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Abstract

The concept of 'sustainable industrialisation' is now integral to the UN's Sustainable Development Goals. However, there are no historical examples or current models to emulate. Scholarly analyses of putative initiatives to green industrialisation, especially in developing countries, are few and limited. This article explores the conception and implementation of green industrialisation in Ethiopia, one of the world's poorest nations, where an ambitious Climate Resilient Green Economy (CRGE) strategy has been created, alongside a multi-sectoral Growth and Transformation Plan (GTP), to leapfrog environmentally unsustainable development and bring the country to middle-income status by 2025. Using the socio-technical transition (STT) perspective and in particular Smith et al's (2005) framework for assessing sustainable transition programmes, it analyzes the 'selection pressures' on the industrial 'regime' and its 'adaptive capacity'. It finds: (i) clear articulation of the imperative for climate change mitigation and economic growth; (ii) strong high-level government commitment to a greening agenda within the context of accelerated industrialisation; and (iii) a nascent innovation system that is beginning to evolve according to these priorities. However, the analysis also identifies important challenges, including: coordination mechanisms between different stakeholders; framing issues; availability of resources; and ongoing tension between addressing climate change and promoting economic growth. It also highlights the importance of the availability of cross-border resources for purposive sustainability transition within low-income countries.

Keywords

industrialisation, green economy, low-carbon, sustainability transition, Ethiopia

1. Introduction

In the face of global climate change, increasing natural resource degradation and rising environmental pollution, some African countries are attempting to embrace the concept of green industrialisation – to rapidly grow their economies without externalising the negative environmental costs of development. With the encouragement of international development partners, countries such as Rwanda, Ethiopia and Mauritius have sketched ambitious plans to decouple industrialisation from environmental impacts and leapfrog to green economies (Death, 2014; UNEP, 2011; Wakeford *et al*., 2017). There are as yet no existing examples of countries that have pursued a green industrialisation pathway through a deliberate greening policy from the outset. In most high-income countries, industrialisation occurred before there were widespread concerns about the damage polluting industries could do to human health and ecological sustainability. Conventional economic models of development suggest that growth in poor countries occurs through a series of stages of structural transformation, which increase the intensity of both resource use and pollution, eventually bringing long-term

convergence with developed economies in structure, growth and production (Kuznets & Murphy, 1966; Rostow, 1960). Even among newly industrializing countries in Asia, the philosophy has tended to be: 'industrialise first, and clean up later.' With no clear model to follow and a unique socio-economic and institutional context in operation, putative sustainability transition experiments in African countries offer interesting cases to analyse the processes and prospects for alternative development pathways in latecomer countries (Berkhout *et al*., 2009; 2010; Wieczorek, 2018).

Though 'sustainable industrialisation' has been adopted as an ambition within the Sustainable Development Goals (SDG Goal 9), there remain many unanswered questions about the feasibility of green industrialisation in Africa, particularly in terms of sustaining growth, and the conditions under which this might best happen. Some have suggested that a combination of global developments in innovation and communication technology and improved macro-economic governance mean recent 'greening' experiments could mark the dawn of a new epoch and 'a fundamental break with African history' (Frankema, 2014, p. 17). Others suggest that as latecomers to industrialisation, African countries have the advantage of not having to grapple with technology lock-in and associated path-dependencies which often constrain change (UNEP, 2011). However, others like Dani Rodrik (2018) offer a bleak view, suggesting that recent growth in Africa cannot endure, as minimal structural change means poor prospects for sustainable industrialisation. Still others (Dawson *et al*., 2016) warn against imposing external 'green' innovation on Africa, as it could exacerbate the continent's Western dependence. For Swilling, *et al*. (2016), and Ramos-Mejia *et al*. (2018), the main challenge for sustainability transition experiments in Africa comes in connecting the environmental sustainability agenda with goals of poverty reduction, social justice, local community development and broader good governance.

Given the strong correlation between energy use and economic growth, at least historically, decoupling carbon dioxide emissions from economic development presents a huge challenge for any state. But achieving this objective is even more difficult for developing countries like Ethiopia, where institutional capacity and innovation systems are weaker (Mulugetta & Urban, 2010; Wakeford et al., 2017). Yet, despite Ethiopia being one of the poorest countries in the world, with rapid population growth and declining ecological services, the government has initiated an ambitious Climate Resilient Green Economy [CRGE] (FDRE, 2011) strategy alongside a multi-sectoral Growth and Transformation Plan [GTP] (FDRE, 2010) that aims to bring the country to middle-income status by 2025. The CRGE's principal aim is to achieve a high rate of economic growth without increasing the country's greenhouse gas (GHG) emissions.

This article analyses Ethiopia's green industrialisation programme through the lens of the socio-technical transition approaches (STT). STT has been adopted to study and assist deliberate governance attempts to seed and steer green transitions in a variety of sectors, largely in Europe. In this form, it focuses less on firms and market incentives and more on institutional and regulatory dimensions and processes. Specifically, the article provides an initial assessment of two main factors that have been asserted as critical in determining the form, direction, and prospects of socio-technical transitions: firstly, the articulation of

pressures for regime transformation and especially how different and often conflicting pressures for regime transformation are interpreted 'and oriented coherently in a particular direction' by key governance actors (Smith et al., 2005, p.1495); secondly, the adaptive capacity of a regime, understood in terms of the resources available within or beyond the regime for responding to these environmental selection pressures. It also includes analysis of the degree to which resources are effectively coordinated in the management of regime transition towards sustainability (Geels, 2002; 2005; Berkhout *et al.*, 2010; Smith *et al.*, 2005).

The STT perspective has been used to analyse long-term transition processes (mostly in European countries) with a focus on socio-technical systems that provide specific societal functions (transportation, communications, leisure, housing etc) (Geels, 2002, p. 1257). Recently, there have been calls for (e.g. Berkhout *et al*., 2009; 2010), and growing application of, this approach in analysing nascent and ongoing system-wide sustainability transitions in developed (Geels, 2005; Grin *et al*., 2010) and developing countries (Angel & Rock, 2009; Ramos-Mejia, 2018; Rock *et al.*, 2009; Swilling *et al.*, 2016), although mostly focused on Asia. At the same time, a number of highly relevant attempts to analyse sustainable technology diffusion in Africa from the closely related but more limited Technological Innovation System (TIS) perspective has begun to emerge (Kassahun & Mitsufuji, 2015; Tigabu *et al.*, 2015; Tigabu, 2017; Tigabu *et al.*, 2017). As it is too early to meaningfully assess the success or otherwise of these green transition experiments, the utility of the STT approach is mostly in helping scholars to 'identify patterns of change and indicate possible intervention points that would inspire transformative practice and strategy development' (Wieczorek, 2018, p. 211).

This article begins by reviewing the historical process of industrialisation in Ethiopia. It then briefly elaborates the conceptual framework underpinning the analysis of transition governance. It then outlines the CRGE strategy, focusing on the industry sector, to illustrate how the government perceives and articulates selection pressures on the industrial socio-technical regime and how it is attempting to respond. It also examines how resources are coordinated to implement the CRGE. The subsequent discussion highlights the availability of resources as a particular challenge for Ethiopia's greening agenda for industrialisation (an issue likely to be mirrored in other low-income countries), but also looks at how the government is attempting to overcome these constraints. As such, it offers potential lessons for the wider region as well as for sustainability transitions research more generally. Overall, the analysis makes an important contribution, we hope, to the evolving literature on sustainability transitions in Sub-Saharan Africa, and on greening industrialization more specifically.

