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A SYSTEMS-BASED MODEL FOR THE SUCCESSFUL SCALING OF INCLUSIVE INNOVATION

Keywords: *inclusive innovation, bottom of the pyramid, innovation systems, sustainable innovation, international development.*

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A Systems-based Model for the Successful Scaling Up of Inclusive Innovation

Authors

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Abstract:

Inclusive innovation literature provides manifold examples and some answers as to how projects can achieve the full potential of the BoP market and what factors can be considered important in determining the likelihood of an innovation's success. But the existing literature and methods for analysis are mostly oriented towards firms' strategies or project practices, focusing on the micro-level, including such things as products, project organisation, capacity building and the involvement of local stakeholders. Little or no attention has been paid to the surrounding context in which innovation occurs, or to the environmental sustainability of BoP products and technologies. This paper aims to contribute to the debate surrounding new models for innovation within the development sector and to explore the wider implications for innovation in the context of development policies. The central objective guiding this paper is therefore the elaboration of an analytical framework which can be subsequently implemented in analyses of system-wide factors for the successful scaling up of inclusive, sustainable innovations. The authors of this paper present a model for the analysis of the innovation (eco-) system of inclusive innovation. The model includes the following five dimensions: landscape, resources, knowledge, market, and support mechanisms. Ongoing work of the authors currently focuses on the application of this framework to a number of Inclusive innovation projects conducted within TNO's Innovation for Development programme and a number of examples from the literature, particularly from India. The outcome of this ongoing work will provide policy conclusions, salient limitations and avenues for future research.

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1. Introduction

Inclusive innovation is a popular concept which aims to describe those innovations that serve the largest and poorest socio-economic markets in developing countries. It is not surprising that the attention in recent innovation literature has shifted to pro-poor growth and inclusive development, ethical legitimacy, sustainable development and policy support (Hahn, 2009). Inclusive innovation focuses on affordable products and services that create livelihood-sustained opportunities (Mashkelar, 2013).

In general, inclusive innovation scholars have provided manifold examples and some answers as to how projects can achieve the full potential of the BoP market and what factors can be considered important in determining the success or failure of an innovation (Prahalad and Hart, 2002). The existing literature is oriented primarily towards firms' strategies or project practices (Simanis et al., 2008), with a focus on the micro-level, including aspects such as products, project organisation, capacity building and the involvement of local stakeholders. But little or no attention has been given to the surrounding context in which innovation occurs, or to the environmental sustainability of BoP products and technologies. Equally, little has been said about the long-term environmental sustainability of these innovations, albeit in practice a number of inclusive innovations exist in fields related to low-carbon technologies.

Because the surrounding context of any project or company is just as crucial, we suggest that inclusive innovation studies should adopt a systems approach to innovation (Edquist, 1997, Hekkert et al., 2007). Similar messages have been recently posited by Heeks and Foster (2013). The added value of a systems view of innovation lies in the fact that it is well equipped to identify those drivers and barriers that shape the broader "context" of an innovation project (Coenen and Díaz López, 2010). A systems view of innovation enlarges the focus of BoP interventions by looking at a system in terms of innovation, capacity upgrades, and opportunities to enter global value chains in order to increase market success (Pietrobelli and Rabellotti, 2011).

This paper aims to contribute to the debate surrounding new models for innovation within the development sector and to explore the wider implications for innovation in the context of development policies. The central objective guiding this paper is therefore the elaboration of an analytical framework which can subsequently be implemented in analyses of system-wide factors for the successful scaling up of inclusive, sustainable innovations. The analytical dimensions of such a framework are: the

landscape in which innovation takes place, available resources, the knowledge pool, the market, and support mechanisms.

With regard to the theoretical aspects, the authors of this paper have drawn on concepts and notions from innovation studies (innovation systems), sustainability transitions (multi-level perspective), cultural theory and development studies (BoP markets, inclusive innovation). Empirically, the model presented in this paper was further drawn from the analysis of 35 BoP empirical studies. A face- validation of the proposed model was also performed in an expert workshop. The next step toward the validation of this method is due in the summer of 2013. The outcome of this exercise will be the provision of policy conclusions, salient limitations and avenues for future research.

The remainder of this paper is distributed as follows. Section 1 presents a review of past evidence on inclusive innovation projects, together with two bodies of literature which contribute to the integration of an analytical framework for the analysis of inclusive innovations at the systemic level. Next, Section 3 provides a brief description of the methodological approach followed in this paper. The fourth section presents the preliminary results of our literature and evidence-based cases, used for the integration of a first version of an analytical, system-level-based tool for the analysis of inclusive innovation in BoP markets. Finally, some preliminary conclusions are presented.

2. Literature review

Innovation is defined as 'technologically novel or improved material goods, intangible services or ways of producing goods and services' (Edquist, 2005). In this paper we follow Mashelkar's (2013) working definition of inclusive innovation as: '… *any innovation that leads to affordable access of quality goods and services creating livelihood opportunities for the excluded population, primarily at the base of the pyramid, and on a long term sustainable basis with a significant outreach'*[1]. The target group in question is often considered to be those living below the income level defined in the First Millennium Development Goal as less than one dollar per day.

Mashelkar suggests that the objective of a truly inclusive type of innovation would not be just to produce low-performance, cheap knock-off versions of rich countries' technologies so that they can be marketed to poor people. That is getting "less for less". Inclusive innovation offers "more from less". This means that we will have to harness truly sophisticated science and technology, or truly creative non-technological innovation, to invent, design, produce and distribute a reach price-performance envelope that leads to quality goods and services that are affordable for the majority of people. The authors of this paper make a strong plea for considering the sustainability of these innovations with a triple bottom-line logic (economics, environment and society), the so-called sustainable innovations (c.f. Boons et al., 2013 for an overview of recent trend and research challenges). The definition adopted in this paper includes technological and non-technological innovation.

