Sustainability transitions in the developing world: Challenges of socio-technical transformations unfolding in contexts of poverty

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A B S T R A C T

The transitions to sustainability approach has proved to be useful for academics, policy makers and practitioners to understand and promote socio-technical transformations, often aiming at climate change alternatives in European countries. However, little attention has been paid to the limitations of using frameworks such as the Multi-level perspective and the Strategic Niche Management approach in the developing world. Here, countries exhibit a mixture of well- and ill-functioning institutions, in a context of market imperfection, clientelist and social exclusive communities, patriarchal households and patrimonial and/or marketised states. In order to explore such limitations, we have used an institutional framework documented in the development studies literature, which describes three types of institutional settings: 'welfare', 'informal security' and 'insecurity'. This institutional analysis shows that (1) the context for innovation in developing countries is a loose scenario where the concepts of 'pockets' or 'layers' can be useful; (2) the characteristics of the institutional setting shape in several ways the quality of the niche structuration processes that create and unfold. Our rationale and illustrations call for bringing the poverty alleviation agenda into sustainability transitions studies in developing countries. We propose areas of further reflection attempting to inspire future research pathways.

1. Introduction

The transitions to sustainability approach has proved to be useful for academics, policy makers and practitioners to understand and promote socio-technical transformations that allow more sustainable ways of production and consumption (Grin et al., 2010; Markard et al., 2012; Smith et al., 2010). This approach has spread widely, with abundant examples from practice, mainly in European countries, in areas such as energy, transportation and food, often aiming at climate change alternatives. These transformations intend to change socio-technical systems of production and consumption into greener and more inclusive ones, through deep structural changes which involve diverse degrees of cooperation and conflict among all actors involved (Newig et al., 2007; Shove and Walker, 2007; Smith and Stirling, 2007). Despite increasing attention to the politics of these transformations in the transitions literature (Avelino et al., 2016; Geels, 2014; Hoffman, 2013), a closer look at the questions *which transformation?*, *for whom?*, and *by whom?* (Scoones et al., 2015) is still needed in order to understand the kind of sustainability these transformations bring about.

These questions are particularly relevant in the developing world, where countries exhibit a mixture of well- and ill-functioning institutions, in a context of market imperfection, clientelist and social exclusive communities, patriarchal households and patrimonial and/or marketized states (Bevan, 2004a; Wood and Gough, 2006). The existence of ill-functioning institutions is the main feature that characterises what we call 'developing countries' in this paper. This 'illness' consists of the fact that both formal and informal institutions in the developing world are contested and personalised at various extents, undermining the well-being of many and strengthening the privileges of a few, and therefore, reproducing patterns of social exclusion.

Most sustainability transitions scholars have implicitly focused on the environmental sustainability of production-consumption systems, while overlooking their 'socio-institutional' sustainability (Romijn et al., 2010:335). The socio-institutional dimension of sustainability refers to the ability of societies to tackle the 'illness' mentioned above, i.e. to counteract processes of poverty reproduction and capability deprivation (Sen, 2000). Sustainability policy and practice in the developing world needs to include eradicating poverty as a focus (UN, 2012, 2015). In fact, some have argued that 'sustainability sits at the nexus of poverty, the natural environment and innovation'

(Khavul and Bruton, 2013:287) and others that 'a just transition would consist of a dual commitment to human well-being (with respect to income, education and health) and sustainability (with respect to decarbonisation, resource efficiency and ecosystem restoration)' (Swilling et al., 2016:650).

In this paper we intend to uncover patterns of poverty reproduction that transitions frameworks have so far overlooked, in order to include sensitivity to poverty alleviation within sustainability transitions analyses. We understand poverty as a multidimensional phenomenon that causes capability deprivation and undermines people's well-being (Bebbington, 1999; Sen, 1981, 2000). We aim at highlighting some elements which connect the transitions to sustainability approach to some fundamental concepts related to poverty alleviation and well-being. Poverty alleviation refers to the expansion of human capabilities for all, i.e. 'the ability of human beings to lead lives they have reason to value and to enhance the substantive choices they have' (Sen, 1997:1959), which can only be realised in the context of well-functioning institutions committed to social security (Nussbaum, 2000; Sen 1982). Specifically, in this paper we examine the question *to what extent the conceptual elements of the sustainability transitions theory embrace the reality and complexity of exclusive socio-technical systems in poverty contexts, i.e. systems that strengthen the privileges of a few while undermining the well-being of many?*

While the paper is mainly theoretical, we use cases that have been discussed in the transitions literature in order to illustrate our argument.

The paper is structured as follows. Section 2 explores notions of landscape and regime in poverty contexts. This exploration builds on the Institutional Responsibility Matrix (IRM) (Wood and Gough, 2006), which pictures 'the institutional landscape within which people have to pursue their livelihoods and well-being objectives'. Section 3 illustrates the poverty reproduction challenges that niche structuration processes deal with in the developing world. Finally, Section 4 discusses the implications of our conceptual contribution for a research agenda on sustainability transitions in developing countries.

2. Transitions in developing countries: contextualising notions of landscape and regime

Developing countries exhibit a mixture of well- and ill-functioning institutions, in a context of market imperfection, clientelist and social exclusive communities, patriarchal households and patrimonial and/or marketized states (Bevan, 2004a; Wood and Gough, 2006). In this context, both formal and informal institutions are contested (i.e. exhibit problems of legitimacy) and personalised (i.e. in the hands of elitist groups) at various extents, undermining the well-being of many and strengthening the privileges of a few (reproducing patterns of social exclusion). This institutional scenario differs from the one in European countries, where the transitions to sustainability has widely spread, both in theory and in practice. In the following sections we make use of the Institutional Responsibility Matrix suggested by development scholars, in order to explain in which ways the institutional scenario differs in different regions of the world. Then, we will highlight the implications of these differences for approaching socio-technical landscapes and regimes in the developing world.