2. Industrial transformation in Ethiopia

In the last 30 years Ethiopia has embarked on an aggressive pursuit of industrialisation spearheaded by an 'activist developmental state' (Oqubay, 2015, p. 3). The launch of the

Growth and Transformation Plan (GTP) in 2010 marked the beginning of a strong emphasis on structural transformation to position the manufacturing sector to lead economic growth.

Having inherited a weak industrial base from the previous government, the Ethiopian People's Revolutionary Democratic Front (EPDRF) government started out in 1991 by introducing a market-led economic policy was marked by a series of reforms. During this period, the country implemented three phases of IMF/WB sponsored programmes (Gebreeyesus, 2013). But, unlike several other sub-Saharan Africa countries, Ethiopia did not open and liberalize everything as prescribed by the IMF/WB, but rather followed a more selective and gradual reform approach. However, at the turn of the century, the government formulated its first coherent industrial development strategy (IDS), which emphasised the importance of industrial transformation and, particularly, the need to strengthen links between agriculture and industry, especially in 'export oriented and labour intensive industries in line with the country's perceived comparative advantage' (Abebe & Schaefer, 2015, p. 124).[1] Crucially, the strategy also stated the importance of government intervention, not only to facilitate but also to lead a development agenda (Altenburg, 2010). Under this philosophy, the government has over the last 30 years poured enormous resources into infrastructural development and pursued 'an "activist industrial policy" in search of distinctive growth path' (Oqubay; 2015: 4). While debate rages over its sustainability, this bold experiment has so far seen Ethiopia halving poverty in two decades and recording double-digit growth over 15 years (2003 - 2017). In the last 15 years, it has dramatically expanded its industrial base with large-scale growth in the leather, garment, and floricultural sectors (Abebe and Schaefer, 2015); and global brands such as Pittards, Uniliver, and the Huajian group all operate in the country (Oqubay, 2015). Ethiopia currently has the largest airline and the largest electric railway network in Africa, and is now also constructing the largest hydropower plant on the continent.

The ambitious Growth and Transformation Plans (GTP I 2010/11-2014/15, and GTP II 2015/16-2019/20) aim to consolidate and expand on achievements made in the last 30 years. The stated ambition is to take the country towards middle-income status by 2025 by boosting agricultural productivity, strengthening industrial production and fostering export growth. The goal is to raise per capita GDP from its current (2018) level of around USD 890 to over USD 1200 within 15 years, effectively maintaining an annual GDP growth rate of over 10% (FDRE, 2010). The GTPs envisage agricultural development continuing as a critical part of growth. The agriculture sector is expected to grow at an annual rate of 8.6%, although its share of GDP is projected to diminish from 42% to 29% by 2025.

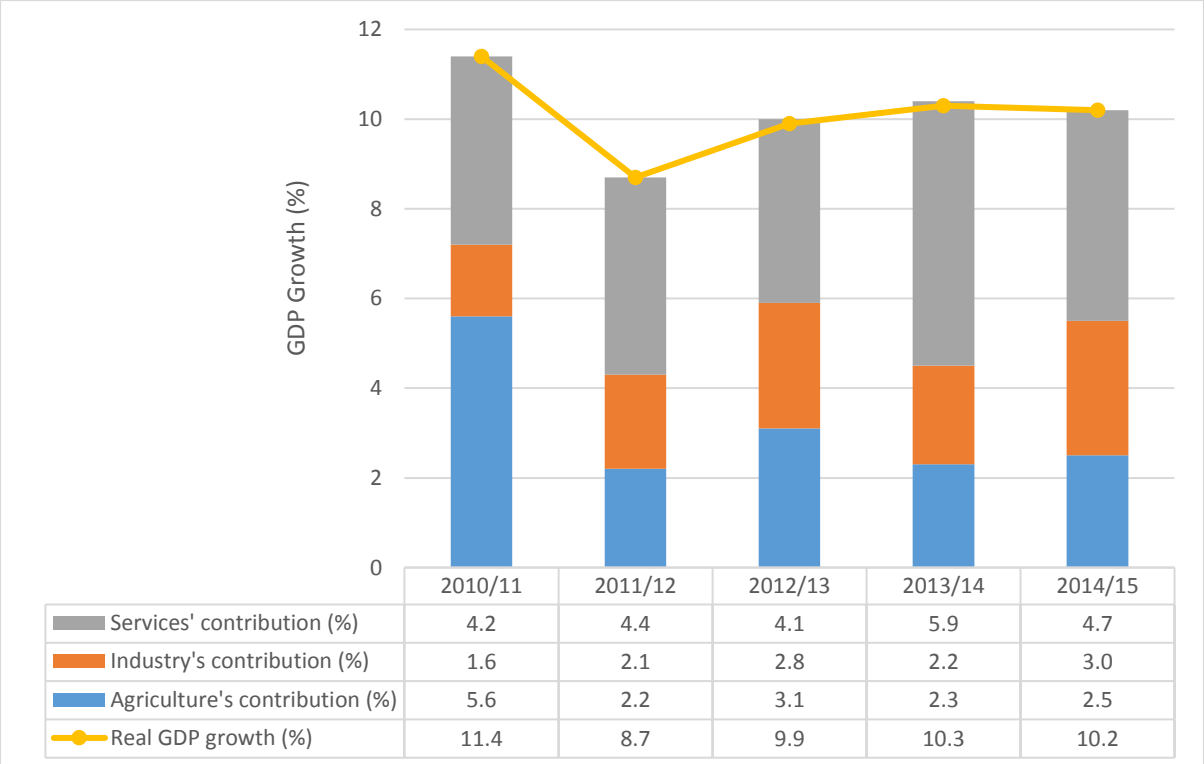
More importantly, the industrial sector is expected to grow at a rate of 20% per annum, with its share of GDP rising from 13% as at 2016 to 32% by 2025. The services sector is expected to contribute 39% of GDP by 2025, down from 46% in 2013/14. These figures show that the economy is expected to expand, but more significantly that its structure (in terms of GDP

[1] The IDS is based on the government's broader development vision called the Agriculture Development Led Industrialization (ADLI), which was developed in the mid-1990s and subsequently elaborated.

shares) is projected to change increasingly in favour of the industrial sector. The textile, leather and cement industries top the list of priorities, with the expectation that foreign currency earnings from textiles would rise from USD 22 million in 2010 to USD 1 billion in 2015, with cement production increasing by a factor of 10.

Overall, the growth of the industrial sector thus far is promising (Noman & Stiglitz, 2015). In 2013/14, it achieved a growth rate of 21.2% (NBE, 2014). The industry sector share of GDP rose to 14.2% from 11.5% two years early, although falling short of the 19% target share set in GTP II. The industry sector growth is driven mainly by the construction and manufacturing sub-sectors, although the contribution of the latter was lower than in the previous two years. Specifically, the construction industry contributed 53.1% to industrial sector growth, as a result of infrastructure expansion in Ethiopia, which has seen extensive road, railway, dam and house building. The manufacturing sub-sector, on the other hand, grew by 11.3% in 2013/14, contributing about 30.8% to industrial output growth (NBE, 2014). However, the export performance of the manufacturing sector remained weak and below expectations. For example, as indicated above 1 billion USD earnings was expected from textiles and garment exports by the end of GTP I period. But the actual performance turned out to be USD 97.9 million, which is only 9.8% of the target (FDRE: NPC, 2016).