In this section we provide an overview of the literature that aims at a better understanding of the following topics:

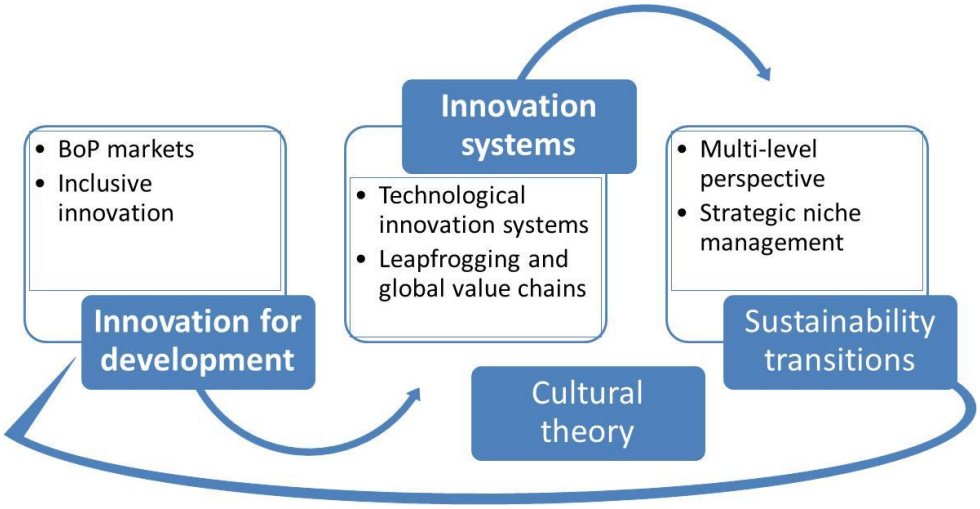
- The context in which inclusive innovation traditionally occurs, including cultural aspects.
- The systemic nature of innovation, beyond projects at the community level; looking at the broader set of actors, networks and institutions[2] and the general framework conditions that affect the functioning of a system and ultimately the scaling up of innovations.
- Notions related to innovation and the transition to sustainability, involving a drastic change in terms of user practices, norms, regulations, economy, etc.

[1] R.A. Mashelkar and V.K. Goel originally coined this term during their interaction in the World Bank Missions in the years 2001-02. This term has been consistently used over the past four to five years, leading to a wider acceptance in the creation of national agendas or national progress. The forthcoming book by Mashelkar & Goel, entitled "Inclusive Innovation: More from Less for Many" is built on the essential theme of true inclusion, namely getting '*more from less for more (people)'* and '*not just for more (profit)'*.

[2] North (1990) describes institutions as the rules of the game in a society, comprising formal rules, norms and codes.

A schematic representation of the (assumed) relationships between the different bodies of literature described in this section is depicted in the figure below.

Figure 1. Bodies of literature guiding this paper



Inclusive innovation, BoP markets and development

As noted in the introduction of this paper, inclusive innovation scholars have provided manifold examples and some answers as to how projects can achieve the full potential of the BoP market and as to what factors can be considered important in determining the success or failure of innovations (Prahalad and Hart, 2002). Existing literature is mostly oriented towards firms' strategies and project practices (Simanis et al., 2008), focusing on the micro-level of products such as project organisation, capacity building and the involvement of local stakeholders. But little or no attention has been paid to the surrounding context in which innovation occurs, or to the environmental sustainability of BoP products and technologies. Most of the methodologies and advice offered in the literature is written for practitioners developing and implementing projects.

In the view of some authors, inclusive innovation is a continuation of the not-for-profit "Appropriate Technology" movement of the 1970s, with a stronger need to develop low-wage and poor-infrastructure appropriate innovations and increased capabilities in the South (Kaplinsky, 2011). The typical outcome of a pro-poor demonstration project aiming at fostering appropriate technology transfer has been extensively documented (e.g. Diaz Lopez et al., 2005). An example was the demonstration programme of the United Nations Development Programme and the Third World Network (Khor and Li Lin, 2001). The analytical focus of this programme focused on development projects implementing technical solutions which could bear the potential to be

transferred to other developing economies. The view of scaling up innovations mainly looked at technical and/or market factors, such as the capacity of the device, size, additional funding required, etc. The role of policy was deemed narrow, favouring local technology and public purchasing options for policy intervention. Some authors would like to believe this situation has changed, and that the playing field for pro-poor innovation now allows new entrants and new competitors, notably from East Asia. It is expected that the new generation of appropriate pro-poor innovation will contribute to a wider view of innovation beyond technical specificities, in which growth, poverty reduction and the distribution of income in the South will become a major driving force of innovation (Kaplinsky, 2011).

The work of London and Hart (2004) suggests that the traditional business logic model of companies introducing products into low-income markets requires fundamental rethinking. A stronger focus on the local environment and capacity building, developing relationships with non-usual partners and processes of co-creation of innovations were deemed as necessary factors for success. Such thinking led to the development of the BoP protocol, which is a business model generator based on the principle of co-creation of innovative solutions (Simanis and Hart, 2008). This type of protocol includes the stages of (i) opening up, (ii) building the (eco-) system, and (iii) enterprise creation. In the aforementioned BoP protocol, the view of the ecosystem is defined at the project and local levels. It is used as an analogy to describe a process of building the organisational foundations of the innovation project with a low degree of technological complexity. It includes a project team, the participation of the local community, a conceptualisation of a business prototype and some basic upscaling. Overall, this methodology places no real emphasis on analysing the broader institutional environment in which innovation takes place (e.g. at the national or regional levels), nor the establishment of the market base of the innovation.

A growing number of studies on innovation for BoP markets focus on the role of entrepreneurs and their quest to overcome specific challenges that are uncommon in “regular” innovation projects. Although many inclusive innovation projects nowadays are located within a market based approach, they work in an environment that has a history of aid and development co-operation. Therefore, one of the concerns seen in a number of studies is “the development effect” during the project, as this is influential in decisions about the adoption of new technologies and subsequent behaviour (de Boer et al., 2013). Aligned to the view above, some methodological considerations for successful BoP projects have been added to the ones originally suggested by Simanis and Hart (2008) (collaboration, business models,

capabilities, co-creation, social embeddedness, etc., see Figure 1). The methodological guidelines of De Boer et al. (2013) suggest looking at the institutional and policy context in which innovation occurs, e.g. the broader setting of the governance mechanisms of innovation support. In their appraisal, De Boer et al. recognise that despite BoP projects not having an explicit ambition to change policy agendas, governance agendas or policies, these are influenced by national policies and the institutional setting. These factors affect the uptake and implementation of the service on a local and international level; therefore they should be taken into consideration when designing BoP interventions based on innovation. Other important in BoP methodological guidelines relate to social and cultural considerations[3]. Additional insights from this practitioner's literature are the attention given to the strategic context of innovation projects.

