

# Innovation for Inclusive Structural Change\*

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Revised Chapter prepared for the Book on  
*Technology Upgrading and Economic Catch-Up*  
Oxford University Press

## Abstract

The chapter proposes the foundations of an analytical framework to identify innovation pathways that lead to inclusive structural change in low- and medium-income countries (LMICs). Innovation pathways depend on how actors, interactions, and conditions affect the origin of innovation; the uptake of the innovations (adoption and diffusion); the impact of this diffusion on upgrading; the extent to which technological upgrading scales up to drive structural change and inclusion; the complementarity among these processes; the potential trade-offs between structural change and inclusion. After delineating the analytical framework, the chapter focuses on applications of the framework to identify typical trade-offs between inclusion and structural change, and policy options to tackle these trade-offs and achieve outcomes of inclusive structural change. We finally propose a research agenda to build upon the framework and directly inform policies for inclusive structural change. The contribution of this work aims 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 inclusive development in LMICs.

**Keywords:** Innovation; Technological Upgrading; Structural Change, Inclusion, Low and Medium Income Countries (LMICs)

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

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\* An earlier and longer version of this chapter was presented as a report for the International Development Research Centre (IDRC), titled "Innovation Pathways to Inclusive Structural Change. A Framework for a New Research Agenda". This paper has received funding from the IDRC under the project "Pathways to Inclusive Development through Innovation, Technology and Structural Change", co-led by SPRU and IDS at the University of Sussex. The paper has greatly benefitted from early discussions with Martin Bell and Raphie Kaplinsky, and from comments in the early stages of revisions by David O'Brian and Matthew Wallace and by participants in the workshops "Innovation pathways to inclusive structural change" in London (UK) and Nairobi (Kenya). We would like to acknowledge specific contributions by Jo Chataway, Xiaolan Fu, Fred Gault, Rebecca Hanlin, Richard Mavisi Liahona, Maureen Mackintosh, Dorothy McCormick, Smita Srinivas, and Anke Weisheit. We have also crucially benefited from constructive comments from the SWPS editors and one SWPS anonymous reviewer. Related articles are: Saha and Ciarli (2018) [Innovation Structural Change and Inclusion. A Cross-country PVAR analysis](#). Saha, Thorpe and Ayele (2018) [Inclusive Structural Change: Case Studies on Innovations in Breeding Practices in Kenya and Anti-Retroviral Therapy Service Provision in Mozambique](#).

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## 1. Introduction

There has been a rising interest in understanding how innovation is to be steered to ensure more inclusion, condensed in the recent hype on “inclusive innovation policies”, particularly within the context of the Sustainable Development Goals (SDGs) (Akhtar, Hahmv, and Stone 2018; Kaplinsky 2018).<sup>5</sup>

The creation/adoption of new goods, services and processes can be “destructive”, in the Schumpeterian tradition (Schumpeter 1934). The outcomes of innovation 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; new winners and losers result from innovation, as some segments of the society benefit from their needs being satisfied, while others remain excluded. Also, when innovation is cumulative (Schumpeter 1942), it may increase concentration at the expenses of small players (Autor et al. 2017), and often has consequences in terms of unequal income distribution (Aghion et al. 2015; Lee 2011). Depending on who gains 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, typically by increasing productivity across sectors, or increasing the share of employment in highly productive sectors. Structural change, in its own right, may also be exclusionary 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. If structural change and inclusion tend to be negatively associated in the short term, we will observe either innovation pathways of higher inclusion but lower structural change, or of more disruptive change that results in exclusionary outcomes.

The identification of the conditions under which innovation leads to both structural change and inclusion, that reinforce each other in a virtuous circle of inclusive structural change (ISC), in the short and the long run, is therefore of high relevance for analysis and policy. Currently, the foundations of an analytical framework to unpack these conditions is not as developed as it could be, as the different literatures on inclusion, innovation, and structural change have never been properly bridged.

Our aim here is to propose the foundations of an analytical framework that unpacks the theoretical blocks behind innovation, structural change and inclusion, and supports testable hypotheses to understand how *innovation leads to inclusive or exclusionary structural change in low- and medium-income countries*.<sup>6</sup>

The framework has two main objectives: first, we provide a conceptual model to illustrate how innovation (INN), structural change (SC), and inclusion (INC) are

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<sup>5</sup> See for instance the UK research councils Global Challenges Research Fund (<http://www.rcuk.ac.uk/funding/gcrf/>) and work by the OECD (Paunov 2013; Planes-Satorra and Paunov 2017; OECD 2015) among others

<sup>6</sup> 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*.

interrelated in a dynamic way, and we identify regularities behind pathways that combine different innovation, structural change, and inclusion outcomes; second, we propose a multidisciplinary, multi-methods research agenda to test several conditions leading to inclusive structural change. The agenda should feed industrial and development policy more at large.

