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Boodoo, Zyaad

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DONOR SUPPORT FOR SUSTAINABILITY TRANSITION

The case of low-carbon development in the cement sector of Tunisia

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Zyaad Boodoo

Author Zyaad Boodoo

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Supervisors Karen Holm Olsen (principal supervisor)
Senior Researcher
UNEP DTU Partnership (UDP)

Ulrich Elmer Hansen (co-supervisor)
Senior Researcher
UNEP DTU Partnership (UDP)

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Abstract

The overwhelming evidence and scientific consensus on the impacts of human-induced climate change have prompted enhanced mitigation responses over time, led by developed countries representing the biggest emitters historically. More recently, rapid economic growth in developing countries has led to soaring emissions of greenhouse gases. As a result, measures to promote a shift to low-carbon and sustainable futures in all countries of the world are now vital elements of global goals for the climate and sustainable development as established in two historical agreements in 2015, the Paris Agreement on climate change and the 2030 Agenda on sustainable development. To address the global challenge of sustainability transition, developed nations have confirmed in the Paris Agreement 2015 at the 21st Conference of Parties to the United Nations Framework Convention on Climate Change to jointly mobilise USD 100 billion per year by 2020 for climate change action supporting developing-country counterparts. As part of this pledge, bilateral development cooperation agencies and multilateral financial institutions have been identified as key channels through which funding will be delivered. In turn, this indicates that the international community envisages donors playing an important role in supporting developing countries in their attempts to shift towards more sustainable futures.

Against this background, the key aim of this PhD thesis is to contribute to the emerging literature on the role of donors in promoting sustainable transitions by investigating how transition concepts and donor practices influence low-carbon transitions in the developing world. This overall research topic is addressed in two ways throughout this thesis: 1) through a theoretical review of the management approaches that are prevalent within the donor community, and 2) by applying case-study methodologies to examine the impacts of donor interventions on low-carbon transitions in the case of the Tunisian cement sector. The theoretical and conceptual basis of the three articles comprising this thesis are drawn from the "Transition Management" literature to understand how transitions to low-carbon development can be governed and from the “Multi-Level Perspective” to understand the factors that influence the development of niches within the Tunisian cement sector. Analyses are based upon qualitative data collected mainly from semi-structured interviews, direct participation and observations conducted during consecutive periods of fieldwork in Tunisia in 2014-2015.

This thesis finds that donors contribute towards stimulating low-carbon transitions in the developing world by addressing issues that limit the development of low-carbon measures in recipient countries, such as a lack of local expertise, coordinated action, and available funding. Donors address these constraints by engaging in niche development processes and encouraging regime-level changes through support for political and regulatory reforms or, more broadly, via donor funding modalities, which provide a basis for rational thinking and project structuring. In addition, this research finds evidence that current donor modalities suffer from a lack of attention to sustainability transition features of path dependency and lock-in. In particular, factors that constrain donor attempts towards sustaining low-carbon transitions in the developing world are: the lack of key change agents, the absence of formal decision-making legitimacy by donors within the formulation of transition initiatives, the short-term nature of development aid, a lack of coordination amongst donor agencies, the limited attention given to addressing local political processes, a lack of reflexivity, and assumptions regarding foresight and control in donor interventions.

Given that the Parties to the Paris Agreement are now moving towards an implementation phase of increasingly ambitious climate policies and actions set out in Nationally Determined Contributions, the results of this thesis provide useful lessons that could be used to enhance donor impacts by avoiding the pitfalls highlighted.