Mashelkar (2013) suggested a five-point matrix for the qualitative evaluation of inclusive innovation based on the following characteristics: (i) affordable access, (ii) (long-term) sustainable business, (iii) high quality, (iv) inclusion of excluded population, especially BoP, and (v) significant outreach. These five parameters are interdependent. For example, the scale of production determines the price, therefore "significant outreach" and "affordable access" are interdependent. And both of these are, of course, linked to "sustainable business". By definition, for the same inclusive innovation candidate, the rating on any individual parameter in the matrix will be time-dependent. Mashelkar proposes the Five Point Matrix Evaluation as a support tool for determining government interventions. Notwithstanding, this first generation of evaluation tools does not fully accomplish looking at innovation in the broader perspective, in which the institutional framework and market and systemic failures in the innovation system are systematically identified and addressed.

The following section presents a review of the literature focusing on the systems view of innovation, which has been successfully used to analyse the impact of innovation in the sustainability and competitiveness of countries (Coenen and Díaz López, 2010).

Inclusive innovation and innovation systems

A system of innovation is defined as networks of organisations and institutions that develop, diffuse and use innovations (Edquist, 1997, Hekkert et al., 2007). In spite of the rich amount of work about innovation systems in developing countries, only a

[3] A basic understanding of cultural differences is crucial when analysing factors affecting inclusive innovation. Hofstede (1981) identifies a number of dimensions that indicate important values to consider when doing business across "cultural borders", including the dimensions of individualism, uncertainty avoidance, power distance, etc.

few mentions of inclusive innovation, catching up and development can be identified in the literature. But no provision of an analytical framework has been suggested (Kaplinsky, 2011; Alterburg, 2009).

In this literature, innovation is primarily seen as a means for firms and industries to achieve competitiveness. This approach argues that the right mix of knowledge infrastructure, entrepreneurship, risk capital, launch markets, etc. must be in place. The role of policy is to amend market and system failures and to level the playing field for new entrants (Coenen and Díaz López, 2010). Innovation policies focus on the identification and removal of both market- and system-level failures (Klein Woolthuis et al., 2005).

Most IS literature is in essence academic (non-intervention based), but it has the power to prescribe policy recommendations useful for policy analysis and policy makers. It also provides further guidance for innovation practitioners by clearly describing what factors could hinder the successful market deployment of an innovation. A popular approach for studying emerging innovations is the Technological Innovation Systems (TIS) approach (Hekkert et al., 2007, Carlsson and Stankiewicz, 1991). The TIS approach has especially proven itself in explaining why and how sustainable (energy) technologies have either developed and diffused into a society or have failed to do so (e.g. Suurs et al., 2010, Markard and Truffer, 2008). Such studies usually provide a clear map of actors and a description of relevant regulations. Obviously, the technological innovation at the core of the study is also described. In order to assess the performance of the Innovation System, scholars tend to focus on a set of so-called system functions, or key activities necessary for an innovation (eco-) system to perform (see Table 1).

Table 1. Functions of an innovation system

System function	Description	Event types associated
F1. *Entrepreneurial Activities*	At the core of any innovation system are the entrepreneurs. These risk takers exploit business opportunities and perform innovative commercial and/or practice oriented experiments	Projects with a commercial aim, demonstrations, portfolio expansions
F2. *Knowledge Development*	Technological research and development (R&D) are a source of variation in the system and are therefore prerequisites for innovation processes to occur. Non-technological knowledge is also of key importance	Studies, laboratory trials, pilots
F3. *Knowledge Diffusion*	The typical organisational structure of an emergent innovation system is the knowledge network, primarily facilitating information exchange	Conferences, workshops, alliances
F4. *Guidance of the Search*	This system function represents the selection processes necessary to facilitate a convergence in development	Expectations, promises, policy targets, standards, research outcomes
F5. *Market Formation*	New technologies often cannot outperform established ones. In order to stimulate innovation it is necessary to facilitate the creation of (niche) markets, where new technologies have a possibility to grow	Market regulations, tax exemptions
F6. *Resource Mobilisation*	Financial, material and human factors are necessary inputs for all innovation system developments	Subsidies, investments
F7. *Support from Advocacy Coalitions*	The emergence of a new technology often leads to resistance from established actors. In order for an innovation system to develop, actors need to raise a political lobby that counteracts this inertia, and supports the new technology	Lobbies, advice

Source: Suurs, 2009

Altenburg (2009) highlighted the need to adapt the innovation systems approach to the particularities of inclusive innovation in developing countries. Altenburg suggests a stronger focus on learning, knowledge exchange and capacity building at the national and regional levels. According to this author, a good balance should be kept when analysing the role of governments as resource allocation entities, and more focus should be had on improving basic institutions that support the formation of the market, such as financial intermediation. In the context of TIS in developing countries, Van Alphen (2011) replaced knowledge development by creating adaptive capacity, which refers to the capacity which is required to adopt the technology in the developing country.[4] Also, he includes a separate function for "demand articulation" activities. This refers to activities that can affect the visibility of specific needs of users. Van Alphen focuses on the needs of users and not solely on the "guidance of search activities" mentioned above. The table below provides a set of systems functions that is specifically adapted to be used within the context of developing economies. This representation is particularly interesting, as it applies an attractive clustering of the different system functions into four groups. Provided that these kinds of amendments are seriously considered, the framework seems to be useful for the analysis of Inclusive innovations. It is especially useful as a guide for pointing out important strengths and weaknesses. See Table 3 below for an example.

[4] According to Van Alphen, implementation of a new technology is not simply a matter of transferring the technology to developing countries; it should meet local conditions by sharing knowledge and adapting the technology. Clearly, this is a message borrowed from development studies literature (e.g. appropriate technologies).