As Figure 1 indicates, the industrial sector has contributed between 2 and 3 percentage points to real GDP growth from 2011/12 to 2014/15. However, so far it is the service sector that has contributed the most to GDP growth, for example between 4% and 6% from 2011/12 to 2014/15.



	2010/11	2011/12	2012/13	2013/14	2014/15
Services' contribution (%)	4.2	4.4	4.1	5.9	4.7
Industry's contribution (%)	1.6	2.1	2.8	2.2	3.0
Agriculture's contribution (%)	5.6	2.2	3.1	2.3	2.5
Real GDP growth (%)	11.4	8.7	9.9	10.3	10.2

Figure 1: Sectoral contributions to real GDP growth, 2010/11 - 2014/15

By 2014/15, the industrial sector share of GDP growth had overtaken that of agriculture, in line with the policy of Agricultural Development Led Industrialisation (ADLI), which aims to provide inputs from the agricultural to the industrial sector. The service sector has contributed most to GDP growth so far, implying that the expected transformation in the economy's structure has yet to occur. Moreover, whilst the manufacturing sub-sector's value-added has grown from USD 1 billion in 2011 to USD 1.5 billion in 2014, largely driven by companies that employed 50 people or more, growth here has not been as significant as that in other industries, particularly construction.

Analysis for the second period of the Growth and Transformation Plan (GTP-II) from 2016-20 suggests three particular reasons why the share of total GDP held by the manufacturing sub-sector had not managed to rise above 5% over the period of the first plan (GTP-I), despite the targets set. The first is that the domestic private sector, which was expected to play a large role in the expansion of industrial production, has tended to invest in the service sector instead, both because initial costs are often lower and because manufacturing expertise is lacking. The second is the underachievement of existing firms in terms of productivity and competitiveness (FDRE, 2016: 30). The third is the supply-side constraints related to infrastructure, energy and access to credit, which have created obstacles to the establishment of new industries and the development of existing industries.

GTP-II has been partly formulated to address these issues, moving to bring about the 'economic structural transformation' and associated export-oriented industrialisation seen as essential to make Ethiopia a lower middle-income country by 2025. GTP-II is therefore no less ambitious than GTP-I in terms of the targets set for the industrial sector. There is an expectation that the share in overall GDP will rise from 15.1% in 2014/15 to 22.3% by 2019/20, based on a vision that sees Ethiopia becoming a leading manufacturing hub in Africa (FDRE, 2016: 136-137). However, GTP II also aims to achieve industrial development while minimising pollution and utilising renewable energy to meet the CRGE's aims. A key strategy for achieving these ambitions is the formation of industrial parks (see 4.2.2).

3. Theoretical framework

Over the last two decades the socio-technical transition (STT) framework has emerged as one of the leading approaches for analyzing sustainability transitions in advanced economies, especially those in Europe (Berkhout, 2002; Geels, 2005; Geels, 2011; Grin *et al*., 2010; Jacbosson & Johnson, 2000; Kemp & Never, 2017). A core tenet of STT theory is that socio-technical systems comprise technologies, actors, networks, and institutions, interacting in a co-evolutionary manner.

Much of the STT literature makes use of Rip and Kemp's (1998) and others' (e.g. Geels (2002; 2005; 2011) further elaboration of the multi-level perspective (MLP) that distinguishes between the macro-level 'landscape', meso-level 'regime', and micro-level 'niche'. The regime fulfils societal functions and supplies needs such as transport,

communication, and housing. The regime comprises technologies, the different actors shaping their use (developers, distributors, users), as well as the institutions making policies and regulations. Regimes are often defined as comprising the sets of rules and routines that set the dominant mode of practice in any aspect of society (Geels, 2002). They account for stability and path dependencies, on the one hand providing certainty for investment and lowering transaction costs, but on the other giving rise to lock-ins which hinder radical change. Niches are the pockets of space where innovation happens, often under regulatory or government protection from market forces. The landscape is the wider terrain where the regime functions, and includes longer-term trends (globalisation, climate change, and population dynamics, for example) as well as background variables like broad material infrastructure, political culture and worldviews. Other landscape variables include shocks such as wars and environmental disasters (Kemp *et al.,* 2001; Schot & Geels, 2008). These features can be seen as beyond the direct control of the regime, particularly when broader policy influencing and debate is positioned 'outside' the regime and within the landscape level (e.g. outcomes of UNFCCC negotiations).

The regime's level is of primary importance because transitions are defined as shifts from one regime to another (Geels, 2011: 26). The core proposition is that the 'problem of transition' is therefore the 'problem of regime change' (Kemp *et al.*, 2001: 277). Shifts in the existing socio-technical regime are seen as occurring because of changes in the 'selection environment', often at the landscape level, with new selection pressures creating tensions within the incumbent regime (Berkhout *et al.,* 2003; Geels, 2002; Smith *et al*., 2005). At the same time, the niche level draws attention to processes of innovation. Successful diffusion of novel artefacts and related practices may lead to new configurations among artefacts, institutions and actors, thus changing the nature of the regime.

Originally, the MLP viewed transitions as 'non-linear processes that result from the interplay of developments at the three analytical levels' (Geels, 2011, p. 26). According to this view, transformations are neither uniform nor deterministic. Change is not caused by a single factor, but results from several connected factors reinforcing one another. In essence, transformations are multi-causal and co-evolutionary. More recently, STT scholars have acknowledged that many current greening industrialisation programmes are 'purposive', involving deliberate attempts to create sustainability transitions through large-scale national transition plans (as in Ethiopia). The creation of spaces (e.g. on-the-ground local projects) protected from conventional regime selection pressures such as market forces, means that innovations can be developed, adapted and piloted appropriately to increase the chance of successful diffusion (Geels, 2005; Tigabu *et al.,* 2017). There are scholars within the sustainability transitions field who still question how feasible it is for specific actors to steer the evolution of socio-technical regimes, given the complexity of regimes and of the politics of related governance systems (Loorbach, 2010; Shove & Walker, 2007, 2010). However, they would still concede that the actions of a powerful coalition of actors governing any particular regime are significant in determining transition processes and outcomes.

Given its emphasis on technological innovation, systems stability, and change, the STT framework offers valuable tools for analysing the processes of green transitions, including in

developing countries (Berkhout *et al.*, 2010; Wieczorek, 2018). Development scholars have, of course, long recognised the importance of technology advancement (including leapfrogging) in shaping the trajectory of growth in Africa (Soete, 1985; Sharif, 1989). The critical role of innovation in economic growth as well as the impact of globalisation and other transnational events on development has also been a long-term topic of discussion (Gould & Gruben, 1996; Malerba, & Mani, 2009). On the whole, though, dominant theories of development have treated these as discrete forces. Moreover, most development theories have tended to be structural or functionalist, emphasizing the importance of macro-economic conditions and the struggle for resource allocation (Rapley, 2013). The appeal of the STT approach lies in its recognition of complex and multi-dimensional facets of transformation while 'making the context and its impact more explicit and articulated in ways that development studies have not previously considered in great length' (Wieczorek, 2018., p. 210). STT therefore offers a useful tool for studying the interplay of factors in sustainability transition programmes in Africa.