We first briefly map how innovation may impact on inclusion and structural change (Section 2). We then fully articulate the analytical framework and discuss possible pathways of innovation that might lead to different degrees of inclusive structural change. Here we unpack the potential virtuous or vicious dynamics between innovation (INN), structural change (SC) and inclusion (INC) based on the interactions between actors, processes and outcomes (Section 3).

Third, we sketch how the framework would allow narrowing some key gaps in the literature (Section 4), and incorporate policy lessons from the existing literature to highlight what would be needed to tackle the trade-offs and challenges to achieve inclusive structural change (Section 5). We argue for the case of policies to be framed into a general issue of ensuring ‘inclusive structural change’.

In Section 6 we summarise the key themes of this complex topic, and propose a research agenda to direct innovation towards inclusive structural change, with the aim of responding 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 inclusive development to meet the Sustainable Development Goals (SDGs) in LMICs.

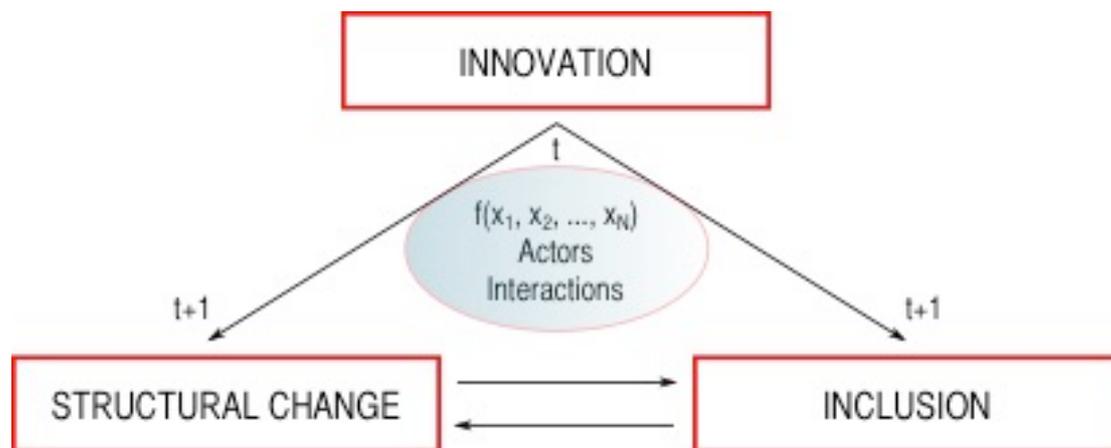
## 2. Innovation, structural changes and inclusion: A first glance

Innovation induces structural change in economies and societies, and plays an important role in (economic) development (Syrquin 1988; Cimoli and Dosi 1995; Cimoli and Porcile, 2009, 2011; Verspagen 2004; Hidalgo et al. 2007). Both innovation and structural change might have inclusive or exclusionary outcomes (Fig. 1). 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. 2019; Lee 2011; OECD 2015).

The extent to which innovation leads to more or less structural change and inclusion depends on several conditions (some of which can be measured), the actors that enact and diffuse innovations and how these actors interact. In Figure 1 the  $x_i$  represent the **conditions**. These are capabilities, characteristics of the technology such as capital intensity and scale, sectors, final demand, geographical characteristics, and institutions. Beyond these conditions, 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 **conditions** above ( $x_N$ ), which also determine the way in which they interact.

The literature envisages one of the two outcomes of innovation, as we discuss below: higher inclusion at the cost of lower structural change and potential for economic growth, or more disruptive changes that result in exclusionary outcomes. What are the conditions, actors and interactions under which innovation leads to both structural change and inclusion, and reinforce each other in a virtuous circle? For instance, by including more actors in the innovation process (Bell et al. 2016; Aghion et al. 2017), through more access to technological capabilities, a country's opportunities to innovate may increase.



**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 (Cirera and Maloney 2017). 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 what actors are 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.

The literatures behind the blocks in Figure 1 have rarely been bridged in a unique framework, to identify the conditions  $x_n$  that 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. This chapter is a first step in the direction of bridging these literatures in a unifying framework.

### 3. Inclusive Structural Change: The Analytical Framework

We develop an analytical framework to understand how a number of conditions, actors, and interactions affect: (i) the diffusion of a given innovation in the

economy; (ii) outcomes measuring structural change and inclusion; and (iii) their trade-off. The different outcomes are the results of different dynamic pathways. We envisage pathways that might lead: mainly to exclusionary structural changes, mainly to inclusive outcomes yet with little structural change, 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 as devised in our framework.

### 3.1 Building blocks: Definitions and System Dynamics

*Innovation* is defined as “a new or improved product or process (or combination thereof) that differs significantly from the unit’s previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process).” (OECD/Eurostat 2018).<sup>7</sup> Innovation could be new to the world, the market, or the producer. In our framework we do not assume that an innovation needs to be new to the world (highly radical), but to the local market and users (low degree of radicality or incremental). For simplicity, we *initially*<sup>8</sup> assume that innovation occurs exogenously (technology transfer). The way in which innovation diffuses and generates structural change and/or inclusion depends on a number of conditions, actors and interactions, as mentioned above (Figure 1).