Table 2. TIS functions adapted to the context of a developing economy

	Function	Indicators
Supporting framework	1. Creating adaptive capacity	- National policy on biogas - Establishment of new organizations - Business planning
	2. Creation of legitimacy	- Social acceptance and compliance - Information campaigns - Lobbying activities
Knowledge	3. Knowledge diffusion	- Capacity building activities as training seminars and workshops - (Development of) Educational material - Connection to international and regional networks
	4. Knowledge development	- R&D activities in the country itself - Pilot projects - Published articles
Resources	5. Resource mobilization	- Availability of natural resources - Availability of human capital - International and national capital flows - User capital flows - Credit facilities
Market	6. Demand articulation	- Feasibility studies - User surveys
	7. Entrepreneurial activities	- Number of (active) entrepreneurs - Types of entrepreneurial activities - Number of experiments with the new technology
	8. Market formation	- Market size and development - Governmental actions - New tax regimes - New environmental standards - Marketing efforts of firms

Source: Van Zuylen Internship Report (TU Delft).

In the past few years the focus of attention of a small number of TIS scholars has realised the need to build on insights from strategic management literature, in particular from the resource-based view of the firm (Markard and Worch, 2009). Resources shape the base of an innovation system, and strategic decisions of individual actors (e.g. companies) can have decisive implications on how an innovation system is shaped or functions (Musiolik, 2012), most notably in view of network and system-level resources. At the company level, innovation studies in developing countries have shown that the gradual accumulation of capabilities depends to a great extent on a firm's internal technological, organisational, and managerial processes (Kim and Nelson, 2000). The novelty of the novel RBV-informed TIS studies relies on the understanding of system resources for system-building. Based on our review of TIS in developing countries in global value chains, we can infer some further complementarities for the case of inclusive innovation, in which open modes of collaboration and strategic choices help innovators to access global value chains and increase competitiveness. This is clearly an avenue of research that should be further explored.

Emerging economies show a different level of development, as these countries are rapidly catching up with the most advanced Western economies. There are a myriad of examples in which

innovation in transitional economies have set up leapfrog dynamics leading to levelling capabilities at the global level (Altenburg et al., 2008), particularly in a number of areas related to sustainable, low-carbon innovation (Walz, 2011). Recent studies have focused on the process of catching up and inserting innovators from developing countries in global value chains (Pietrobelli and Rabellotti, 2011). Pietrobelli and Rabellotti identified a growing trend in open modes of collaboration and association for the deployment of emerging innovations, which has strong implications for the consolidation of regional and global value chains. This observation is based on recent findings in the literature of global value chains in emerging economies (Mexico, South Korea, etc.), which identified a number of areas in which innovation activities play a key role for the integration of value chains, learning mechanisms, knowledge spill-overs, capacity building, etc. Moreover, the innovation system influences decisions on how a global value chain sources its production system, either locally, regionally or elsewhere.

The innovation systems literature addresses the lack of a system-wide focus of innovation. It also provides insights on why certain countries develop faster than others and what conditions should exist if countries are to be immersed in a process of leapfrogging and catching up, especially in view of the challenges and opportunities driven by major sustainability challenges. But the innovation systems literature has focused in emergent technological fields, mostly related to energy and low-carbon innovations. Innovation systems for inclusive innovation could be a way forward for the integration of the topics described in the literature review hitherto presented.

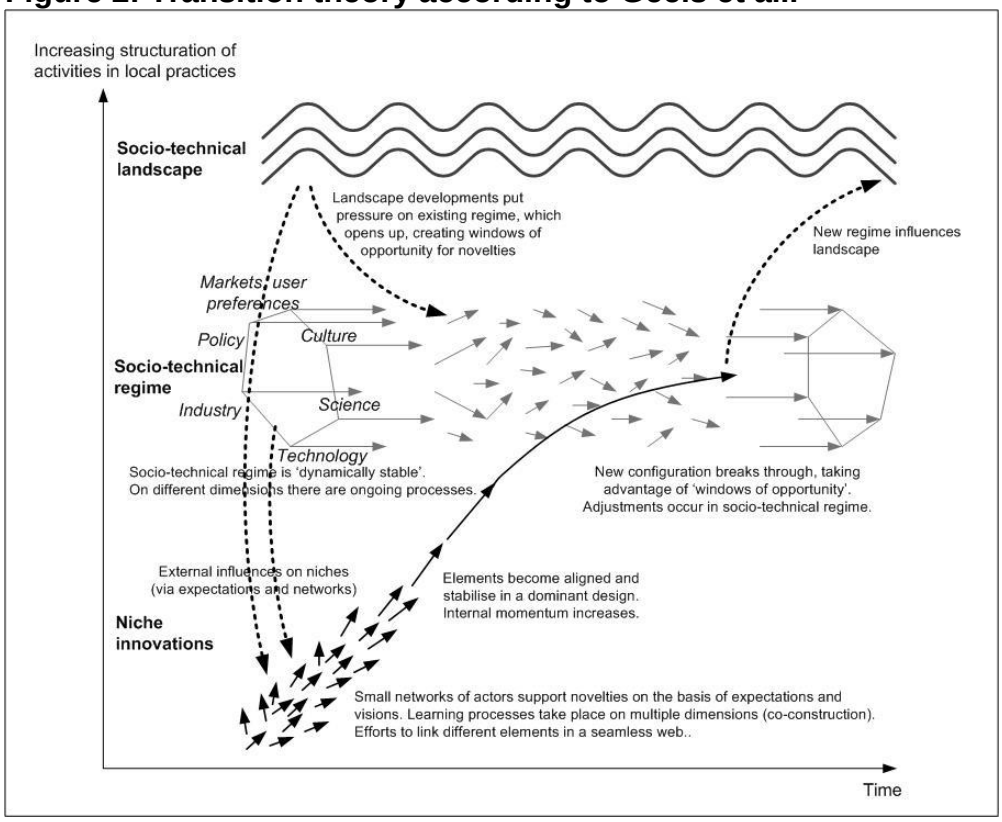
Inclusive innovation and sustainability transitions

There is growing concern about a transition to sustainability because the availability of resources and the ecological crisis will have an impact on the future of the wider system in which new sustainable technologies, products and services are being developed (Jackson, 2009, Markard et al., 2012), that is, the *landscape* shaping major sustainability transformations (Geels, 2002).