2.1. Institutional responsibility matrix

In Wood and Gough's view (2006), even though poverty eradication is a universal goal, 'one size fits all' policy solutions to poverty eradication do not make sense. They call for context-specific means to achieve it, because in a hostile political economy where inequality and arbitrary exercises of power prevail, the extent to which people (individually and collectively) enact their capabilities depends on the extent to which local institutions are able to guarantee social security (Nussbaum, 2000; Sen 1982; Wood, 2003).

As we will explain below, both state and non-state institutions in the developing world fail to provide social security at various degrees, reproducing informal social security or insecurity. This way of characterising institutions has led Wood and Gough (2006) to suggest three types of institutional settings: 'welfare', 'informal security' and 'insecurity'.

This typification is derived from a theoretical framework that comprises four components: 1) The institutional conditions, which include the character of markets, legitimacy of the state, societal integration, culture and values and the position of the country in the global system. 2) The institutional responsibility matrix (IRM),[1] which describes

> the institutional landscape within which people have to pursue their livelihoods and well-being objectives, referring to the role of government, community (informal as well as organized, such as NGOs and Community Based Organizations), private sector market activity and the household, in mitigating insecurity and well-being, alongside the role of matching international actors and processes. (p. 1701)

3) The welfare situation of the population, measured by, for example, the Human Development Index. 4) The pattern of stratification and mobilisation, which refers to the existing distribution of power in a society and the range of societal inequalities. These four components are interrelated and shape the dynamics of each other.

The authors argue that both formal and informal institutions in developing countries are contested and personalised at various extents, so that 'people have to engage in wider strategies of security provision, risk avoidance and uncertainty management' (p. 1697). These strategies usually prioritise survival and security in the present, continuously postponing long-term sustained well-being, i.e. the 'Faustian bargain' (Wood, 2003). In contrast, in welfare settings people rely on legitimated states and regulated labour and financial markets that provide for all citizens minimum conditions for reproduction.

In informal and insecurity settings, the role of the state, the market, the community and the household (IRM components) is always ambiguous. Therefore, individuals and communities develop a portfolio of strategies and livelihoods, in order to face insecurity and uncertainty. On the one hand, in 'informal security' settings people rely heavily on community and family relationships to pursue their livelihoods and meet their well-being objectives, which results in problematic inclusion or adverse incorporation, because these relationships are usually hierarchical and asymmetrical, reproducing social structuration via patron-client relations. On the other hand, in 'insecurity' settings, local warlords and their clients block the reproduction and emergence of relatively stable informal mechanisms that mitigate insecurity for all (Wood and Gough, 2006: 1699)

Wood and Gough (2006) acknowledge that this classification is not confined to national boundaries and that different parts of the population of one single country might experience different institutional settings, which might also change over time.[2]

2.2. Understanding socio-technical landscapes and regimes in developing countries

Transition studies have widely used the 'Multi-level Perspective' as a framework for understanding major shifts in socio-technical systems (Geels, 2002; Smith et al., 2010). According to this perspective, changes

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[1] This matrix shows the permeability between state, market, community and household institutions and its manifestations at both the domestic and the supranational level. The purpose of highlighting such permeability is to make clear that the state cannot disentangle itself from deep social and political structures and function to compensate for them (Wood and Gough, 2006:1702–1703Wood and Gough, 2006Wood and Gough, 2006:1702–1703).

[2] For instance, in the case of (sudden) change in the ruling government.

Table 1

Characteristics of socio-technical landscapes in welfare, informal security and insecurity settings.

Setting		
Welfare	Informal security	Insecurity
- Capitalist economy based on technological progress - Social relationships are mediated by formal and legitimate rules - States are autonomous and legitimate	- Peasant economies within peripheral capitalism - Social relationships are mediated by informal rules and exhibit exploitation, exclusion, domination - States are weak and hardly differentiated from other power systems	- Predatory capitalism - Social relationships are mediated by informal rules and are often characterised by oppression - States are weak, illegitimate and sometimes criminal

in the system come about through the interaction of three levels: 1) Landscape, which refers to the exogenous environment defined by macro economic, political scenarios and deep cultural patterns. 2) Regime, which includes all elements that shape patterns in socio-technical systems, such as infrastructure, sunk investments in machines, regulation and standards, cognitive routines, lifestyles. 3) Niche, which refers to protective spaces where novelties emerge (Kemp et al., 1998). Bringing the insights into diverse types of institutional settings discussed in the previous section, in the following paragraphs we will propose a description of these levels in the developing world.

First, the socio-technical landscape would then consist of a combination of informal security and insecurity aspects. At the macro level, informal security landscapes are characterised by peasant economies within peripheral capitalism, while predatory capitalism prevails in insecurity landscapes. Exploitation, exclusion, domination and oppression are the dominant social relationships. Political systems are based on patron-clientelism and on particularised power (Wood and Gough, 2006). In Table 1 we describe in more detail the socio-economic and political characteristics of these landscapes, according to the institutional typification discussed in Section 2.1.

Second, moving onto the characteristics of socio-technical regimes, the elements so far identified in the transitions literature need to be carefully explored in order to understand regime dynamics in the developing world. These regime elements have been summarised in guiding principles, technologies, industrial structure, user relations, policy and regulations, knowledge and cultural meanings (Geels, 2002). Following the IRM analysis, in developing countries states are often illegitimate; markets (e.g. labour and financial) are mostly informal in interaction with formal ones; community organisations are often clientelist and at the same time providers of services to meet basic needs (e.g. water supply and sanitation, transport, education, healthcare, housing); and households are usually patriarchal, increasing the vulnerability of women and girls.