However, despite the growing dominance of the STT approach, very few studies have sought to apply it rigorously to the greening transition agenda in Africa. In this paper, we make particular use of the framework developed by Smith *et al*. (2005) to explore the industrial system change towards sustainability, from both descriptive and normative perspectives.

One of the key contributions of Smith *et al*. (2005) to the evolving literature on sustainability transitions is the identification of two main factors whose analysis can help to assess the character, 'form, and direction' (p. 1491) of a given socio-technical transition. The first is 'the articulation of environmental selection pressures by governance actors' (p. 1495), i.e. the degree to which selection pressures are oriented coherently in a particular direction and the processes through which such issue-framing is made explicit and translated into forms that allow intended response from regime actors. As noted, the STT literature has long recognised that changes in socio-technical systems are often prompted by dynamic interaction of pressures at the three different levels of the system – niche, regime, and landscape (Geels, 2002; Berkhout *et al.*, 2003). Smith *et al*. (2005) emphasise that sustainable socio-technical transition is not simply about the existence of selection pressures but, crucially and decisively, how governance actors identify, interpret and frame the multiple and often conflicting environmental selection pressures to warrant specific interventions in the pursuit of transition. Hence, in the case of Ethiopia, we need to know not merely what selection pressures are prompting the ambitious state-led green industrialisation programme in such a poor country, but also how such a programme is justified and framed, as well as the mechanisms and processes through which the greening industrialisation agenda is rendered governable by government actors and their allies.

The second factor identified by Smith *et al*. (2005) is the 'adaptive capability of the regime in transformation.' (p. 1495). This refers to the ability of a regime to negotiate and respond to a set of selection pressures in ways that result in a successfully managed transformation. Drawing on seminal work by Jacobsson and Johnson (2000), Smith *et al*. (2005) identify a number of key aspects that define a regime's adaptive capacity. First, is its knowledge creation ability, i.e. the quality and quantity of innovation activities in the socio-technical

system. This includes ‘the quality of interaction and interactive learning among several knowledge creating, diffusing, using and supporting agencies’ (Tigabu, 2017, p. 2). The importance of innovative systems in providing an incubation environment has long underpinned sustainability transitions research (Jacobsson & Bergek, 2011; Markard & Truffer, 2008). Other factors that define a regime’s adaptive capacity include its ability to direct ‘search and build’ expectations for alternative futures among producers and users of emergent technologies, the availability of human and financial resources, and crucially, the political support to drive change. Equally important is the creation of sustainable markets for new technologies, often through public procurement and favourable fiscal policies, and the regime’s capacity to create positive external economies that can increase competitiveness through, for example, infrastructural developments, regulation, or the recruitment of key players to help reduce information, knowledge and transaction costs.

Smith *et al.* (2005) are clear that the articulation of selection pressure and the adaptive capacity of regimes are very closely related and may be hard to separate empirically. Hence the description of the framework as ‘quasi-evolutionary’ (p. 1497). Furthermore, they draw attention not only to the context of transition (how coordinated the adaptive response is, and whether resources for adaptation come from within or outside the industrial regime), but also to the issue of power and agency in terms of who resists or promotes change.

This framework clearly identifies useful parameters for differentiating the context of transitions while analysing the form and direction of a transition process. However, its utility for analysing transition in the context of developing countries, characterised by weak intuitions and innovation capabilities, still needs to be more widely tested empirically. The analysis here therefore considers an attempt at ‘purposive transition’ in a low-income country in sub-Saharan Africa, where industrial development is still relatively nascent. As noted, most of the sustainability transitions literature analyses the experiences of industrialised countries where the transition is from ‘unsustainable’ to ‘sustainable’ industrial or socioeconomic regimes. In developing countries such as Ethiopia, by contrast, the aim is to facilitate the emergence of a (largely new) green industrial regime in a country where industry is currently extremely limited. Rip and Kemp (1998), however, have warned against seeing less industrialised countries as ‘empty receptacles’, noting that these countries have trajectories of their own which involve technology in various ways. Sustainability transition is therefore still a valid term in these cases.

This study of Ethiopia’s early attempts to green industrialisation will therefore assess: (i) the articulation of selection pressures impacting on Ethiopia’s industrial regime; and (ii) the locus and availability of resources to facilitate green transition, including the status of the current innovation system and the actors and coordination mechanisms involved in pursuing this agenda.

4. Assessing the parameters for greening industrialisation in Ethiopia

4.1 Articulating selection pressures

This sub-section explores the evolution of environmental policy, a major means for articulating environmental selection pressures and fulfilling diagnostic and prognostic functions of governance. It focuses in particular on the recent Climate Resilient Green Economy (CRGE) strategy.

4.1.1 The evolution of Ethiopian environmental policy

Environmental issues began to be considered within the broader governance of Ethiopia following the establishment of the EPRDF government. The concept of sustainable development was enshrined as a right within Article 43 of the Constitution of 1995, alongside Article 44, which asserts the 'right to a clean and healthy environment' (cited in Getu, 2012, p. 57). In 1997, the Environmental Policy of Ethiopia for sustainable development was adopted. Its principles included minimising the use of non-renewable resources, ensuring the sustainable use of renewable resources, and diffusing and adopting energy-efficient technologies. It also espoused the 'Precautionary Principle' to encourage consideration of long-term environmental protection over short-term economic gains, the incorporation of environmental and social costs into development thinking, and the regular collection of environmental assessment data to monitor improvements (Getu, 2012, pp. 58-9). A revision of the Environmental Policy was completed in 2016 with the overall goal unchanged, but an additional policy objective included to reflect the CRGE, namely to 'ensure the reduction of GHG emission to the threshold level, hereby promoting emission reduction technologies and practices' (MEFCC, 2015).

Although the term 'green economy' was not explicitly used, the notion that the industrialisation process should become less resource-intensive and involve less pollution was also a central feature in many key national development policies and strategies implemented between 2000 and 2011, including the Sustainable Development and Poverty Reduction Programme (2000-2005) and the Plan for Accelerated and Sustained Development to End Poverty (2006-2010). However, it was not until the Climate Resilient Green Economy (CRGE) strategy of 2011, building on the Growth and Transformation Plan (GTP), that a roadmap was laid out to enable Ethiopia to achieve a high rate of growth without increasing the country's net GHG emissions (FDRE, 2011).

4.1.2 The Climate Resilient Green Economy strategy

The CRGE (FDRE, 2011) arguably represents a key articulation of two perceived selection pressures now building on the industrial regime at the landscape level: the need to promote (inclusive) growth and the need to address climate change. While climate change is presented within the CRGE as a potential barrier to development, it is also perceived as a potential opportunity for harnessing the country's vast renewable natural resources and for growing the economy in a way that minimises environmental externalities. The logic is that even though Ethiopia's current CO_2e emissions are tiny, the country should attempt to prevent them from increasing and contributing (however minutely in the global context) to climate change, which is expected to harm Ethiopia's natural resource base. The green path to development is seen as necessary not only for long-term sustainability, but also to achieve economic growth and alleviate poverty. As such, the CRGE provides an initial diagnosis of the problem of

climate change in relation to Ethiopia and its development, and a prognosis of how a green economy can be achieved.