From a scientific point of view, a transition is regarded as a drastic socio-technical shift in the way societal functions (energy, housing, mobility) are organised (c.f. Markhard, et al 2012). This involves not just new technologies, but also new social structures (rules, norms, social networks, habits, flows of material and finance). Transition theorists study such complex processes by applying a multitude of concepts and methods, stemming from a range of scientific disciplines: history, economics, sociology, innovation studies, etc. There is no single way of studying a

socio-technical transition but a majority of scholars use the so-called multi-level-model as an analytical perspective.

Figure 2: Transition theory according to Geels et al..



The figure above provides a representation of multi-level-thinking. A transitions is approached as being a historical pattern that unfolds from interaction between three different levels; the niche (micro), the regime (meso) and the landscape (macro) (Geels, 2002a; Geels, 2004; Rip and Kemp, 1998).In the multi-level model, the regime is generally regarded as the main object of research. For a sustainable energy transition, this would be the incumbent energy system / sector. The macro level is a source of exogenous change which plays into the structures of the regime but is not (easily) influenced by it. The principal force of innovation is situated on the niche level (micro). It is on the micro-level that radical novelties emerge. These novelties are initially unstable socio-technical configurations with low performance. Hence, niches act as “incubation rooms” protecting novelties against mainstream market selection […].’ (Geels and Schot, 2007).

Transition scholars have successfully provided insights in many historical cases and in long-term and large-scale development processes in general. One possible scenario of a transition is that shifting landscape factors (e.g. oil prices, climate change) put pressure on the regime, leading to its destabilisation (e.g. shifting politico-economic relations among powerful actors), with the

result that selection pressure on niche-level experiments starts to change. Eventually, niche experiments may come to fill in larger parts of the regime, and, if niches are sufficiently supported, a full-scale transition may occur. Niches have been studied separately as well in the literature on Strategic Niche Management (SNM). In this literature, a conceptual framework has been developed that explains how niches are shaped and how they can be protected so they can develop in relative isolation from the regime.

Sustainability transition thinking has been recently applied to the study of Inclusive innovation (see Annex 1). In these studies the landscape level involves factors that are relevant but hardly within the span of influence for an individual project. The regime level points to a sector or mainstream to be influenced / improved by the BoP project. In a number of examples reported in Annex 1, multiple regimes are to be considered as biogas cooking is not merely related to energy but also to agricultural practice and to the way that people cook. On the niche level the biogas case is clearly just one of many available 'solutions'. This implies the possibility of competitive or complementary developments in other (BoP) projects.

Transition theory does not provide a very clear set of factors to be studied. Most student reports consider rather general topics, such as: demographic characteristics, socio-cultural features, economics, social environment, etc. Also, technological characteristics of, for instance, the energy system are provided. Most importantly, transition theory should be regarded as a 'way of looking'. This is not to be underestimated as this helps to organise research. Each specific case will then result in a different version of the picture / narrative given above.

Inclusive innovation and cultural theory

Clearly, an understanding of cultural differences is crucial for the purposes of the present study. Literature reported in Annex 1 take some form of cultural theory into account. Some authorities in this field are Hofstede and Trompenaars (c.f. Hofstede 2001.)..

Table 3 Cultural value dimensions

Value Dimension	Value Description	High Score	Low Score
Power Distance Index (PDI)	The degree of equality, or inequality, between people in the country's society	Indicates that inequalities of power and wealth have been allowed to grow within the society. These societies are more likely to follow a caste system that does not allow significant upward mobility of its citizens.	Indicates the society de-emphasizes the differences between citizen's power and wealth. In these societies equality and opportunity for everyone is stressed.
Individualism (IDV)	Degree to which a society reinforces individual or collective achievement and interpersonal relationships.	Indicates tat individuality and individual rights are paramount within the society. Individuals may tend to form a larger number of looser relationships.	Typifies societies of a more collectivist nature with close ties between individuals. Reinforce extended families and collectives where everyone takes responsibility for fellow members of their group.
Masculinity (MAS)	Degree to which a society reinforces, or does not reinforce, the traditional masculine work role model of male achievement, control, and power	Indicates the country experiences a high degree of gender differentiation. Males dominate a significant portion of the society and power structure, with females being controlled by male domination.	Indicates the country has a low level of differentiation and discrimination between genders. Females are treated equally to males in all aspects of the society.
Uncertainty Avoidance (UAI)	Level of tolerance for uncertainty and ambiguity. within the society - i.e. unstructured situations.	Indicates the country has a low tolerance for uncertainty and ambiguity Creates a rule-oriented society that institutes laws, rules, regulations, and controls in order to reduce the amount of uncertainty.	Indicates the country has less concern about ambiguity and uncertainty and has more tolerance for a variety of opinions. Reflected in a society that is less rule-oriented, more readily accepts change, and takes more and greater
Long-Term Orientation (LTO)	Degree to which a society embraces, or does not embrace, long-term devotion to traditional, forward thinking values.	Indicates the country prescribes to the values of long-term commitments and respect for tradition. This is thought to support a strong work ethic where long-term rewards are expected as a result of today's hard work. However, business may take longer to develop in this society, particularly for an "outsider".	Indicates the country does not reinforce the concept of long-term, traditional orientation. In this culture, change can occur more rapidly as long-term traditions and commitments do not become impediments to change.

There is not a single clear definition of culture. Hofstede uses the following definition of culture; “Culture is the collective mental programming that distinguishes members of one specific group or category from those of other groups or categories”. Hofstede states that culture is a concept that is learned to people and not something we are born with. Culture is transferred via the social environment. But what does become clear from cultural theory is that one should be very careful when ‘judging’ another culture. One will naturally look at activities in another culture form the viewpoint of ones own culture. Whenever people from one country (or culture) start working in another country (or culture), one will initially have the urge to change a lot of things, trying to copy one’s own culture to the new situation. It is important to consider that other cultures cannot simply be judged on the basis of one’s own cultural background. This concept of cultural relativism implies that a blind copying of concepts from one’s own culture to another is likely to lead to several problems. In order to get a grip on the cultural differences, Hofstede and Trompenaars have developed sets of dimensions that indicate important values to consider when doing business across ‘cultural borders’.