As a result, understanding socio-technical regimes in the developing world means embracing high levels of social complexity. For instance, understanding technology and industrial structure is not straightforward, because in informal security and insecurity settings firms are not necessarily the basic production unit: formal firms coexist with other production units such as informal family-based businesses and community organisations. Legal formal firms often import technology (rather than developing it) and it is often adapted by indigenous knowledge. Additionally, despite the existence of regulations and standards, issues such as corruption undermine their objectives (in developing countries regulatory frameworks partially exist and are often illegitimate). In relation to infrastructure, which in developing countries is uneven centrally planned and insufficient, it is usually not a matter of the adequacy of the infrastructure itself, but about the interests and power of the actors involved. The question about culture and lifestyle adaptation to technical systems would then need to be considered in terms of gender, class and other social characteristics, and differentiate rural from urban contexts. In Table 2 we suggest a comparison between the characteristics of regime elements in 'welfare', 'informal security' and 'insecurity' settings. The characteristics of these elements in informal and insecurity settings are what makes problematic (in terms

of poverty reproduction) the use of frameworks such as the MLP when trying to understand or promote sustainability transitions in the developing world.

Some cases that have been described in the transitions literature are useful to illustrate how these characteristics manifest in actual systems of provision in developing countries.

When analysing the socio-technical dimensions of the regime of informal transport in developing cities, Sengers and Raven (2014:456) describe regime's guiding principles as 'paratransit' using existing infrastructure; technologies are said to be characterised by being locally-adapted by 'human infrastructure'; industrial structure is informal, based on the 'war over the penny'; user relations and markets are flexible, in the sense that little is fixed (certain) so that customers have to 'haggle' for a fare; the regime is unregulated showing *de facto* control and rent seeking behaviour of officials and strongmen; there is locally adaptive knowledge; cultural patterns are described as marginalising and not modern.

Analysing the energy regime in Mozambique,[3] researchers have found that the manipulation of utilities and the development of electricity infrastructure has enabled the dominant political party to achieve its own political objectives, benefitting companies with links to political and economic elites. According to them, 'there is now arguably a greater concern with maintaining relationships of patronage and rent-seeking than with providing services to citizens' (Power et al., 2016:14).

When the transitions literature has looked at regime actors and networks such as firms, industry associations, policymakers, local administrations, it has been assumed that their roles are univocal, mainly because research has focused on the developed West (Farla et al., 2012).[4] However, the role of regime actors in developing countries is always ambiguous, as Sengers and Raven's (2014) case illustrates.

In their study on Bangkok's motorcycle taxi industry when introducing a high-tech platform used as taximeter (2014), they reveal how policymakers were interested in the new technology as a tool of bargaining power, rather than as a technology that would bring about societal benefit in terms of mobility. Also, they explain that motorcycle taxi drivers are socially differentiated young uneducated males who have migrated from poor rural areas and cannot find any other livelihood. In both cases, we argue, besides their formal role of 'policymakers' and 'drivers', actors deploy survival strategies to secure provision, avoid risk and manage uncertainty.

We have so far used examples documented in the transitions literature to call attention to the fact that socio-technical landscapes and regimes in the developing world are highly institutionally hetero-

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[3] Wood and Gough (2006) and Bevan (2004b) have argued that Mozambique's institutional scenario exhibits characteristics of an insecurity setting, evidencing 'a combination of predatory capitalism; variegated forms of oppression; inadequate, insecure livelihoods; shadow, collapsed and/or criminal states; diffuse and fluid forms of political mobilization reproducing adverse incorporation and exclusion; and political fluidity if not outright chaos' (Wood and Gough, 2006:1707; Wood and Gough, 2006)

[4] Studies of socio-technical transitions in developing Asia have focused on settings where formality prevail (Berkhout et al., 2009; Jolly and Raven, 2015). Little attention has been paid to settings of informal security and insecurity.

Table 2

Characteristics of socio-technical regime elements in welfare, informal security and insecurity settings.

Setting		
Welfare	Informal security	Insecurity

-Centrally planned infrastructure
    -Technology is developed in research centres, often linked to industrial needs
    - Knowledge is captured and developed in research centres
    - Firms constitute the basic production unit (firms are main providers of goods and services)
    - Legal property rights
    - Legitimate regulatory frameworks
    - Modern lifestyles based on technology and individual freedom
    - People have access to formal labour markets as their main source of livelihood
	-Uneven centrally planned infrastructure. Locally developed (insufficient) infrastructure
	-Firms import technology
	- Technological solutions are usually adapted by indigenous knowledge
	- Formal firms coexist with other production units such as informal family-based businesses and community organisations
	- Formal and informal property rights. Informal collective property rights
	- Regulatory frameworks partially exist or are illegitimate
	- Enforcement is weak
	- Urban and rural lifestyles differ widely
	- Households are patriarchal limiting individual freedom (especially for women)
	- People develop a portfolio of livelihoods (resources based on access to in/formal markets and household/community strategies or other forms of social differentiation)
		- Generalised lack of infrastructure
		- Indigenous knowledge and technologies are not appropriate anymore because of environmental changes and global pressures
		- Basic production units are informal and often based on family/community organisations
		- Informal or inexistent property rights
		- Regulatory frameworks are inexistent. Strongman's rules
		- Urban and rural lifestyles differ widely
		- Households are patriarchal limiting individual freedom (especially for women)
		- People develop a portfolio of livelihoods (resources based on access to in/formal markets and household/community strategies or other forms of social differentiation)

geneous and dynamically unstable. Therefore, the frameworks used to address and analyse socio-technical transformations in these regions should be able to reveal institutional nuances.