*Conditions* characterise the ways in which innovation is absorbed in an economy (e.g. source, channels, characteristics of the adopters, technology), and its adoption and diffusion (e.g. demand, geography and capital intensity). The *actors* are individuals and organisations that are involved in any stage 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 innovation to diffusion to its outcomes in terms of structural change and inclusion 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 also the circularity discussed below – changes in the outcomes (structural change and inclusion) at time  $t$  influence innovation at time  $t+1$ . 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 and outcomes. At the organisation level, increased technological capabilities and technological upgrading; upgrading in Global Value Chains (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,

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<sup>7</sup> A major definitional difference introduced in the latest version of the Oslo Manual is that innovation might occur in units that not necessarily are business firms, but also households or informal activities. This is an amendments that *might* affect measurement of innovation most especially in LMICs, although we do not enter in this more in depth here. We however include this in the research agenda on measurement.

<sup>8</sup> We relax this assumption when we look at the dynamic version of the framework.

technology is internalised, necessity entrepreneurship is replaced by opportunity entrepreneurship, informality reduces as a result of entrepreneurial opportunities, and activities agglomerate spatially. Institutions also evolve, become more complex, establish regulations on the labour markets, the environment, and technology (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 income inequality. 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.<sup>9</sup> 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.

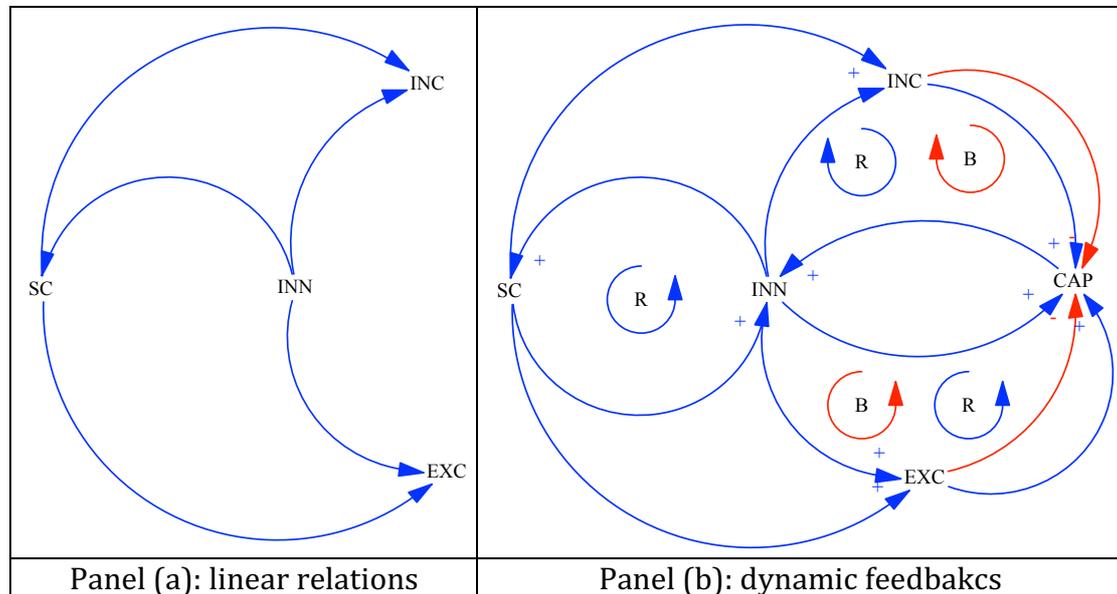
We acknowledge that the relation between innovation, structural change, and inclusion is non-linear, and subject to a number of feedback mechanisms. Figure 2 plots these relations in a system dynamics framework. In panel (a) we reproduce the same relations as in Figure 1: innovation in time  $t$  influences structural change and inclusion/exclusion in time  $t+1$ . In turn, outcomes of structural change may be (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, for instance, 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 a further reinforcing mechanism (top-right) or to a balancing one (where inclusion does not necessarily lead to learning and higher capabilities that facilitate future innovation). At the bottom-right part of the figure, innovation is assumed to be exclusionary (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, 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

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<sup>9</sup> 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.

reinforcing mechanism. Finally, structural change (SC) may also be inclusive (INC) or exclusionary (EXC). If inclusive, the positive effect of innovation on structural change further reinforces innovation through inclusion in the next time period. If exclusionary, the positive effect of innovation on structural change may reduce innovation in the next time period, depending on the effect of exclusion on capabilities.