The CRGE assesses business-as-usual (BAU) and green economy (GE) scenarios for the year 2030 using a net-zero GHG growth trajectory (limiting it to 145 Mt CO_2e in 2030). Both scenarios were developed from a 2010 country baseline for current emissions of only 150 Mt CO_2e in 2010, with more than 85% of GHG emissions coming from the agricultural and forestry sectors (see Figure 2). Under BAU, emissions would more than double from 150 Mt CO_2e in 2010 to 400 Mt CO_2e in 2030, with the largest absolute increase coming from agriculture. Yet industry and transport are expected to see significant increases in GHG emissions of 15% and 11% per annum, respectively. Unusually, the only sector where emissions are not expected to rise is power, mainly because more than 90% of total power generation capacity to energise future industrial development and transport systems, among other sectors, is projected to come from hydropower plants.

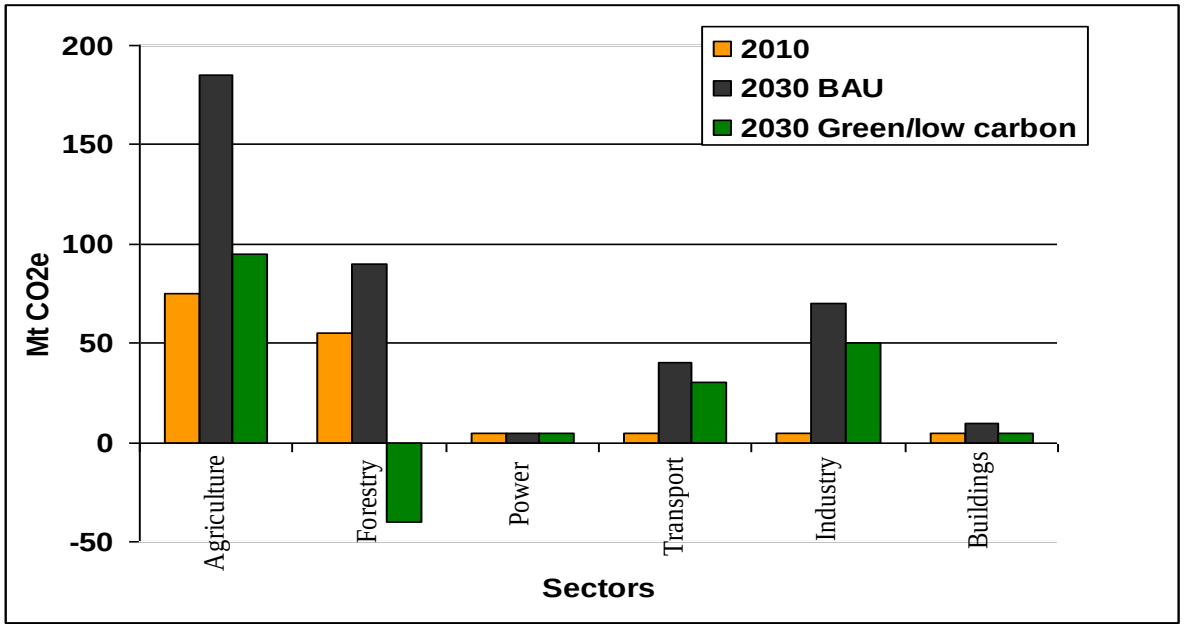


Figure 2: GHG emissions trends/sector - 2010, BAU, Green Economy (FDRE, 2011)

Due to industry's relatively small share in the economic activity of Ethiopia, the sector accounted for only 3% of GHG emissions in 2010 (FDRE, 2011). Approximately 50% of the 4 Mt CO2e emitted by the Ethiopian industrial sector comes from cement production, 32% from mining, and 17% from the textile and leather industries (UNDP Ethiopia, 2011). However, given the government's concerted efforts to spur industrialisation, particularly in the cement, textile and leather industries, absolute emissions are set to rise significantly in this sector unless mitigation actions are taken. Even within a GE scenario, emissions from the industrial sector will grow tenfold from 5 Mt CO_2e to 50 Mt CO_2e (see Figure 2) – though over a quarter less than the 70 Mt CO_2e predicted for the BAU scenario. Seventy percent of the potential for GHG abatement in the sector, the CRGE suggests, will be in the cement industry, not only because it is already the largest emitter, but also because cement output is projected in the GTP to increase from 2.7 Mt in 2010 to more than 65 Mt by 2030. This is

likely to involve clinker substitution, upgrading to more energy-efficient technologies and waste heat recovery, and utilisation of biomass (mainly agricultural residues) as a fuel. Other industrial sub-sectors identified with abatement potential include chemicals, fertilisers, textiles, leather, and paper and pulp (FDRE, 2011).

Overall, the CRGE suggests that the large cuts in emissions in other sectors, particularly forestry and agriculture, will compensate for increases in emissions in the industrial sector and keep overall emissions slightly below current levels. However, the estimated cost of measures to facilitate this to 2030 is USD 150 billion. Yet the CRGE analysis also suggests that the industrial sector is the one likely to benefit most from GHG-abatement interventions as long as the best available energy-efficient technologies are introduced to build renewable energy capacity. In all, these changes are expected to generate USD 1 billion of annual savings in fuel costs.

4.2 Coordinating resources

Clearly, greening industrialisation requires more than articulating a plan for low-carbon economic development. It also needs substantial funding and investment and corralling both will and expertise to facilitate implementation (Oqubay, 2015). Indeed, Smith *et al*. (2005) suggest that coordination of resources (financial, organisational and human) is the other core governance role for promoting sustainability transitions. The coordination of financial, organisational and human resources is likely to be particularly challenging in low-income countries, where investments in greening industry mean introducing expensive 'complex technology' (Rip & Kemp, 1998, p. 370). Smith *et al*. (2005) argue that purposive transitions occur when the locus of resources is external to the incumbent regime, and when there is a high level of coordination of adaptive capacity. This sub-section therefore explores existing mechanisms (including human capabilities) for mobilising resources and the potential locus for such resources.

4.2.1 Environmental governance coordination mechanisms

Historically, the Environmental Protection Authority (EPA), established after the formulation of the Environment Policy of Ethiopia in 1997 to provide federal leadership, was the locus of environmental governance in Ethiopia 'with the objective of formulating policies, strategies, laws, and standards to ensure that social and economic development activities sustainably enhance human welfare and the safety of the environment' (Getu, 2012, p. 63). This includes responsibility for providing technical advice on environmental management to sectoral institutions, and for auditing the environmental performance of large-scale projects (Nyssen *et al.*, 2004)

Getu (2012) notes that under the EPA proclamation, regional states were required to create regional environmental agencies (REAs). This has occurred to some degree in regional and all city administrations. However, he suggests that the REAs suffer from practical limitations, (lack of approved conservation strategies to guide their environmental management, for example, as well as understaffing and a lack of expertise).

Another important development, which hints at the desire to ensure environmental coordination and mainstreaming, was the establishment of Sectoral Environmental Units (SEUs) in each relevant agency with the mandate to provide a mechanism for ensuring environmental concerns and regulations were part of sectoral developments and policy (Getu, 2012; Paul & Weinthal, 2018). But this has occurred in only a few cases, 'leaving most relevant federal agencies (as well as all regional ones) without environmental coordination' (Getu, 2012, p. 65).