To clarify, the setting differentiation we have proposed (welfare, informal security and insecurity settings), does not suggest that in developing countries there are three types of clearly defined socio-technical systems which are in interaction.[5] Rather, we suggest that socio-technical systems in the developing world exhibit a mixture of institutional characteristics which can be seen as pockets.[6] For instance, in Latin American and South Asian countries researchers have found welfare pockets within broad informal security settings (Wood and Gough, 2006). Thus, we argue, the context for innovation in developing countries is a loose scenario where different pockets or *layers* (Rip, 2012) can be present or absent at various intensities.

On the one hand, the concept of pockets refers to the presence of a type of institutional setting within another type of institutional setting. On the other, the concept of layer emphasises 'that the context influences the dynamics of innovation journeys in different ways, not that there are different levels in the context' (Rip, 2012:159). These two concepts are useful for exploring the roots of weak and fragmented innovation systems in developing countries. In these contexts, innovation does not only lead to failure in technological catching up (Intarakumnerd and Chaminade, 2011), but also to deepening inequalities (Cozzens, 2007; Alzugaray et al., 2012).

Some transitions scholars have found degrees of informality, loose regulations and regime gaps in developing countries as opportunities for the emergence of highly novel innovations (Berkhout et al., 2010). Following our argument, these gaps might represent institutional pockets, exhibiting patterns of informality and insecurity. Therefore, we suggest caution with this optimistic view. As we will explain in Section 3, special attention has to be paid in the way socio-technical innovations may align to (rather than challenge) poverty reproduction patterns.

3. Contextualising niche structuration and development processes

Niches are limited and protected domains where new technologies

can be tested and adjusted before facing the open market. This protection can be intentional, in order to construct a desirable path, which has been called 'strategic niche management' (Kemp et al., 1998). Niches may also be formed as a consequence of socio-economic exclusion or created in deliberate opposition to mainstream regimes (Seyfang and Smith, 2007).

The SNM approach has highlighted six key processes for niche structuration and development (Kemp et al., 1998; Raven, 2012; Smith and Raven, 2012; Seyfang and Longhurst, 2014). For policy purposes, focus on these processes should allow juvenile novelties to develop further and become more stable so that when a window of opportunity opens, the likelihood of generating change at the system level increases. These processes are: 1) Visions and expectations are negotiated and articulated by a growing number of actors. 2) A network of different stakeholders takes shape, increasing resources. 3) A shared learning process among actors takes place. 4) There are intermediary organisations and actors who carry localised knowledge to other localities, promoting and strengthening institutional practices among the niche. 5) There is evidence of niche, regime and landscape dynamics. 6) Niche protection not only serves as a shield, but also prompts innovation development and empowers actors.

As explained in Section 2.1, in 'informal security' and 'insecurity' settings, societal functions that are the main focus of sustainability transitions research, such as transport, energy, water supply and sanitation, etc., are usually not collectively fulfilled but individually achieved through diverse survival strategies. Here, we argue, the survival nature of such strategies may shape the way niche structuration processes create and unfold. We will discuss these processes in specific examples documented by transitions scholars. Attention will be paid to the poverty reproduction challenges that each of these processes deal with, in order to bring to the fore our argument about the need for sustainability transitions researchers to uncover the poverty reproduction patterns in processes of socio-technical change in developing countries. In other words, the need to enquire about the quality of sustainability these processes possess.

First, in relation to expectations, Wood and Gough (2006) highlight a paradoxical situation in which people in developing countries desire public goods at the same time that there is unwillingness to invest in them.

In the case of the taximeter experiment in Bangkok explored by Sengers and Raven (2014), 'after they [the drivers] were assured that they would not have to pay up in case of theft and that they would be compensated for potentially lower fees, they were willing to participate'

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[5] Smith et al. discuss that the MLP is challenged by the complex reality of existing plural regimes and niches in interaction (2010: 443).

[6] Scholars studying geography of poverty have used the term 'pockets of poverty' for the last four decades. See for example Alkire et al. (2013), where they bring evidence of the existence of poverty within prosperity in the Global South.

(Sengers and Raven, 2014 p. 463). In relation to the bureaucrats, they supported the experiment because 'at least those people in power didn't look at it as a threat' (p. 462). We argue, therefore, that in informal security and insecurity settings, expectations and willingness to change through socio-technical innovations strongly relate to the ways in which people's survival strategies might reconfigure.

Second, networking is a highly sensitive aspect in constructing niches in the developing world. As we mentioned in Section 2.1, communities are exclusive and shaped by patron-client relationships (Wood and Gough, 2006). In this context, networking activities are based on and facilitated by the same patron-client relationships.

In the case of the taximeter experiment in Bangkok, Sengers and Raven (2014) mention that the organisation of motorcycle taxi drivers which 'seeks social justice and political bargaining power in their battle against the extortion of motorcycle taxi drivers' (p. 460) 'was not directly involved in the experiment … [because] it might have spelled trouble in dealing with some of the bureaucrats, government officials and local police chiefs who do not view the association as a legitimate stakeholder to deal with' (p. 463). Nevertheless, the entrepreneurs who were running the experiment achieved the association to back the experiment, by sending 'a charismatic Thai friend and colleague to the association headquarters … with … a device (to demonstrate how the taximeter worked), an iPad (to show a movie clip of the experiment) and a bouquet of red roses' (p. 463).

Here, the way the network around the new technology is shaped does not challenge the clientelistic nature of the regime, but reproduces it in a subtle way. Therefore, if researchers are interested in looking at sustainability transitions in developing countries, they need to analyse not only whether a network of different stakeholders takes shape, but also in which ways this network develops, because 'clientelist, or even reciprocal, systems of informal rights deliver dependent rather than autonomous security' (Wood and Gough, 2006:1698).

Third, because niche structuration requires a shared learning process among actors, it is important to ask whether such knowledge refers to the new technology itself or to the ways in which informal security and insecurity patterns are not reproduced.