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

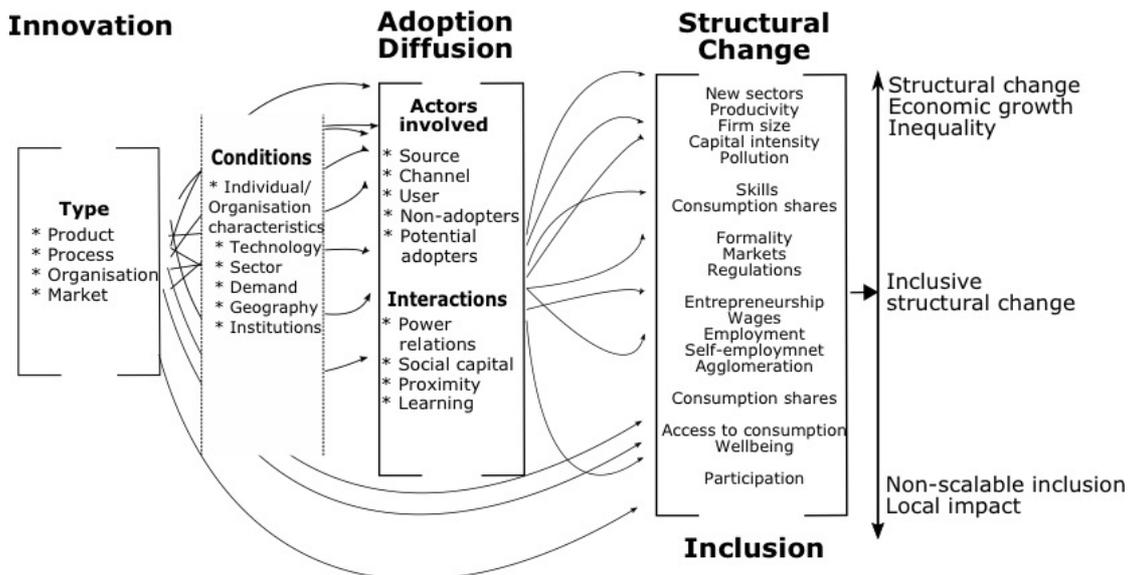
**Figure 2: Dynamic relations between innovation, structural changes, and inclusion**

We then face the following questions: under which conditions, forms of interactions and role of actors, does an innovation lead to (some form of) structural change and (some form of) inclusion/exclusion? Which aspects of structural change favour inclusion/exclusion? Which aspects of inclusion/exclusion favour structural change? To answer these questions, we remove the feedbacks (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 and exclusion benefit or hinder further innovation? We will address these questions to some extent here, but leave their full conceptualisation for future work, while we have attempted an empirical test of the dynamic pathways in a different work (see (Saha and Ciarli 2018)).

### 3.2 From innovations to structural change and inclusion: illustrative steps

To answer the above questions, we map the steps through which several conditions, actors and interactions may affect the strength and direction of the impact of an innovation on structural change and inclusion (Figure 3).

First, an innovation is introduced, which may be indigenous (domestic or local), or adopted 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.



Notes: Arrows represent pathways. The variables that represent conditions, 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 represent 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**

Second, the innovation becomes part of the system as soon as individuals or organisations adopt it,<sup>10</sup> which may in turn lead to an upgrade of the product, the process, or the organisation of its production/deliver. It then diffuses as other actors in the system start adopting it. The extent to which the innovation diffuses in the system also depends on a set of actors, interactions, and conditions, for instance, the capital intensity of the new technology, its scale, appropriability, adaptability, and cost. We distinguish between two types of variables: those that *enable the access (or production) of the new technology*; and those that *act as an incentive to adopt*. Examples of enabling variables are capabilities, access to resources, and other individual, organisational, institutional, and relational

<sup>10</sup> The first adopter may be the local innovator.

variables. 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 conditions.

Some of the actors, interactions and conditions 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 those parts of the population that are 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 conditions that characterise adoption. For INC outcomes, the role of diffusion depends on the types of inclusion considered. Following the inclusion ladder (Heeks, Foster, and Nugroho 2014), inclusion outcomes at the bottom of the ladder (e.g. access to goods) are also shaped by actors, interactions, and conditions 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, (before redistributive policies, which consider only some aspects of inclusion). For instance, an 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) (Saha, Thorpe, and Ayele 2018). 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.

## **4. Inclusive Structural Change: Bridging the gaps in the literature**

### **4.1 Technological upgrading, Structural Change, and Inclusion: A glance of the extant literature**

The scholarship that looks at the relationship between innovation/technological upgrading, structural change and inclusion – let alone the three-way link – is quite limited.

A first immediate channel that leads from technological upgrading to structural change is through the mediated effect on productivity. 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, being exposed to trade competition 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).

However, 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 achieve inclusion and social upgrading through structural change (Barrientos et al 2016a, 2016b, 2011, Bernhardt and Pollack 2016, Brewer 2011, Lee and Gereffi 2015, Milberg and Winkler 2011, Tokatli 2013).