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PART 1: SYNOPSIS

1.0 Introduction and rationale

1.1 Background

Studies of the global impacts of human development indicate that the safe space for developing sustainable futures is becoming tighter (Steffen et al. 2015; Rockström et al. 2009; Hoekstra & Wiedmann 2014). Of the factors that account for this situation, the interactions of the climate system play a major role. Given the magnitude of human-induced climate change, efforts by all major emitters are now required to prevent catastrophic consequences (IPCC 2014). While the historical opposition between developing and developed countries has often undermined climate action by individual nations, improving scientific evidence of the scale of the climate change mitigation actions required has provided the basis for moving away from this dichotomy. Unprecedented efforts by all are now widely recognised as essential features of an efficient global climate and sustainable development agenda, with negotiations among the parties to the United Nations Framework Convention on Climate Change (UNFCCC) and the 2030 Agenda for the global Sustainable Development Goals (SDGs) culminating in two historical agreements in 2015. The Paris Agreement to the UNFCCC was ratified already one year later and the 'rulebook' to implement the agreement is expected to be finalized by end of 2018.

In view of the growing contribution of developing nations to global emissions (Elzen et al. 2013; Arndt & Tarp 2017), how such countries can transition to low-carbon futures is a major new challenge. Development assistance programs aim to play a key role in such efforts. Pertinent literature analysing the focus and approach adopted in aid interventions across developing countries indicates an evolution in emphasis, from technologies to market-oriented approaches, whereby donors aim to remove financial, technical and regulatory barriers to environmental technologies (Tigabu et al. 2017). Across the academic literature, a number of scholars studying socio-technical transitions[1] have started looking at developing countries' efforts to nurture transitions, and some of them have examined the role of donors.

However, attempts to explore (a) how the sustainability transitions literature can inform donor approaches to planned interventions for low-carbon transitions[2] and vice-versa, (b) how the literature captures the specific challenges of donors in promoting sustainability transitions in developing countries are rare. The principal aim of this PhD thesis is thus to investigate these gaps in greater depth.

[1] "Socio-technical transitions", "sustainability transitions", "transitions" and their derivatives are used interchangeably in this thesis, as defined in (Markard et al. 2012).

[2] In this study, "low-carbon transitions" or "low-carbon development" are to be understood as referring to a sustainability transition which takes into account reductions in greenhouse gas emissions as part of a broader set of sustainable development dimensions.

1.2 Positioning of the thesis in the literature

1.2.1 Sustainability transition theories

Societal needs, such as energy, food, water and mobility, are fulfilled through a complex interplay of social and technical elements interacting and dependent on each other. However, addressing various societal needs over time has raised a number of persistent global sustainability challenges, such as scarcity of natural resources and climate change[3]. The scale of such challenges has now reached a stage whereby fundamental changes are required to avoid dangerous consequences. Being inherently systemic, complex, as well as spanning over extended geographies and time intervals, global societal challenges cannot be addressed merely through short-term, silver bullet solutions such as technologies, market or conventional policies. Means to understand, and eventually promote processes of fundamental change in the basic systems providing societal needs, i.e. transitions to sustainable development, are thus required.

This thesis seeks to understand the role of development aid in supporting developing countries towards transitioning to low-carbon futures in line with the Paris Agreement's global temperature goal of 1.5°-2°C for limiting global warming. Inspired by an extensive literature on socio-technical change (Sovacool & Hess 2017)[4], the thesis focuses on transition theories in view of their emphasis on far-reaching transformational processes of sociotechnical systems (Markard et al. 2012). Emerging in the late 1990s and early 2000s, "sustainability transitions" is a rapidly growing area of research which explicitly incorporates the socio-technical, socio-institutional and socio-ecological aspects of transitions to sustainable development. Defining sustainability transitions as "*long-term, multi-dimensional, and fundamental transformation processes through which established socio-technical systems shift to more sustainable modes of production and consumption*" (Markard et al. 2012, p. 956), this scholarship is based on a number of key common ideas on the nature of transitions, which are unpacked in the following section.