More recently, with the establishment of the CRGE, the institutional framework for coordinating the implementation of environmental actions has been strengthened, in particular with the establishment of the Environmental Council (Paul & Weinthal, 2018). The Council is chaired by the Prime Minister and comprises members selected from relevant Federal Ministries, the Presidents of the National Regional States, and representatives of non-governmental organisations, the private sector, and trade unions (FDRE, 2011). It is responsible for recommending CRGE-relevant laws and regulations for approval by the Council of Ministers, and also has the power to set environmental standards and directives. Of particular relevance is the Sub-Technical Committee responsible for Industry, which links the sector to the Ministerial and Technical Committee, creating a platform for sharing information and understanding sectoral synergies and interdependencies more clearly.

The creation in 2013 of the Ministry of Environment, Forest Development and Climate Change [MEFDCC] was another important development, designed explicitly to elevate the Environmental Protection Agency 'to an executive level in order to promote a green economy and climate change resiliency'[2]. MEFDCC supervises and regulates implementation of the technical components of the CRGE initiative. This is facilitated by a team of experts who work on each economic sector to (a) monitor the effectiveness of projects, (b) measure, report, and verify (MRV) project outcomes, and (c) provide the public with appropriate information. The team maintains close links with all relevant ministries, partly by fostering the establishment of environmental units within ministries and sectoral agencies that do not already have them. The MEFDCC is accountable to the Environmental Council, collaborating with the Ministerial Steering Committee and the Technical Committee responsible for the alignment and approval of technical content. Meanwhile, the Ministry of Finance and Economic Development, in collaboration with the MEFDCC, has responsibility for soliciting financial support from international sources and ensuring compliance with international agreements.

The role of federal ministries and sectoral agencies in CRGE implementation is largely focused on developing and supervising funded green economy initiatives, with the Ministry of Industry (MoI) responsible for ensuring the implementation of the green economy strategy in the industrial sector. Of particular importance are the MoI's industrial development zone and environmental protection directorate (responsible for promoting the expansion of industrial zones in environmentally appropriate ways); its policy and programme research, monitoring and evaluation directorate; its textile, leather and metal research monitoring and

[2] Source URL: http://www.lse.ac.uk/GranthamInstitute/law/proclamation-creating-the-ministry-of-environment-and-forestry/.

evaluation directorate; and its leather industry and textile industry development institutes (responsible for facilitating the development and transfer of relevant technologies and upgrading the respective sub-sectors to make them more competitive and enable industrial growth).

One other important aspect not clarified in the CRGE strategy to date is the role (if any) of the private sector. A Public-Private Consultative Forum was established after the development of the Industrial Development Strategy in 2002. Co-chaired by the then Minister of Trade and Industry and the President of the Ethiopian Chamber of Commerce, this was supposed to meet quarterly to identify sectoral policies and strategies and address potential problems with new regulations (IMF, 2004). A National Private Public Partnership supported by a series of sub-sectoral committees covering priority industries in the IDS also aimed to discuss opportunities for future development in each of the industries. There are, therefore, established means to facilitate dialogue between government and industry, but whether they fully represent the full spectrum of industries, including both public and private-owned companies, is unclear (Paul & Weinthal, 2018).

Moreover while previous government re-structuring in Ethiopia had provided political weight for the environmental portfolio at a national level (through the new Ministry of Environment and Forest and the Environment Council, for instance), this decision has been reversed with the Ministry of Environment, Forest & Climate Change changed to a commission within the Office of the Prime Minister. It's not clear why this decision was taken and what implications this will have on the country's climate strategy and its integration into and coordination with the programmes of line ministries and the development activities under the Regional Governments. At the same time, the high level of focus on government led provision of public goods has caused some to argue that the state is crowding out the private sector and thus injuring the durability of industrial transformation (Rodirk, 2018). It is also not clear how much influence regional environmental units have to translate and embed national policies at the local level. Moreover, whilst some (Bekele, 2008; Nyssen *et al*., 2004; Zikargae, 2018) point to the growing importance of non-governmental organisations in 'managing Ethiopia's environment', their role in CRGE implementation and oversight is limited.

4.2.2 Resource mobilisation mechanisms for CRGE implementation

The CRGE's initial implementation plan outlines over 60 initiatives across all identified sectors. The plan has been further developed through the government's submission of its Intended Nationally Determined Contribution (INDC) to UNFCCC. According to the CRGE and INDC documents, the full implementation of Ethiopia's INDC will require more than USD 150 billion by 2030 (FDRE, 2011; FDRE, 2015). A CRGE Facility has been established to mobilise such funds from international, public and private sources based on two designated accounts, including the National Account managed by MOFED to which the Parliament of Ethiopia has allocated 2% of the annual federal budget, with the support of, amongst others, the Austrian and Norwegian governments and the UK's Department for International Development.

The initial emphasis of resource coordination appears to have been the mobilisation of capital from beyond Ethiopia, as highlighted in the preamble of the 2013 proclamation establishing the MEFDCC, which states that industrialised nations will help Ethiopia to decarbonise its economy. This was envisaged to include not only grants, but also loans and foreign direct investment. For example, in December 2014, Ethiopia for the first time raised a $1 billion Eurobond to finance industrial parks, the sugar industry and power transmission infrastructure. However, the emphasis in other prominent sectors, particularly agriculture, forestry and energy, has been more on domestic resource mobilisation, including community participation. For example, Ethiopia is financing the construction of the largest dam in Africa (the Grand Ethiopian Renaissance Dam) almost entirely from domestic sources.

The government has identified the development of industrial parks as one the main routes to industrialisation (Oqubay, 2015). This is broadly intended as an effort to attract domestic and foreign direct investment, thereby upgrading industries and generating employment. The plan is to build about 14 public industrial parks in different parts of the country over the period 2015-20. The Industrial Parks Development Corporation of Ethiopia (IPDC) was established in 2014 with the mandate of developing and operating a wide range of industrial parks. So far four public industrial parks (Bole Lemi, Hawassa, Kombolcha, and Mekelle) have been inaugurated, while two others (Dire Dawa and Adama) are under construction. There are also a small number of private industrial parks.

The government has also introduced two other kinds of industrial park: 'integrated agro-industrial parks' (for processing agricultural products in rural centres) and 'eco-industrial parks'. Designed with centralised and standard facilities, the eco-industrial parks aim to optimise environmental performance (through, for example, the provision of clean energy and wastewater treatment plants) and to achieve green industry targets. The government is spending significant amounts of money to build eco-industrial parks with a range of common facilities. These include recycling, waste collection, refrigerated storage and treatment services for effluent (testing, standard quality control and heat treatment), and even extend to the provision of security services, recreation areas, health facilities and post offices. The Hawassa Industrial Park (HIP), for example, has been constructed at a cost of more than US 250 million dollars.[3] However, funding from external loans and foreign investment means that at least part of the resources are external to Ethiopia's industrial regime.

The government's industrial strategy also includes the relocation of existing firms (particularly those in polluting industries such as leather tanning) to new locations with a common effluent treatment plant. There are plans, for instance, to build an industrial zone for leather factories (a 'tannery village') with a USD 42 million Common Effluent Treatment Plant (CETP) for 20 tanneries in Modjo town (71 km from Addis Ababa). The Ministry of Industry has finalised a feasibility study for the first phase of construction, but it is estimated that implementation will cost USD 58 million. The Leather Industry Development Institute has also been preparing a Clean Development Mechanism (CDM) proposal to submit to

[3] Source URL: http://www.ipdc.gov.et/index.php/en/news-and-information/202-ethiopia-industrial-parks-promoting-foreign-investment-influx-tapering-unemployment.