**At the micro-level of analysis**, inclusion might result from technology transfer and technological upgrading, depending on a set of further conditions and contextual characteristics. The literature has 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).<sup>11</sup>

The mechanisms that affect inclusive outcomes of innovation are even less explored.

Paunov (2013) suggests that innovation affects 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 to innovate themselves, choosing the directions of welfare improvements (i.e. grass-roots and informal sector activities).

The literature has also highlighted that labour intensive, cheaper and low quality intermediate outputs and technologies produced and used by firms in 'Southern' countries are more appropriate for firms in other countries in the South.<sup>12</sup> For this reason, they are more accessible for SMEs and for disadvantaged groups such as women (Hanlin and Kaplinsky 2016).

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<sup>11</sup> An exhaustive map of the literature dealing with the role of International Technology Transfer as a specific source of technological upgrading at the micro, meso and macro levels is offered in Marquez, Ciarli and Savona (2017)

<sup>12</sup> See Section 5.1 below for a review of the South-South trade and its role in achieving inclusive structural change.

On the distribution of the returns to innovations, and how the initial income distribution influences innovation, a recent scholarship has studied how market and technological innovation might usefully create new opportunities to include poor and marginalised people from low income countries in the global economy (Chataway, Hanlin, and Kaplinsky 2014; Heeks, Foster, and Nugroho 2014).

At the **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 the **macro-level of analysis**, the relation between structural change that fosters economic development and *inclusion* has largely been framed within the issue of how to achieve 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 income distribution (Ravallion 2004; Kuznets 1973), which follow 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 income inequality (one of the macro indicators 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, are claimed to have a positive effect on economic development (World Bank 2006). However, a wealth of empirical tests 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.

Overall, it seems there is a long way to go in terms of further empirical research to disentangle the three-ways link between innovation, structural change and inclusion as we put it forward in the analytical framework in Section 3. We reprise the issue and propose avenues of exploration below and in the subsequent Section 5.

## 4.2 Innovation for Inclusive Structural Change: Narrowing the Gaps

To wrap up the key messages of our argument so far: structural change is a foundational 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 mainly covers the emerging (rather than low income) countries, the manufacturing sectors, and a few successful firms or clusters of small firms. The analytical framework proposed in Section 3 allows us to better identify the gaps in the literature that would need further research effort to be pursued.

First, we know little about **which innovations, in which contexts, lead to learning, technological upgrading, and further to structural change**. It has been argued that innovation more conducive of learning might not necessarily be the most radical ones, rather than the incremental ones (Bell, 2009). There is therefore a **latent bias towards radical, more disruptive innovations** that might be comparatively less inclusive or learning-conducive.

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, Hanlin, and Kaplinsky 2014). There is also limited empirical evidence on **who is included/excluded from a specific innovation and 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.

By proposing an analytical framework that accounts for all these aspects and the dynamics among them, our ambition is to direct empirical research towards addressing the gaps identified above. Going beyond a macro-economic accounting perspective, our framework should be exhaustive enough to allow investigation of *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, actors, and their interactions.

In addition, we are aware that, in addressing the gaps above, it is important to build upon and go beyond the stylised dynamic relationships between innovation, structural change and inclusion that have served the purpose to found the

framework. It is important to consider the trade-offs (and bottlenecks) that affect each link at each stage, and how these might be addressed through policy. We address this in the next section.

## **5. Inclusive structural change: Three cases of trade-offs in LMICs and the role of policy**

Trade, investment, innovation and diffusion proceed via the decisions and interactions of numerous public and private actors - farmers, artisans, employees, consumers, entrepreneurs, civil servants, ministers and community workers, amongst others (Fig. 3). These decisions together shape outcomes in terms of structural change and inclusion, and the trade-offs between them. While actors' decisions reflect their priorities and interests, they are also shaped by a series of policies, regulations, and incentive structures which influence such priorities and interests.

On the one hand, technological upgrading may promote structural change with inequitable patterns of winners, who reap the lion's share of rewards, and losers, who are left behind or carry a disproportionate share of the costs. Policies are needed to balance these trade-offs by changing or enabling new incentives and practices, and resulting in a different and more equitable distribution of costs and benefits. On the other hand, innovation may take place in ways which are highly inclusive of currently marginalized groups, ensuring their participation in both the process of innovation and its outcomes, but with few structural effects. The role of policy can then be to enable access to the resources necessary to scale up structural change from these more inclusive processes.

This section reviews literature with respect to innovation, trade and related policies, and their role in managing the trade-offs between inclusion and structural change, particularly in low income countries. It considers three settings that may be more conducive of learning and capabilities accumulation than North-South transfer of more radical, disruptive innovation. These are (1) South-South trade and investment, (2) agglomeration economies that facilitate technology diffusion, and (3) indigenous grassroots innovation. It offers policy considerations for each setting: in what ways may public policy move outcomes towards to the centre of the structural change-inclusion spectrum (Fig 3), based on the state of current knowledge.