The table above provides an explanation of the set of Hofstede. The dimensions are well studied and empirically validated. Hence they constitute a good reference matrix for the study of cultural aspects of inclusive innovation since it is obvious that cultural differences should be considered when assessing a project context. What is not so obvious is how to do this. Most reports in Annex 1 provide rich descriptions of a culture, according to the value dimensions.

Summing up, what the literature review above also suggests is that the environmental dimension of sustainability vision and the development and use of sustainability-oriented innovations is critical in view of sustainability value creation. These are dimensions often ignored in inclusive innovation literature, or at least there is often a bias towards the social dimension of sustainability. Interestingly, a recent call was made to align inclusive innovation in view of sustainability challenges (George et al., 2012). Existing inclusive innovation literature refers to sustainability as long-term business sustainability, not necessarily sustainable development principles at the company or product levels.

3. Research methods

Our research methodology is based on a narrative analysis of documents (Stanley and Temple, 2008). In addition to drawing from the literature, the model presented in this paper was informed by the analysis of a number of master thesis studies carried out in the period 2005-2012. The complete set of 35 studies was subjected to a quick scan in order to arrive at some first insights and to establish an overview of the field. Based on the overview, some case studies were selected for closer study (see Annex 1). From the study and comparison of cases, common drivers and barriers were identified and related to the theories used. Finally, a workshop was organised in which these results were presented to our partners/stakeholders in the field. A face validation of the proposed model was also performed by means of an expert workshop.

The next step of our work will include the application of the framework to a number of Inclusive innovation projects conducted within TNO's Innovation for Development programme and a number of examples from the literature, particularly from India[5]. Next, the identification of the systemic nature of and factors conditioning the success or failure of will be further identified in an ex-post way. Finally, conclusions, salient limitations and avenues for future research will be presented. At this stage we can only present some inferences and assumptions guiding the work presented in this paper.

Before presenting our findings, it is important to consider the bias of our case selection. To consider this, an overview of the cases studied is provided in Annex 1. Some important general characteristics to take into consideration when interpreting our results are: (i) cases are mainly focused on sustainable innovation, especially decentralised energy production, and (ii) the countries that have been studied most intensively are: Nigeria, Kenya and Bangladesh.

[5] These projects are: (i) ergonomic hand tools for farmers in Ghana, (ii) electricity from biogas for households in Rwanda and Bangladesh, (iii) testing antibiotics in drugs for pharmacists in Kenya, and (iv) increasing milk yield of cows by improving their feed for farmers in India.

4. Towards an integrated framework

This section presents a synthesis of the literature studied. We do this by considering two analytical dimensions: the macro and meso levels of analysis. On the one hand we consider the *Inclusive innovation Landscape*, covering aspects that include the landscape or macro view of innovation. On the other hand, we consider the *Inclusive innovation (Eco-) System*. Here, we primarily consider the direct surroundings of the *Inclusive innovation Project*. Further steps in our analytical work include the development of the project – micro level dimension in our analytical framework.

The review of BoP and inclusive innovation cases (Annex 1) and the literature presented in Section 2 provided a useful indication on the information needed for analysing analyse the context where innovation takes place in the view of development interventions. Below we list all the factors found to be relevant for the analysis of the Inclusive innovation.

Table 4. The three layers of a the framework for the assessment of inclusive innovation at the systems level

Layers	Span of influence	Builds on…
Landscape	Adapt / Accept	Systems approach to innovation (sustainability transitions)
Eco System	Influence	Technological innovation systems Innovation systems in developing countries Inclusive innovation
Project	Control	BoP markets Strategic management of sustainability

We propose considering the so-called DESTEP factors as a starting point. The main purpose of the factors included in this category is to provide general guidance about trends that need to be addressed when operating within a certain country or region. This exploratory level of analysis should provide a rich qualitative description in order to provide a sufficiently concrete basis for action/strategy. Complementary to this, quantitative indicators may be useful, especially when comparing various project locations before actually starting a project.

1. *Landscape* (DESTEP factors): includes demographic, economic, socio-cultural, technological, environmental (ecological) and institutional (political-legal) factors, at the national, regional and/or local levels.

Following on, the remaining factors included in the assessment of the Innovation System for inclusive innovation are aimed at identifying drivers & barriers relevant for the uptake of Inclusive innovation projects at the eco-system level. This concerns factors

that will determine the success or failure of the project. Vice-versa, if successful, the project will (by definition) have an impact on these factors. The factors are organised according to the four categories introduced by Van Zuylen (2011) and partly also by Johnson, Schrauwen, Van Vliet & Wu (2011). The eco-system level categories at listed below.

2. *Resources (and capacity):* financial, human and physical, resources are necessary as a basic input to all the activities within the innovation system.
3. *Knowledge:* the required technical and practical knowledge, as well as the proper networks that allow this knowledge to be diffused and applied throughout the system.
4. *Market:* this group involves activities that are commercially oriented. The idea is that Inclusive innovation cannot prosper without at least a first customer. Local entrepreneurs should also be present to meet the demand(s) of the customer.
5. *Support:* this group involves activities related to the support of government(s), NGOs and other relevant stakeholders. These comprise policies and directives, but also political actions, such as lobbying and campaigning.

In the table below, the different relevant factors belonging to each of the two levels of analysis are presented.