UNFCCC in order to obtain finance under the climate fund scheme. There have also been efforts to coordinate other types of resources, particularly by building a strong cadre of staff to advise and support CRGE implementation across government. UNDP has been a major provider of technical assistance (Paul & Weinthal, 2018).

4.2.3 Ethiopia's innovation system for green industrialisation

A robust and healthy innovation system largely depends on a number of conditions transcending technical elements and encompassing institutional, social, and organizational factors. These include regulations, values, donor funding, and market structures, to name only a few (Geels, 2002; Tigabu, *et al.* 2017). In the case of Ethiopia, the past decade has seen rapid improvements in several of these, albeit off a very low base. The macroeconomic environment has been characterised by rapid growth, averaging close to 10% per annum for over a decade (2003-2017), with some diversification from agriculture to industry, although inflation has been somewhat volatile. The economy is reasonably open to trade (as evidenced by a trade/GDP ratio of over 40%), and is attracting increasing amounts of Foreign Direct Investment (UNCTAD, 2017).

Although some forms of information and communication technology infrastructure – especially mobile phone connections – have been expanding quickly, access to the Internet and sufficient transport infrastructure remain very limited, thereby hindering innovative activities. Enrolments in education have risen rapidly, especially in tertiary institutions, though possibly at the expense of quality given the shortage of fully trained personnel and an inadequate teaching infrastructure. The tertiary enrolment ratio of 6.3% is still just over half the sub-Saharan Africa average. The share of government expenditure on research and development in GDP in Ethiopia has risen steadily, more than tripling from 0.17% in 2007 to 0.61% in 2013 (UNESCO Institute of Statistics, 2016). The number of research and development personnel more than doubled between 2005 and 2013, although many were administrative positions rather than research. Finally, although environmental legislation – which can be a spur to green innovations – has improved, the enforcement and effectiveness of regulations has been lacking (Ruffeis *et al.,* 2010).

A preliminary indication of the functionality of Ethiopia's emerging innovation system can be made on the basis of a national innovation survey carried out in 2015 by the Science and Technology Information Centre (STIC, 2015). Of the 1,200 firms from various economic sectors, 60% reported that they had undertaken innovations in the period 2012-2014. Some 20% of firms engaged in product innovation and 25% in process innovation, while marketing innovation (50%) was more common. According to the World Bank Enterprise Survey, innovation in Ethiopia lags behind that of its neighbour Kenya as well as the low-income country group (Kuriakose *et al.,* 2016). A major weakness identified by the Ethiopian Innovation Survey was the lack of mechanisms for collaboration and exchange of information among innovation actors, especially universities and government research institutes (STIC, 2015).

However, the Ethiopian government is currently attempting to strengthen the contribution of science, technology and innovation systems to economic development. In 2012, it adopted a

Science, Technology and Innovation (STI) policy. This identified eleven critical areas: technology transfer; human resources development; manufacturing and service enterprises; research, financing and incentive schemes; universities, research institutes, technical and vocational education and training institutions and industry linkages; intellectual property systems; national quality infrastructure development; science and technology information; environmental development and protection; and international cooperation. The STI policy proposes a set of strategies to deal with each of the 11 issues. For example, in the area of environmental protection, a key strategy is to 'create local capabilities to learn about, adapt and adopt green technologies' (FDRE, 2012, p. 18).

A coordinating body for national innovation has been established to facilitate implementation of the STI policy. This includes a number of other bodies. The National Science, Technology and Innovation Council, which comprises government officials, scientists and prominent individuals from the private sector, is responsible for resource allocation for technology capacity-building and for monitoring and evaluating technology adaption and utilisation, as well as making recommendations for national priorities and enabling an integrated approach across innovation system actors. The Ministry of Science and Technology (MoST) is responsible for implementing policy strategies and recommendations from the Council. Other related ministries for industry and for education, together with research institutes, universities and technical and vocational training centres, are also included. Together with national laboratories, financial support service providers, science and technology parks, the intellectual property office, manufacturing and service enterprises and the agencies of the national quality infrastructure, they make up the collection of actors in the emerging national innovation system.

While there is less emphasis on entrepreneurship – 'a key engine for innovation' (Yèhoué *et al.*, 2014) – in the STI policy than might be expected, it can be said in summary that there is an emerging innovation system within Ethiopia that could play an important role not only in supporting industrialisation and related economic growth through improving competitiveness and productivity, but also by embedding sustainability within this development strategy.

5. Discussion

The assessment of parameters for sustainable socio-technical transition suggested by Smith *et al.*'s (2005) framework presents an encouraging picture overall for greening industrialisation in the Ethiopian context. The current industrialisation agenda and environmental governance processes involve clear articulation of two selection pressures on the industrial regime – the imperatives of becoming a middle-income country and of climate change mitigation – which have been aligned within an overall strategy of carbon-neutral economic growth. However, tensions remain and the greening agenda is not yet fully integrated with wider industrial policy. It also involves coordination mechanisms for policy implementation that have been strengthened within the government to facilitate change, based on raising and managing resources that are largely external to the current industrial regime. However, while mechanisms have been set up to raise the financial capital and investments seen as required

from both within and outside Ethiopia, the amounts secured do not yet match those sought. This may curtail the capacity of the regime to adapt to the selective pressures being articulated.

Moreover, whilst avenues exist for collaboration between industrial and government stakeholders, it is not clear how active these are, particularly in terms of encouraging entrepreneurial and innovation-focused activity. Nevertheless, several 'framework conditions'[4] for the development of an effective IS in Ethiopia, appropriate to local needs, appear to be increasingly in place, particularly with regard to the growth of research capabilities focused on adaptation and learning. Examples include the strengthening of the Technical and Vocational Education System (Altenburg, 2010) and the Industrial Policy Dialogue for Mutual Learning and the Pilot Project for Productivity and Quality Improvement (*Kaizen*) (see Shimada, 2015 for an excellent review of these programmes). Indeed, this could be aligned to the green growth agenda through an innovation policy highlighting environmental development and protection as one of its eleven critical areas. It should be noted that innovation as commonly defined, and green innovation in particular, does not necessarily require a country to develop new technologies itself. Rather, green innovation involves the introduction and diffusion of new knowledge, technologies and practices (which may have been developed in other countries) in the domestic economy, possibly with particular adaptations to the local context as required.

There appears, too, to be a good degree of alignment within government and the policy sphere between the selective pressures being articulated and the attempts to coordinate resources to address them. However, whilst the CRGE encompasses the concepts of both 'climate resilience' and 'green economy', its contents essentially equate these with a mitigation-focused carbon-neutral pathway. In other words, though the CRGE has explicitly embraced the concept of the green economy for the first time, its analysis and plans refer predominantly to attempting to decouple economic growth from greenhouse gas emissions as the basis for achieving development objectives, reflecting the recent global low-carbon development discourse.