### **5.1 South-south trade and investment**

Low income economies tend to be characterized by two disparate groups of firms with very different levels of assets. The majority are low productivity micro or small firms, often in the informal sector. These firms predominately operate in isolation from a much smaller group of large and more productive firms, including subsidiaries of foreign corporations (Altenburg 2009). Unlike in high income countries, there is relatively limited productivity growth of firms in the first group, even those in the formal sector. While technology upgrading by these small firms does create needed jobs and contributes to productivity growth, structural change

is largely determined by the larger and more productive firms (Van Biesebroeck 2005). These large firms are in a position to attract higher productivity labour, have better access to capital and greater capacity to adopt new technologies. While the productivity increases by these firms support structural change, the outcomes are likely to exacerbate exclusion, at least in the short-term.

Given that technology upgrading in low income countries relies predominately on the diffusion of 'new-to-market' technologies, rather than 'new-to-world' innovation (Bell 2007), global value chains are a route to technological upgrading and higher value adding activities (Pietrobelli and Rabelloti 2006; Jaffee and Masakure 2005; Fu, Mohnen, and Zanello 2018). Which firms participate in global value chains, and how value-adding activities are distributed is frequently determined by the dominant or 'lead' firm in the chain (Kaplinsky 2000; Ponte and Gibbon 2005).

Small and informal producers are generally excluded from northern firm-led value chains - unable to meet exacting standards, and hampered by low productivity and poor quality infrastructure which undermine their competitiveness (Dolan and Humphrey 2000; Maertens and Swinnen 2009; Poulton et al. 2008). On the other hand, where the lead firms are located in the south, there is greater likelihood of knowledge transfer and skills upgrading that enables firms to move up the chain into higher value activities based on technology more similar to their own (Mohanty, Franssen, and Saha 2019; Gold et al. 2017). A smaller technology gap within this network also enables technological diffusion via 'learning-by-doing', supporting diversification in manufacturing exports by local firms (Amighini and Sanfilippo 2014; Didier 2017).

Technology diffusion also depends on the human and financial resources and the absorptive capacity of firms (Zanello et al. 2016; Cohen and Levinthal 1989; Keller 1996). More advanced technologies from developed countries are more likely to be adopted by firms in the already productive group, which have the necessary resources and absorptive capacity to take up the technologies. Since these recipients of North-South technology transfer achieve higher productivity growth (Gold et al. 2017), the result is likely to be structural change without inclusion, as already larger and more productive firms pull further away from the rest. These exclusionary outcomes may be counter-balanced where they support employment growth; however, the evidence on the relationship between North-South vs South-South trade and employment is mixed (Gold et al. 2017; Mohanty, Franssen, and Saha 2019)

The extent and type of trade and investment patterns are influenced by policy factors, including trade policy itself. Currently, although trade liberalisation has led to an overall reduction in trade tariffs imposed by southern governments, tariffs imposed on imports from other LMICs tend to be higher than for imports from developed countries (Jha and McCawley 2011). Policy in sectors that support trade is also relevant. For example, poor trade-related infrastructure and logistics, or infrastructure directed at supporting trade with countries in the North, rather than with other LMICs, undermines south-south trade (Jha and McCawley 2011). Another area is finance. Greater financial sector development in LMICs supports

trade in technology and skill-intensive manufactures, and the effect is highly significant with respect to South-South trade (Demir and Dahi 2011).

Policies that support inclusive structural change will therefore address these trade-offs. One approach is to support structural change through North-South trade while introducing policies that enable those left behind to cope with or benefit from these changes, such as through social protection or significant public investment in human capacity development (Timmer 2009). Alternatively, trade policies may be geared towards (more inclusive) South-South trade, but coupled with efforts to build the capacity of small firms and their access to finance, contributing to greater productivity gains and growth (Mohanty, Franssen, and Saha 2019). Of course, policies may also seek to strike a balance between these two alternatives.

## 5.2 Agglomeration economies and diffusion

Agglomerations and networks of enterprises and other economic actors, such as those found in industrial clusters and in cities, enable knowledge exchange and joint learning at relatively low cost. Outcomes may include technology adaptation and diffusion and increased productivity supportive of structural change, although these outcomes are not guaranteed (Wolman and Hincapie 2014). The contribution of clusters and cities to inclusive structural change depends on who has access to these spaces and networks, and the degree to which supply and demand side constraints to wide-scale productivity growth are addressed.

Clusters facilitate innovation through knowledge diffusion and spillovers, including the exchange of tacit knowledge which is otherwise difficult to codify and transmit (Cumbers and MacKinnon 2004). Clusters are also distinguished by joint actions by the firms which comprise them, leading to greater collective efficiency (Schmitz 1999). Through encouraging the development of more specialized suppliers and creating demand for labour with specialized skills, clusters increase productivity (Wolman and Hincapie 2014; Porter 1998).