In the example at hand, the experiment took place for a few months in a wealthy area in Bangkok (Sengers and Raven, 2014). The lessons, therefore, were related to that particular configuration. Users and drivers were pleased about being able to trust in technology for a fare, rather than having to negotiate it. The device also gave drivers a sense of modernity, which they felt proud of. The entrepreneurs responsible for the experiment acclaimed success, and fascination with the implemented technology was internationally spread. The experiment showed evidence of learning and existence of enthusiasts promoting its development elsewhere. However it is contested to what extent this process promotes a sustainable niche.

On our view, the conclusions derived by local and international actors were quite obtuse. They were focused on the technology itself and its effects on the modernisation of urban transport. However, they did not take into account social aspects which are related to a broader notion of sustainability. In this learning process, important sustainability questions were overlooked: What if the experiment had been run in a poorer area of the city? In which ways the relationship between taxi drivers and the head of the territorial group (who manages the queue of motorcycles and appoints new drivers) have changed? How is the benefit of a reliable fare weighted against other mobility issues such as safety and pollution? Is the informal privatisation of public services being legitimised?

Fourth, the role of knowledge intermediaries in the developing world is key when looking at poverty reproduction patterns within socio-technical change. Beyond new knowledge and capabilities required for developing greener systems of provision (Berkhout et al., 2010), new visions and framings of innovation are required to counteract patterns of social exclusion (Fressoli et al., 2014). Here, the role of community-based organisations, non-governmental organisations

(NGOs) and social movements is particularly relevant, especially in rural areas (Kilelu et al., 2011; Klerkx et al., 2011). Given the reach of such organizations, they have been referred to as systemic intermediaries (Iyang et al., 2014; Van Lente, 2003). Grassroots intermediaries are shown to play a role governing the local level, voicing and shaping the aims, values and means of local transformations (Balanzó, 2016).

Fifth, in relation to the dynamics between niche, regime and landscape, it has been argued that closer attention to relations and translations between levels is needed, 'as socio-technical elements, but not entirely alternative practices, translate from niches into regimes and components of each appear in the other' (Smith, 2007:447). In this translation process, both power and creativity are involved (Hoffman and Loeber, 2016).

For instance, in the case of Bus Rapid Transit in Bangkok, where buses constitute an affordable option for lower classes, 'in a situation where old routines of regulating traffic proved obdurate and where a growing number of middle-class car drivers wielded considerable power, the struggle for road space and a transition to infrastructural systems based on a different logic provided a significant challenge' (Ghosh et al., 2016:133).

Similarly, Romijn et al. (2010) discuss how successful systems of local provision of electricity in rural India that had improved living standards in rural areas, especially for poor women and marginal farmers, were overthrown by relatively well-off and better politically linked villagers:

> the systems could not cater for the energy preferences of some of the relatively well-off villagers, who wanted use electricity for fans, radios, irons, and so on. In some cases, wealthy persons who lost their privileged access to the bulk of irrigation water and had to share more equally with their poorer neighbours under the conditions of the project actively lobbied for grid connection and discontinuation of the stand-alone systems. Due to their political connections and power, they persuaded/intimidated other villagers to support them. For example, such political scheming led to the ultimate demise of the Hosahalli system even though it had become more or less competitive with government-supplied services (Romijn et al., 2010 p. 331).

Hence, in the context of ill-functioning institutions, more powerful actors who benefit from unsustainable socio-technical systems would tend to impede translation processes, due to their ability to lobby discourses which weaken, delegitimate or eliminate attempts at translating.

Sixth, in relation to protection processes, specifically about empowerment processes, we follow Smith and Raven's (2012) argument about 'empowerment to stretch and transform' socio-technical regimes. According to them, empowered niches can influence processes of institutional reform by bringing about evidence of more sustainable alternatives.

In the case of the motorbike taximeter in Bangkok, the technological 'success' empowers both bureaucrats and drivers through a sense of modernity. However, modernity does not necessarily translate into sustainability. On the contrary, the knowledge society has brought increasing inequalities at all levels (Bortagaray and Ordoñez-Matamoros, 2012; Cozzens, 2007). This 'sense of modernity' empowers actors to fit and conform to the incumbent regime, rather than to stretch and transform it.

Studying the strategies that niche actors develop in order to advance more sustainable mobility innovations in India and Thailand, Ghosh et al. (2016) observe a combination of strategies at different dimensions of regime change. In technological, infrastructural and cultural dimensions, niche actors tried stretch-and-transform strategies, while in public policy and political power dimensions they deployed fit-and-conform strategies. We argue that empowerment to stretch and transform is needed to counteract poverty reproduction patterns. As in the case of the metering motorbike mobility in Bangkok, 'to undermine the

reproduction of certain informal institutions such as paying informal site rent and the associated chain of privilege and corruption' (Ghosh et al., 2016 p. 129). Otherwise, this socio-technical change might 'constitute an (un)sustainable mobility pathway' (Sengers and Raven, 2014:465).

In conclusion, after having explored six key processes of niche structuration in developing countries, we argue that it is not enough for researchers to look for evidence of whether these processes take place or not, but to enquire deeper about the institutional settings underlying such processes, which shape in several ways the quality of the processes that create and unfold. In other words, transitions scholars need to enquire about the kind of sustainability these processes possess. Sustainability transitions, in contrast with socio-technical transitions alone, must take into account the quality of change processes, so that informal security and insecurity regimes can be challenged and transformed. A socio-technical transition approach that does not take this into account could claim a technology's success in the developing world, while overshadowing reproduction of informal and insecurity socio-technical systems.