Table 5. Framework for the analysis of an Inclusive innovation System

Level	Factor	Example of indicator
Landscape		
	Demographic factors	Population characteristics
	Economic factors	National income
		Poverty situation
	Socio-cultural factors	Power distance
		Individualism
		Masculinity
		Uncertainty Avoidance Index
		Long-Term Orientation
	Technological factors	Knowledge base
		Technological infrastructure
	Ecological factors	Environment
		National resources
	Political-legal factors	Legal system
		Governance system
Ecosystem		
Resources (and capacity)	Sustainable use of natural resources	Physical stick used as inputs for production
	Human capital	Education degree of personnel
	Financial capital	Operating expenses/year
	Facilities, ICT, etc.	Inventory of facilities
	Equipment	Fixed capital …
	Basic infrastructure	Inventory of infrastructure
	Credit facilities	Credit history
Knowledge	Knowledge development	- R&D activities
		- Pilot projects
		- Publications

	Knowledge diffusion	- Regional network strength (scale, diversity of actors)
		- Specialised education
		- Connection to international networks
Market	Demand articulation	- Comparative advantage Inclusive innovation
		- Consumer motivation
		- Market incentive(s) / affordability
	Entrepreneurial activities	- Active entrepreneurs (quantity, quality, diversity)
		- Practical experiments with the Inclusive innovation (quantity, quality, diversity)
		- …
	Market formation	- Market size (potential)
		- Rate of market growth
		- Distribution channels target market(s)
		- Directives, tax exemptions, carbon credits
		- Standards (quality, safety, compatibility, etc.)
		- …
Support	Absorptive capacity	- Capacity to adopt / adapt external knowledge
		- Adaptive capacity
	Public policy	- Support / Opposition by the government
	Political support / legitimacy	- Support / Opposition locals
		- Support / Opposition politicians / relevant authorities
		- Support / Opposition NGOs
		- Support / Opposition Multi-Nationals
		- Information campaigns (positive / negative)
		- Lobbying activity (positive / negative)

The project level of the framework could be implemented with any of the frameworks discussed in Section 2 (e.g. de Boer et al 2013, Mashelkar, 2013, Simonis et al 2010). However, it is important to note that the proposed framework should be explicitly applied within a triple bottom-line logic, paying special attention to the environmental, social and economic dimension of inclusive innovation projects. Hence, the ecological dimension of the DESTEP factors could be better operationalised and properly linked at the project level, but it is important to keep these variables in mind when analysing each of the parameters suggested in the analytical framework hitherto introduced.

Linking the micro focus of inclusive innovation interventions with the three different layers of analysis (project based, ecosystem and landscape) represents an analytical and empirical challenge. Since inclusive innovation in a new market (i.e., a developing country) requires the formation of infrastructure, networks, etc., one way forward might be to focus on the formation of supportive structures, network formation and the mobilisation of collective resources,

Despite the progress achieved in identifying a number of dimensions and parameters for the suggested framework, the question remains as to how such criteria are to be implemented in practice to actually support inclusive innovation projects. The authors of this paper suggest the following options.

First of all, the framework could be used to perform a quick scan for one or more countries / regions that are ‘nominated’ for a

Inclusive innovation project. This could be done on the basis of crude qualitative assessment in combination with some of the available quantitative national / regional indices. The quick scan is useful for making a quick assessment of different Inclusive innovation (Eco-) Systems.

A second application is a more in-depth analysis of a specific case, in which the idea is to determine the feasibility of a project, indicating important strengths and weaknesses. This can be done for the different factors, also on the basis of quantitative and qualitative indicators. This study should be done on the basis of local expertise, typically through a series of interviews. The result can be regarded as a kind of risk analysis, indicating important weaknesses and suitable strategies to deal with them.

The third option is to further develop the framework into a reflective 'project monitoring' tool. The idea is to actually apply the framework, periodically, when the Inclusive innovation Project is already running. This way, the assessment serves to point out important changes in the Inclusive innovation Landscape and Innovation (Eco-) System. For this application it is useful to develop more solid indicators that work specifically for the project. The advantage of this kind of application is that local expertise is readily available. The results of a Inclusive innovation Project are well adapted to its surrounding environment. Also, if properly designed, the indicators will help to measure the impact of the Inclusive innovation Project.

Finally, the fourth application area is to develop a database that can be used for benchmarking numerous Inclusive innovation (Eco-) Systems. This would actually be the result of successful applications in the other three areas.

Clearly, it is imperative to improve the proposed framework. For each factor in the framework, a clear useable set of indicators and data sources needs to be specified. Where available, quantitative indices should be specified. Ideally, this will be done in projects, with the support of practitioners and people with local expertise. After all, the indicators should be applicable by non-scientists, innovation intermediaries and practitioners. The framework should be simplified. Manuals, formats and visual aids need be developed in order to make it easier to explain and communicate.

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6. Conclusions and implications for future work

The central aim of this paper has been to elaborate an analytical framework which can be implemented for the analysis of system-wide factors for the successful up-scaling of inclusive innovations. By doing so, this contributes to the on-going debate of new models for innovation within the development sector and about wider implications for innovation for development policies.

The authors of this paper presented a summary of literature and identified a number of salient messages. First and more notably, most BoP literature focuses on the project level (community-based intervention), attending a market failure rationale with a growing focus on the role of entrepreneurs. A rather weak focus on sustainability can be identified (triple bottom line, profit, people, and planet). Scholars such as Prahalad and Hart are pioneers in the study and practice of Inclusive innovation, providing methodologies and frameworks for analysis. Secondly, the innovation systems concept is resourceful analytical construct for analysing the firm in a systemic context. System failures can be identified and amended. Innovation systems (and more notably the Technological Innovation Systems approach) focus on emerging technologies at the micro and meso-levels of analysis. From our literature review it is evident that two conditions are necessary for a process of leapfrogging – catching up helping the successful up-scaling of innovation in the context of BoP markets: a well-functioning innovation system and an adequate exploitation of the benefits derived from innovation in value chains.

The literature review also showed that innovation systems in developing countries often show an uneven and rather weak development. There is also a growing literature on IS in developing countries now focusing on value chains and leapfrogging, where the main message is that only those countries with a similar level of development than industrialised ones (in the same value chain) are well-positioned for leapfrogging. Useful concepts such as adapting capacity and other adaptations may be required to fully capture the dynamic of an innovation system in the context of the lower tier of developing economies.

Based on an analysis of the literature and a number of practical cases, a multi-level analytical framework describing the broader picture of Inclusive innovation has been suggested. The current model for analysis considers five dimensions: (i) landscape, (ii) resources (and capacity), (iii) knowledge, (iv) market and (v) support mechanisms, notably in relation to institutions. But our advice is that only those innovations which are sustainable should be promoted. In spite of the progress achieved in this paper, it is necessary to perform a systematic comparison of the

complementarities and differences of the different bodies of literature hitherto presented, so that the project-level dimension can be accurately incorporated.