For LMICs, clusters enable small firms to achieve upgrading without having to invest across the entire production process. Instead they can concentrate on taking much smaller risks in particular steps of the process, while other enterprises in the cluster invest in complementary tasks (Schmitz 1999). As a result, there is often an uncharacteristically high proportion of medium-sized firms represented in clusters in LMICs, although again this outcome is by no means guaranteed (Schmitz 1999).

While clusters have mostly been studied in relation to industrial sectors, and to a lesser extent to business services (Meliciani and Savona, 2015; Di Meglio et al., 2018), clustering can also be applied to the promotion of agriculture (Galvez-Nogales 2010); highly relevant for LMICs. Agricultural clusters are based on the coordination of smallholders and agribusinesses to benefit from increased opportunities, reduced costs and spillover effects.

Urbanisation is another process of agglomeration taking place in LMICs, pulling people, enterprises and resources into closer proximity, and, as for clusters,

enabling valuable informal learning and the accumulation of knowledge. Cities allow for the sharing of infrastructure and distribution of risks, while improving the quality of matches between actors in the value chain, or between enterprises and employees with appropriate skills and knowledge (Duranton and Puga 2004). Cities thus offer knowledge, skills and other resources which enable innovation and upgrading, as well as a high density of demand (Srinivas 2014), which creates a strong pull factor.

Despite obvious benefits, the distributional outcomes of these agglomerations are unlikely to be neutral. The fact that clusters support the free spread of ideas among smaller firms and informal enterprises (Kraemer-Mbula and Wunsch-Vincent 2016) means that they may enable more inclusive forms of innovation. On the other hand, clusters are not only spatial mechanisms but have a network aspect reliant on social capital, interpersonal relationships and trust. As a result, clusters may exclude or further isolate firms led by those who are socially marginalized, based on ethnicity, religion or gender, for example.

The benefits of agglomeration are also in tension with its burdens, such as increased urban crime, pollution and crowding (Scott and Storper 2015; Storper and Scott 2016). These burdens adversely affect those who are 'negatively included' in them. The key question is how the benefits and burdens of agglomeration are accrued or borne by different actors.

While the processes of coming together into clusters or cities often takes place spontaneously, driven by market and other forces, they may also be shaped by policy (World Bank 2012; Galvez-Nogales 2010; Wolman and Hincapie 2014). For example, people and enterprises may occupy different urban locations as a result of market forces – e.g. based on the price of land; or due to the actions of government authorities – e.g. through the provision (or not) of infrastructure and facilities (McGranahan, Kasper, and Maestre 2017).

Policies promote clusters where they address weak elements of the 'ecosystem' (World Bank 2012) by making land or transportation more available, offering relevant skills development programmes, facilitating horizontal or vertical coordination, encouraging knowledge spillovers or networking, and fostering the growth of intermediary institutions and supporting services (Wolman and Hincapie 2014; Martin and Sunley 2003). However, there is little evidence of governments successfully creating entirely new industrial clusters in particular places (Wolman and Hincapie 2014). Moreover, subsidies that encourage or regulations that restrict investment in certain geographies can intentionally or unwittingly support or undermine cluster formation (Porter 1998).

Local authorities and urban planning policies may also intentionally (to discourage further migration) or inadvertently exclude low-income residents and low-skill migrants from the benefits of agglomeration economies by confining them to certain areas of the city or denying them access to secure employment or basic services. Where formal authorities recognize the legitimacy of these groups and their needs and capacities, however, policy may be formulated in ways that support their inclusion, while also contributing to greater effective demand. Urban

planning and policy is also important in managing the production and distribution of negative externalities (Scott and Storper 2015).

### 5.3 Indigenous and informal sector innovation

Trade and investment from both North and South offer sources of new to market technologies in low income countries, supporting varying degrees of structural change and inclusion (as described above). Indigenous innovation involving technology adaptation in the informal sector of low income countries offers an alternative pathway. It centres on incremental, learning-based innovations by firms with relatively low capabilities and minimal capital resources which adopt, adapt and improve technologies. They may do so in response to specific constraints (Fu, Mohnen, and Zanello 2018; Robson, Haugh, and Obeng 2009); or to slight variations in the local market (McGranahan, Kasper, and Maestre 2017).

Closely related to the concept of informal sector innovation is that of 'grassroots innovation' (Fressoli et al. 2014; Smith, Fressoli, and Thomas 2014). Grassroots innovation refers to bottom-up efforts arising from communities and users who are directly involved in the process and/or outcomes of innovation. These are more deliberate and values-based alternative pathways of inclusive innovation and development. The focus is also on empowerment, such that groups achieve greater voice and control over their futures (Fressoli et al. 2014; Arza and van Zwanenberg 2014).