4. Discussion and conclusion

From the previous section, it could be argued that the main challenge of sustainability transitions in developing countries is to avoid reproducing ill-functioning institutions that continue benefitting the privileges of a few, while undermining the well-being of many. In these contexts, socio-institutional sustainability is as important as environmental sustainability. Romijn et al. (2010) have argued before that the main challenge for sustainability transitions studies consists of connecting the environmental sustainability agenda with the agendas of poverty reduction, local community development and capacity building. On our view, socio-institutional sustainability should be at the centre of transitions studies in developing countries. Here, the role of socio-technological innovation is not only about becoming more resource-efficient, but about reconfiguring power balance within production-consumption systems.

We understand, however, that this is not an easy nor simple endeavour. Therefore, in the following paragraphs we suggest four areas of further reflection, which might inspire future research pathways. First, we discuss about the values and principles that lead socio-technical transformations; second, we tentatively explore what the implications of a loose layered scenario might pose for innovation; thirdly, we discuss the need of new conceptual frameworks; and finally we discuss some methodological challenges. Opening up this avenue of research might greatly contribute to a better understanding of the sort of policies required to move towards a just and environmentally sustainable future for all.

First, looking at the values and principles that underlie transformation processes helps to understand the criteria according to which different pathways to sustainability are either promoted or blocked at various extents by diverse actors and networks. Attention to these values helps to 'specify versions of sustainability in terms of the particular properties and flows of goods and services valued by particular social groups or in the pursuit of particular goals' (Leach et al., 2010:42). Besides efficiency, other values have been brought into the sustainability transitions debate, such as social justice, social inclusion and autonomy (Smith et al., 2014); generosity, which refers to an ethics of sufficiency and cooperation, and nature restoration, meaning reconnection with the various dimensions of nature (Swilling and Annecke, 2012).

For instance, a transition led solely by principles of resource efficiency might result in a low-carbon world in which socio-economic inequalities prevail, i.e. an 'unjust transition' (Swilling and Annecke, 2012). On the contrary, innovations based on values of solidarity and sufficiency might bring about broaden access to services, reduced ecological footprints, discouragement of consumerist behaviour, capa-

city development and empowerment of socially excluded groups (Seyfang and Longhurst, 2013; Seyfang and Smith, 2007).

The latter kind of innovations have mainly been found in grassroots innovations (Seyfang and Smith, 2007), a specific sort of socio-technical niche able to develop bottom-up solutions to sustainability problems. It has been argued that grassroots innovators frame and translate sustainability challenges in a way that fits into their understanding of their own world, creating context-specific solutions (Moulaert et al., 2005; Middlemiss and Parrish, 2010). As a result, grassroots innovations constitute 'innovation spaces for bottom-up forms of socially just and environmentally sustainable technological futures' (Smith et al., 2014:122).

However, most grassroots innovation cases documented in the literature take place in 'welfare' settings. Thus, more research is needed in 'informal security' and 'insecurity' settings, aiming to analyse the dynamics of alternative and inclusive innovations, mainly related to basic services such as water supply and sanitation, energy, transport, housing, health care, education, food and information and communication.

Second, as we argued above, the context for innovation in developing countries is a loose 'layered' scenario where different institutional 'pockets' can be present or absent at various degrees. It means that in the same way that there are pockets of ill-functioning institutions, where social exclusion patterns prevail, there should also be pockets of 'better-functioning' institutions, where social justice is pursued. In which ways, then, could transitions researchers discover such 'better-functioning' pockets, able to transform production-consumption systems into more social and environmentally sustainable? How do actors and networks look like and behave in 'better-functioning' pockets? What are their capabilities? What sort of support or protection do they require? How do different types of pockets interact with each other? How does this interaction affect innovation journeys? What if the diversity of institutional pockets relates also to an epistemological diversity? What sort of governance arrangements are suitable for a 'layered' scenario? What are the characteristics of the different layers? Indeed, further research in developing countries is needed in order to attempt to answer these questions.

Such attempt calls for new conceptual frameworks able to highlight the nuances that different institutional settings exhibit. The insights from development studies that we have brought into this paper have identified the problematic areas that transitions scholars should pay attention to, in order to uncover poverty reproduction patterns in socio-technical transformations. New conceptual frameworks should be able to target, or at least take into account, these 'problematic areas' in order to better address transitions in developing countries. The challenge appears to be that of comprehensively approaching the more complex social aspects, particularly those of governance, while still keeping track of the material, technological side. Enriching science and technology studies with conceptual frameworks from development studies, organisations studies, political science, anthropology, geography, among others, might contribute to this endeavour.[7]

Finally, gathering empirical data in these contexts needs researchers and research methods able to deal with the subtleties present in social interaction in the developing world (Mompati and Prinsen, 2000). Issues of positionality emerge in research encounters, because we, as researchers, are also positioned in specific ways within power structures (Hall, 1992; England, 1994; Cloke et al., 2000). Here, the researcher's gender, age, ethnicity, etc., may affect the suitability of particular research methods and, therefore, interpretations (Chacko, 2004; Moser, 2008).

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[7] Recent work of Balanzó (2016) is an example of this.

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References

Alkire, S., Roche, J.M., Sumner, A., 2013. Where Do the World's Multidimensionally Poor People Live? OPHI Working Paper 61. University of Oxford, Oxford.

Alzugaray, S., Mederos, L., Sutz, J., 2012. Building bridges: social inclusion problems as research and innovation issues. Rev. Policy Res. 29 (6), 776–796. http://dx.doi.org/10.1111/j.1541-1338.2012.00592.x.

Avelino, F., Grin, J., Pel, B., Jhagroe, S., 2016. Special issue: the politics of sustainability transitions. J. Environ. Policy Plann. 18 (5), 557–567.

Balanzó, A., 2016. Unfolding Capacity: Strategies of Farmers' Organizations as Change Agents. (PhD Thesis). University of Twente, The Netherlandshttp://dx.doi.org/10.3990/1.9789036541862. Retrieved from.