Future avenues of research are now highlighted. The next step in the development of the proposed framework is the wider application into a series of inclusive innovation projects. The identification of the systemic nature of and factors conditioning success of failure of inclusive innovations will be identified. Finally, conclusions, policy implications, salient limitations and avenues for future research should be fine-tuned.

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The usual disclaimer applies.

Annex 1. Selected Inclusive innovation Studies

Utrecht University / BOP Centre

Author	Title	Year	Subject
Benjamin van der Hilst	Inclusive Innovation Systems: How innovation intermediaries can strengthen the innovation system.	2012	Agro-food sector in Vietnam

TU Delft

Author(s)	Title	Year	Subject
Christine van Zuijlen	Bottlenecks and Facilitators of the Implementation of the National Domestic Biogas Programme in Rwanda.	2011	Domestic biogas
Eric Johnson, Noortje Schrauwen, Julian van Vliet, Wei-Han Wu	Biogas Cooking in Kenya.	2011	Domestic biogas
Folkert Moll	Cultural differences: The Dutch and Nigerian approach reconciled.	2010	Solar energy, rural electrification
Juan Leandro del Viejo	Feasibility Study for Solar Energy in Nigeria.	2011	Solar energy, rural electrification
Karla Romoleroux	Proposal for the Implementation of a Decentralized Energy Supply System Based on a Bottom-up FIS Approach for Rural Development: Case study in Belize.	2009	DG / RET
Lynn Van Heule	Small Wind Turbines in Kenya.	2012	Small wind turbines, rural electrification
Max Tack	Actor Network Development in Strategic Niche Management: Analysis in the field of Solar Energy in Kenya.	2010	Solar energy, rural electrification
Tom vd Voorn	Community Management: A participatory tool for a safe and accessible drinking water supply in rural Bangladesh?	2008	Rural drinking water services
Wiebe Mulder, Wytse Dassen	Institution Building on Grass Root Level: A study to the sustainability of the Pani Parishad (water council) in Patilburi and Kakonhat	2005	Rural drinking water services

Vitae

Dr. Roald Suurs works as a researcher / advisor at the Netherlands Organisation for Applied Scientific Research TNO –Strategy and Policy in Delft, the Netherlands. His work focuses on the analysis and evaluation of innovation processes in the field of sustainable energy technologies. Roald developed a scientific background in innovation studies while writing his PhD thesis at Utrecht University, in the period 2003-2009. His PhD thesis, dealing with dynamics of technological innovation systems, has resulted in numerous publications in international peer reviewed journals. Roald has provided policy advice for various government institutes on the basis of his work.

Dr. Fernando J. Diaz Lopez is a scientific researcher at the Netherlands Organisation for Applied Scientific Research TNO –Strategy and Policy in Delft, the Netherlands. He is also an external fellow of the research group of Knowledge-based Organisations and Science, Innovation and Technology Policy, at the Universidad Autonoma Metropolitana in Cuajimalpa, Mexico. Fernando is also a member of the Mexican Science and Technology Council – CONACYT's National Researchers System (SNI, level 2). With a PhD in International Development and a MPhil in Economics and Management of Innovation, Fernando is a leading expert in the field of eco-innovation for a green and inclusive economy providing advice the European Commission, the United Nations Environment Programme, the Organisation for Economic Co-operation and Development, etc. Fernando was recently awarded by the General Congress of the Mexican United States as the runner up prize of the National Award for Social Sciences of Mexico for his work on inclusive and green economies. His forthcoming book on "Eco-innovation in Firms' is called to be a key contribution to the field.

Mathilde Miedema is managing the corporate program of TNO Innovation for Development (I4D). She also coordinates the TNO Flying Innovation Team; 20 highly skilled professionals who lead innovation projects in developing countries. Mathilde studied Human Movement Science at the Rijks Universiteit Groningen in the Netherlands and got a Master's on Work and Health in 1992. In 1993 she worked at the department of Ergonomic Innovation at TNO Quality of Life in the Netherlands. Starting as researcher/consultant on physical load and Ergonomics and growing to senior project manager and account manager. Since 2006 she is working at the Corporate Social Responsibility department of TNO with the specific task to provide strategic planning to, partnerships for and monitoring of the I4D programme.

Jenny de Boer MSc is a consultant at the Netherlands Organisation for Applied Scientific Research TNO – Organisational Innovation in Delft, the Netherlands. She has an academic background in Industrial Design Engineering and Cultural Anthropology and Development Sociology. She has both research and practitioner experience in developing inclusive innovations, particularly in the field of information and communication

technologies for development. She is focusing on organizing inclusive innovation projects for economic, social and technical sustainable innovation; creating ownership, developing a viable business model with innovative technologies. As a facilitator and designer she works in project teams with public, private and not-for-profit organisations, representing the voice of the end-users.

Professor Dr. R.A. Mashelkar is National Research Professor and also the President of Global Research Alliance, a network of publicly funded R&D institutes from Asia-Pacific, Africa, Europe and USA with over 60,000 scientists. Dr. Mashelkar served as the Director General of Council of Scientific and Industrial Research (CSIR). He was also the President of Indian National Science Academy and President of IChemE (UK). Dr. Mashelkar was elected as Fellow of Royal Society (FRS), London, Foreign Associate of US National Academy of Science, Foreign Fellow of US National Academy of Engineering , Fellow of Royal Academy of Engineering, U.K. and American Academy of Arts & Science. Deeply connected with the innovation movement in India, Dr. Mashelkar is currently the Chairman of India's National Innovation Foundation, Reliance Innovation Council, Thermax Innovation Council and Marico Innovation Foundation, besides being a member of Prime Minister's National Innovation Council as well as Prime Minister's Science Advisory Council for around three decades. Recipient of over 50 national and international awards, including the Business Week (USA) award of 'Stars of Asia'. Thirty universities have granted him with honorary doctorates, which include Universities of London, Salford, Pretoria, Wisconsin and Delhi.