Indigenous informal sector and grassroots innovation supports inclusivity since groups that are normally marginalized move to the centre of the processes of innovation and the benefits arising from them, as they meet local needs. Indigenous innovation in informal firms in LMICs has also been shown to increase labour productivity, and improve these firms' performance (Fu, Mohnen, and Zanello 2018; Agyapong, Agyapong, and Poku 2017). There is nevertheless a wide gap between these locally developed solutions and achieving the wide-scale productivity growth necessary for structural change.

Time and financial resource constraints constrain the forms of innovation which are possible (Kraemer-Mbula and Wunsch-Vincent 2016). Innovators that invest in new activities and new knowledge assets also lack any guarantee of their ability to appropriate the benefits (Hausmann and Rodrik 2003), acting as a further deterrent. Low population density (especially in remote rural areas) and/or weak spending power contribute to low effective demand, limiting the scale which informal firms can reach.

There is little systematic policy guidance on innovation in the informal sector. Although attitudes are beginning to change, policy-makers have often been blind to such processes, with policies that are geared towards suppress informality rather than enable and support its innovation.

That said, enabling policies for informal innovation might include those that address general limiting factors, such poor quality infrastructure, informational constraints, a lack of skilled labour, poor access to finance and weak skills of

entrepreneurs (Bradley et al., 2012; Kraemer-Mbula and Wunsch-Vincent 2016). More innovation-specific measures would overcome initial barriers for innovators, for example by reducing regulations or requirements, providing low cost credit or other subsidies, enabling linkages between informal and formal firms, or enabling entrepreneurs of high ability to 'migrate' to the formal sector (Kraemer-Mbula and Wunsch-Vincent 2016; Fu, Mohnen, and Zanello 2018; Hausmann and Rodrik 2003). These policies would ideally be matched by mechanisms that enable effective demand, for example by addressing distribution and delivery problems, overcoming informational problems, and raising incomes, through wage policies or welfare regimes (Srinivas 2014). Policies that better enable networking, with support from intermediaries, can also be important to the diffusion of grassroots innovations (Hossain 2016).

## **6. Conclusions: A Research Agenda on Inclusive Structural Change**

### **6.1. Summary of key themes**

The chapter proposes a novel framework, which provides the analytical foundation of the concept of inclusive structural change, in order to inform future empirical research and policy making. From the conceptual advance of this new framework, we seek to understand the dynamic relationship between innovation/technological upgrading, structural change and inclusion.

The main conceptual building blocks of our framework are set out in Sections 2 and 3. Our ambition is 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 and 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- and middle-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, our ambition is that the conceptual categories of our framework and the novel way of systematising the actors, interactions and outcomes of relevant processes will be used to test specific applications of it. For instance, technology upgrading leading to structural change depends fundamentally on existing local capabilities, the absorptive capacity, the ability to upgrade capabilities, from production to innovation capabilities, consumer preferences and needs, and not least on the ways in which the public sector and public research interact with the private sector within a context of aligned incentives. However, the gaps to be addressed and the literatures that need bridging are still substantial.

We have in fact 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 conditions, 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; however, much work remains to be done.

We have devoted particular attention to highlight the trade-offs between innovation, structural change and inclusion that ideally could be counterbalanced by policy action. We have reprised these themes in the case of south-south trade and investments, that has delineated some policy options to address the trade-offs between inclusion and scalability of the structural change that might result from these activities. Other cases of trade-offs between innovation, structural change and inclusion can be found in the recent enthusiasm for grassroots innovation in LMICs. This, inclusive almost by definition, could be adequately supported by policies that point to a higher scalability. Similarly we have looked at trade-offs in innovation and inclusion in specific spatial organisations such as clusters and cities in LMICs. Enabling clustering, networks and agglomeration economies in LMICs, in ways that include rather than exclude, would represent a particularly effective policy aim, one that build up trust and social connectivity, and at the same time facilitates learning and knowledge spillovers.

## **6.2. A Research Agenda towards a New Political Economy of Inclusive Structural Change**

Our novel analytical framework has allowed the identification of a number of research gaps that we consider particularly useful to systematise in the context of this chapter.

In order to develop a thorough understanding of the positive and normative elements of inclusive structural change, a substantial effort should be devoted to test the analytical framework with 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 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 LMICs represents an obviously different challenge. Generating an integrated platform of evidence to inform development policy in LMICs is therefore the core ambition of this research agenda.

A number of policy implications emerge, relevant to the topic of this paper. These are based both on the policy options proposed in Section 5 above to address the specific cases of trade-offs between innovation, structural change and inclusion, and have also 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. 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*.

### ***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, 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, as illustrated above.

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 prematurely (Lopez Gonzalez, Meliciani and Savona, 2019). In the context of inclusive structural change in LMICs, 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. The case of favouring south-south trade illustrated earlier is an exemplative case in this context.

### ***Challenges for innovation and industrial policies***

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 LMICs 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 (Gault, 2018).

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.

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