Bebbington, A., 1999. Capital and capabilities: a framework for analysing peasants viability, rural livelihoods and poverty. World Dev. 27 (12), 2021–2044.

Berkhout, F., Angel, D., Wieczorek, A.J., 2009. Sustainability transitions in developing Asia: are alternative development pathways likely? Technol. Forecasting Social Change 76, 215–217.

Berkhout, F., Verbong, G., Wieczorek, A.J., Raven, R., Lebel, L., Bai, X., 2010. Sustainability experiments in Asia: innovations shaping alternative development pathways? Environ. Sci. Policy 13, 261–271.

Bevan, P., 2004a. Conceptualising in/security regimes. In: Gough, I., Wood, G., Barrientos, A., Bevan, P., Davis, P., Room, G. (Eds.), Insecurity and Welfare Regimes in Asia, Africa and Latin America: Social Policy in Development Contexts. Cambridge University Press, Cambridge, pp. 88–118.

Bevan, P., 2004b. The dynamics of Africa's in/security regimes. In: Gough, I., Wood, G., Barrientos, A., Bevan, P., Davis, P., Room, G. (Eds.), Insecurity and Welfare Regimes in Asia, Africa and Latin America: Social Policy in Development Contexts. Cambridge University Press, Cambridge, pp. 202–252.

Bortagaray, I., Ordoñez-Matamoros, G., 2012. Special issue: innovation, innovation policy and social inclusion in developing countries. Rev. Policy Res. 29 (6), 669–671.

Chacko, E., 2004. Positionality and praxis: fieldwork experiences in rural India. Singapore J. Trop. Geogr. 25 (1), 51–63.

Cloke, P., Cooke, P., Cursons, J., Milbourne, P., Widdowfield, R., 2000. Ethics, reflexivity and research: encounters with homeless people. Ethics Place Environ. 3, 133–154.

Cozzens, S., 2007. Distributive justice in science and technology policy. Sci. Public Policy 34 (2), 85–94. http://dx.doi.org/10.3152/030234207X193619.

England, K.V.L., 1994. Getting personal: reflexivity positionality, and feminist research. Prof. Geogr. 46, 80–89.

Farla, J., Markard, J., Raven, R., Coenen, L., 2012. Sustainability transitions in the making: a closer look at actors: strategies and resources. Technol. Forecasting Social Change 79, 991–998.

Fressoli, M., Around, E., Abrol, D., Smith, A., Ely, A., Dias, R., 2014. When grassroots innovation movements encounter mainstream institutions: implications for models of inclusive innovation. Innov. Dev. 4 (2), 277–292.

Geels, F.W., 2002. Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case study. Res. Policy 31, 1257–1274.

Geels, F.W., 2014. Regime resistance against low-carbon transitions: introducing politics and power into the multi-level perspective. Theory Culture Soc. 31, 5.

Ghosh, D., Sengers, F., Wieczorek, A.J., Ghosh, B., Roy, J., Raven, R., 2016. Urban mobility experiments in India and Thailand. In: Evans, J., Karvonen, A., Raven, R. (Eds.), The Experimental City. Routledge Research in Sustainable Urbanism. Abingdon/New York, Routledge, pp. 122–136.

Grin, J., Rotmans, J., Schot, J., 2010. Transitions to Sustainable Development. New Directions in the Study of Long Term Transformative Change. Routledge Studies in Sustainability Transitions, Routledge, New York/London.

Hall, S., 1992. New ethnicities. In: Donald, J., Rattansi, A. (Eds.), 'Race', Culture and Difference. Sage, London, pp. 252–259.

Hoffman, J., Loeber, A., 2016. Exploring the micro-politics in transitions from a practice perspective: the case of greenhouse innovation in The Netherlands. J. Environ. Policy Plann. 18 (5), 692–711.

Hoffman, J., 2013. Theorizing power in transition studies: the role of creativity in novel practices in structural change. Policy Sci. 46 (3), 257–275.

Intarakumnerd, P., Chaminade, C., 2011. Innovation policies in Thailand: towards a system of innovation approach? Asia Pacific Bus. Rev. 17 (2), 241–256.

Iyang, H., Klerkx, L., Leeuwis, C., 2014. Functions and limitations of farmer cooperatives as innovation intermediaries: findings from China. Agric. Syst. http://dx.doi.org/10.1016/j.agsy.2014.02.005.

Jolly, S., Raven, R.P.J.M., 2015. Collective institutional entrepreneurship and contestations in wind energy in India. Renew. Sust. Energy Rev. 42, 999–1011.

Kemp, R., Schot, J., Hoogma, R., 1998. Regime shifts to sustainability through processes of niche formation: the approach of strategic niche management. Technol. Anal. Strategic Manag. 10, 175–196.

Khavul, S., Bruton, G.D., 2013. Harnessing innovation for change: sustainability and poverty in developing countries. J. Manage. Stud. 50 (2), 285–306.

Kilelu, C., Klerkx, L., Leeuwis, C., Hall, A., 2011. Beyond knowledge brokering: an exploratory study on innovation intermediaries in an evolving smallholder agricultural system in Kenya. Knowledge Manage. Dev. J. 7 (1), 84–108. http://dx.doi.org/10.1080/19474199.2011.593859.

Klerkx, L., Pant, L.P., Leeuwis, C., Cummings, S., le Borgne, E., Kulis, I., Lamoureux, L., Senmartin, D., 2011. Beyond the conventional boundaries of knowledge management: navigating the emergent pathways of learning and innovation for international development. Knowledge Manage. Dev. J. 7 (1), 1–7. http://dx.doi.org/10.1080/19474199.2011.593880.