Yet the CRGE also shows that large-scale industrialisation will not occur without significant growth in GHG emissions in the manufacturing sector, even with abatement measures in place. Some of this disconnect can be attributed to the fact that GTP-I predates the CRGE. GTP-II, which followed on from GTP-I, partly corrects this by calling for deeper integration of the CRGE into sectoral policies and plans. For example, the continued investment in renewable energy-based electricity in Ethiopia is part of this story of avoiding future emissions in GHG emissions across the country's economy, especially the growth sectors such as manufacturing and agriculture. The flagship Hawassa Industrial Park (HIP) of the Ethiopian Industrial Parks Development Corporation (IPDC) will eventually be supplied directly to the Park via a dedicated 200-megawatt (MW) substation, and at present the

[4] Framework conditions refer to factors beyond the innovation system, such as the macroeconomic environment, infrastructure, enrolment in the basic education system, expenditure on research and development, number of R&D personnel, and relevant laws and regulations, that impact on its performance in harnessing commercial value from knowledge and its creation (Remoe *et al.*, 2015).

electricity in Ethiopia has the lowest emissions factor in Africa. On the demand side, the HIP makes extensive use of light-emitting diode (LED) technology that achieves significant energy savings over traditional technologies. Of course, the extent of integration and decoupling remains to be seen since the 'greening' effort will need to be system-wide, consisting of interventions at different points in the supply chain, as well as raising levels of awareness of the workforce.

There is, in any case, a need to move the emphasis away from carbon mitigation and look at the other negative socio-ecological impacts with which industrialisation is often associated, including water, soil and air pollution. This will help to connect the transition project with the need for poverty alleviation and social justice more boldly (Okereke & Agupusi, 2015; Dawn *et al.*, 2016). Whilst the current framing of the green industrialisation agenda in Ethiopia is relatively narrow, some of the discussions regarding the development of eco-industrial parks indicate an awareness amongst relevant governance actors of the need to address broader environmental issues potentially associated with industrialisation. A wider conceptualisation of 'green' that encompasses environmental protection as well as development might help to promote 'home-grown' solutions (Okereke & Agupusi, 2015) and represent a realignment that serves to further spur sustainability-related innovation and ensure long-term durability of the transition project (Dawn *et al*., 2016; Swilling *et al*. 2016). This could contribute to associated social, economic and environmental pillars, but may also raise questions about the impact on competitiveness, which may in turn serve to dilute efforts. It also remains unclear whether the long-term implementation of any form of green agenda, even if focused largely on greenhouse gas emissions, will negatively impact the industrialisation agenda and associated attempts at sustained economic growth.

This initial examination of the CRGE has revealed that, while the level of ambition is high, systemic interactions and linkages with the wider industrial policy encapsulated in GTP-I has been a challenge. Although attempts were made to link the CRGE strategy and GTP-I in some sectors, notably agriculture and energy, there was little integration of the strategy in the industrial sector, mainly due to a lack of institutional and human capacity (Wakeford *et al*., 2017). However, with the emergence of GTP-II and the development of eco-industrial parks, designed to ensure future industrial expansion is cleaner and greener, some of these issues are being overcome.

The recent announcement of opening the key economic sectors in telecoms, aviation, energy, and logistics for private foreign participation has signaled a new phase in Ethiopia's economic transformation. At present, an advisory council has been assembled to evaluate privatization of large state-owned enterprises. Evoking the experience of East Asian countries, UNCTAD (2009, p. iv) had made the statement that 'what is required now is a developmental State that is adapted to the challenges facing an interdependent world in the twenty-first century. This State should seek to harness local, bottom-up problem-solving energies through stakeholder involvement and citizen participation that creates and renews the micro-foundations of democratic practice.' It is clear that Ethiopia will be aiming to widen its investor portfolio, and if the country maintains its deep commitment to climate and resource conservation doctrine, investors with high corporate responsibility ethos may be

attracted to invest in Ethiopia. This could have a knock-on effect on the environmental performance of local companies in Ethiopia, and also for the country to develop tighter regulations and policies that are in line with environmental stewardship.

The past few months have seen major political changes in Ethiopia that could shape Ethiopia's green pathway in the coming years. It is worth recalling that the leadership of the late Prime Minister of Ethiopia, Meles Zenawi, was central to the country's venture into industrial and economy wide greening. He offered a tight combination of idea-based, results oriented and directional leadership to the industrialization mission of Ethiopia. Moreover, he was instrumental in providing the intellectual framing and championing the elaboration of an ambitious CRGE strategy in 2011, and laying down the sectoral implementation plan. Following Mr Zenawi's death in August 2012, his successor, Prime Minister Hailemariam Desalegn and his government maintained the climate vision and worked hard to mainstream the CRGE in the policies of line ministries. But the political challenges that Ethiopia faced since 2015 has created unstable conditions for effective policy implementation. It is not clear, or perhaps it's too early to gauge the degree of commitment for green growth by the current government of Prime Minister Abiy Ahmed.

6. Conclusion

This paper has analysed how the articulation of selection pressures and the coordination of adaptive capacity are evolving in the context of a bold industrial transformation plan articulated in the Climate Resilient Green Economy (CRGE) and the Growth and Transformation Plans (GTP-I and GTP-II) in Ethiopia. There is no doubt so far that 'Ethiopia has used industrial policy to both exploit and create (dynamic) comparative advantages in the priority sectors defined in its industrial strategy (Abebe & Schaefer, 2015, p. 155). It remains to be seen whether the articulation of selection pressures represented in the CRGE and GTP, and concomitant attempts at coordinating resources to adapt or transform the industrial regime, can deliver a 'sustainability transition'.

The Ethiopian government is breaking new ground in a context that is very different from that of late industrialisers in Asia, because the global structure of production and related political economy has shifted dramatically in the past 20 years (Morris *et al.,* 2012). The vision cascaded by the country's senior policy makers with relentless optimism is one of a radical approach to economic transformation, balancing growth imperatives with environmental sustainability concerns. Harnessing the country's considerable renewable resources and safeguarding ecological systems are seen as complementary interventions for building resilience and stimulating economic development. However, as the industrial base and activities expand, the challenges of increasing labour and environmental standards, and growing the local innovation and technical capability, will become more acute (Abebe & Schaefer, 2015).

This assessment also suggests that the main potential area of weakness may lie in the coordinating mechanisms which bring different stakeholders' interests, knowledge and perspectives together to allow planning and oversight of policy implementation. Evidence from elsewhere suggests that facilitating transparent, accountable and meaningful discussions

between government and industry (and possibly civil society actors, too) is vital to ensure policies take account of ongoing realities and impacts in terms of both greening and industrialisation agendas for organisations of all sizes (Stead & Meijers, 2009). Lastly, the nascent sectoral innovation systems in Ethiopia's key industrial sectors, such as cement, leather and textiles, are not yet sufficiently supportive specifically of green innovations, partly because the greening agenda has not become mainstream within national innovation policy (Wakeford *et al.,* 2017). Weak innovation systems and severely constrained human and financial capacity remain key concerns for low-income countries where industrialisation is nascent. The risk is not only of failure to green industry, but of failure to sustain any industrialisation at all.

Whilst it is clear that this experience reflects the specifics of the Ethiopian context and its historical trajectory, nonetheless there may be lessons for sub-Saharan Africa in terms of methods and process. The Ethiopian initiative represents a highly novel approach to the challenges of sustainable development, led by one of the world's poorest nations, and the outcomes are potentially very exciting.

7. References

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