principal Problems. United Nations Department of Economics Affairs, Lake Success, N.Y.: United Nations Publications.

Putranto, K., Stewart, D., & Moore, G. (2003). International technology transfer and distribution of technology capabilities: The case of railway development in Indonesia. Technology in Society, 25(1), 43–53.

Ravallion, M. 2004. "Pro-Poor Growth: A Primer." World Bank Policy Research Working Paper No. 3242, World Bank, Washington, D.C.

Ravallion, M., and S. Chen. 2003. "Measuring pro-poor growth."

Rodrik, D. (2005). Growth strategies. In P. Aghion & S. N. Durlauf (Eds.), Handbook of Economic Growth (Vol. 1). Elsevier

Saha, A. and T. Ciarli (2017) *Innovation, structural change and inclusion: a cross country analysis*, Brighton: IDS and SPRU

Saha, A., J. Thorpe and S. Ayele (2017) *Case studies on innovations in breeding practices in Kenya and anti-retroviral therapy service provision in Mozambique,* Brighton: IDS and SPRU.

Saliola, F., Zanfei, A. (2009) Multinational firms, global value chains and the organization of knowledge transfer. Research Policy, 38(2), 369–381.

Sasidharan, S., & Kathuria, V. (2011) Foreign Direct Investment and R&D: Substitutes or Complements-A Case of Indian Manufacturing after 1991 Reforms. World Development, 39(7), 1226–1239.

Schumpeter, J.A. 1934. The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle. Cambridge, MA: Harvard University Press.

Şeker, M. (2011). Importing, Exporting, and Innovation in Developing Countries. Enterprise Analysis Unit World Bank.

Singer, H.K. 1950. "The Distribution of Gains Between Investing and Borrowing Countries." American Economic Review 40:473–485.

Storper, M., Lavinas, L., & Mercado-Célis, A. (2007). Society, community, and development: a tale of two regions. In K. Polenske (Ed.), The Economic Geography of Innovation (p. 310'339). Cambridge: Cambridge University Press.

Syrquin, M. 1988. "Patterns of Structural Change." In H. B. Chenery and T. N. Srinivasan, eds. Handbook of Development Economics. Amsterdam: North--Holland, pp. 203–273.

Teichman, J. A. (2016). The Politics of Inclusive Development: Policy, State Capacity, and Coalition Building. Palgrave Macmillan UK.

Tokatli, N. (2013). Toward a better understanding of the apparel industry: A critique of the upgrading literature. Journal of Economic Geography, 13(6), 993–1011.

Verspagen, B. 2004. "Structural Change and Technology. A Long View." Revue économique 55(6):1099–1126.

World Bank. 2006. "World Development Report (WDR) 2006: Equity and Development."

Yeung, H and Coe, N (2015), 'Towards a dynamic theory of global production networks', Economic Geography, Vol. 91(1), pp.29-58.

Zanello, G., Fu, X., Mohnen, P., & Ventresca, M. (2015). The Creation and Diffusion of Innovation in Developing Countries: a Systematic Literature Review. Journal of Economic Surveys, advanced online publishing.

Zeschky, M., Widenmayer, B., & Gassmann, O. (2011). Frugal Innovation in Emerging Markets. Research-Technology Management, 54(4), 38–45.

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