Leach, M., Scoones, I., Stirling, A., 2010. Dynamic Sustainabilities: Technology, Environment, Social Justice (Pathways to Sustainability) Earthscan. Oxon/New York.

Markard, J., Raven, R., Truffer, B., 2012. Sustainability transitions: an emerging field of research and its prospects. Res. Policy 41, 955–967.

Middlemiss, L., Parrish, B.D., 2010. Building capacity for low-carbon communities: the role of grassroots initiatives. Energy Policy 38, 7559–7566.

Mompati, T., Prinsen, G., 2000. Ethnicity and participatory development methods in Botswana: some participants are to be seen and not heard. Dev. Pract. 10 (5), 625–637. http://dx.doi.org/10.1080/09614520020008805.

Moser, S., 2008. Personality: a new positionality? Area 40 (3), 383–392.

Moulaert, F., Martinelli, F., Swyngedouw, E., González, S., 2005. Towards alternative model(s) of local innovation. Urban Stud. (Routledge) 42, 1969–1990.

Newig, J., Voβ, J.-P., Monstadt, J., 2007. Special Issue: governance for sustainable development: coping with ambivalence, uncertainty and distributed power. J. Environ. Policy Plann. 9 (3), 185–192.

Nussbaum, M., 2000. Women and Human Development. Cambridge University Press, Cambridge.

Power, M., Newell, P., Baker, L., Bulkeley, H., Kirshner, J., Simth, A., 2016. The political economy of energy transitions in Mozambique and South Africa: the role of the Rising Powers. Energy Res. Soc. Sci. 17, 10–19.

Raven, R., 2012. Analysing emerging sustainable energy niches in Europe: a strategic niche management perspective. In: Verbong, G., Loorbach, D. (Eds.), Governing the Energy Transition: Reality, Illusion or Necessity? Routledge Abingdon, pp. 125–151.

Rip, A., 2012. The context of innovation journeys. Creativity Innov. Manage. 21 (2), 158–170.

Romijn, H., Raven, R., de Visser, I., 2010. Biomass energy experiments in rural India: insights from learning-based development approaches and lessons for Strategic Niche Management. Environ. Sci. Policy 13, 326–338.

The Politics of Green Transformations. In: Scoones, I., Newell, P., Leach, M. (Eds.), Pathways to Sustainability) Routledge, Oxon/New York.

Sen, A., 1981. Poverty and Famines: An Essay on Entitlement and Deprivation. Clarendon Press, Oxford.

Sen, A., 1982. Choice, Welfare and Measurement. Basil Blackwell, Oxford.

Sen, A., 1997. Editorial: human capital and human capability. World Dev. 25 (12), 1959–1961.

Sen, A., 2000. Social Exclusion: Concept, Application and Scrutiny Social Development Papers. pp. 54. Retrieved from http://www.adb.org/sites/default/files/publication/29778/social-exclusion.pdf Retrieved from http://www.adb.org/sites/default/files/publication/29778/social-exclusion.pdf.

Sengers, F., Raven, R., 2014. Metering motorbike mobility: informal transport in transition? Technol. Anal. Strategic Manag. 26 (4), 453–468.

Seyfang, G., Longhurst, N., 2013. Growing green money?: Mapping community currencies for sustainable development. Ecol. Econ. 86, 65–77.

Seyfang, G., Longhurst, N., 2014. Understanding the Diffusion of Grassroots Innovations for Sustainability: An International Study of Community Currency Niches. Science, Society and Sustainability Research Group., Norwich 35 Working Paper 2014–25.

Seyfang, G., Smith, A., 2007. Grassroots innovations for sustainable development: towards a new research and policy agenda. Environ. Pol. 16 (4), 584–603.

Shove, E., Walker, G., 2007. CAUTION! Transitions ahead: politics: practice and sustainable transitions management. Environ. Plann. A 39, 763–770.

Smith, A., Raven, R., 2012. What is protective space?: Reconsidering niches in transitions to sustainability. Res. Policy 41, 1025–1036.

Smith, A., Stirling, A., 2007. Moving outside or inside? Objectification and reflexivity in the governance of socio-technical systems. J. Environ. Policy Plann. 9 (3–4), 351–373.

Smith, A., Voβ, J.-P., Grin, J., 2010. Innovation studies and sustainability transitions: the allure of the multi-level perspective and its challenges. Res. Policy 39, 435–448.

Smith, A., Fressolli, M., Thomas, H., 2014. Grassroots innovation movements: challenges and contributions. J. Clean. Prod. 63, 114–124.

Smith, A., 2007. Translating sustainabilities between green niches and socio-technical regimes. Technol. Anal. Strategic Manage. 19 (4), 427–450.

Swilling, M., Annecke, E., 2012. Just Transitions: Explorations of Sustainability in an Unfair World Claremont, South Africa. UCT Press.

Swilling, M., Musango, J., Wakeford, J., 2016. Developmental states and sustainability transitions: prospects of a just transition in South Africa. Special issue: the politics of sustainability transitions. J. Environ. Policy Plann. 18 (5), 650–672 Special issue.

United Nations, 2012. The Future We Want. (Accessed 18 February 2014) http://www.un.org/en/sustainablefuture/.

United Nations, 2015. Historic New Sustainable Development Agenda Unanimously Adopted by 193 UN Members. (Accessed 26 September 2015) http://www.un.org/sustainabledevelopment/blog/2015/09/historic-new-sustainable-development-agenda-unanimously-adopted-by-193-un-members/.

Van Lente, H., 2003. Roles of systemic intermediaries in transition processes. Int. J. Innov. Manage. 07 (03), 247–279.

Wood, G., Gough, I., 2006. A comparative welfare regime approach to global social policy. World Dev. 34 (10), 1696–1712.

Wood, G., 2003. Staying secure, staying poor: the faustian bargain. World Dev. 31 (3), 455–471.