Common concepts across transitions research

Chang et al. (2017), Markard et al. (2012), Loorbach et al. (2017) and Grin et al. (2010) identify the following common features within the main schools of thought in sustainability transitions: (1) transitions are inherently non-linear, long-term and multi-dimensional, (2) transitions require interactions amongst multiple actors, across different levels[5] and spread over different phases; (3) technological innovations interact with social and institutional changes in a co-evolutionary manner, leading to the emergence of new products, services, business models and organisations which partly complement and substitute existing ones when these factors align; (4) transitions result from radical change in incremental steps,

[3] Climate change is recognised as being a "wicked" or "persistent" problem (Levin et al. 2012, Grundmann 2016), the causes of which are typically interconnected, complex and global in nature, and deeply embedded within societal fabric.

[4] Sovacool & Hess (2017) identify at least 96 theories and conceptual approaches spread over 22 disciplines with such a focus.

[5] Although the main strands of transition research acknowledge the multi-level nature of transitions, some scholars have conceptualised transitions on flat ontologies. 'Arenas of Development' (Jørgensen 2012), which explore transitions through the performance of actors in stabilizing or changing relations and 'Practice Theory' (Shove & Walker 2010), which correspondingly focuses on the dynamics of social practices, illustrate alternative ways to conceptualise transitions.

which are not easily predictable due to the complexity of societal processes at play; and (5) processes of experimentation and societal learning play a key role in nurturing transitions. By utilising transition theories to study the role of development aid in promoting low-carbon transitions in developing countries, this thesis thus implicitly understand those characteristics as key assumptions on the nature of and requirements for transitions to unravel.

At the core of transition research is the concept of socio-technical regimes. Coined by Rip & Kemp (1998), regimes are generally understood as sources of stability, though different scholars have slightly different conceptualisations of regimes. For example, Geels (2002) understand regimes as relatively stable configurations of institutional structures, techniques and artefacts, as well as rules, practices and actor networks, while Grin et al. (2010) define regimes in terms of constellations of institutionalised cultures, structures and practices. Interacting with each other, these elements constitute inertia around certain socio-technical configurations - or constellations, as per the metaphor utilised by Grin et al. (2010) - and over time, produce the dominant means through which societal functions are fulfilled. Due to various stabilising mechanisms, such as sunk investments, benefits of scale, and processes of optimisation and incremental innovation, regimes are characterised by resistance to change, structural lock-in and path dependency (Loorbach et al. 2017). Regimes, therefore, impose a direction for incremental change towards specific pathways of development, while hindering alternative and more sustainable technologies, referred to as niches, from emerging and breaking through to create a transition (Unruh, 2000). In theoretical terms, this thesis thus focuses on how development aid can assist developing nations in overcoming carbon lock-in[6] within regimes.

1.2.2 Schools of thought in transitions research

The common features of transitions (identified in Section 1.2.1) are used by transition scholars from various backgrounds to understand and analyse transition dynamics, as well as the role of agency in strategically managing those transitions. Given the breadth of subjects, disciplines and research areas adopted by researchers, academic debates on what transitions comprise of, as well as how they can be understood, have grown rapidly within this area of research. In view of the rapid expansion of this field of study, typologies to map out its intellectual contours and identify its different schools of thought evolve with new empirical insights obtained and cross-fertilisations with other theoretical frameworks. Nonetheless, previous reviews of transitions research reveal that the literature can be classified in a number of ways, which includes (non-exhaustive) classifications across (1) analytical frameworks used (Chang et al. 2017; Markard et al. 2012), (2) ontological perspectives underlying those frameworks (Geels 2010), (3) approaches adopted (Loorbach et al. 2017), (4) research focussing on transition dynamics and/or transition governance (van Raak 2016; Grin et al. 2010), and (5) geographies (Hansen & Coenen 2015; Wieczoreck 2017).

The most common means to identify what comprises transition research is through the range of analytical frameworks utilised. These comprise of the Multi-Level Perspective (MLP), Strategic Niche Management (SNM), and Transition Management (TM) (Wieczoreck

[6] Carbon lock-in is understood as closed cycles of interdependent systemic problems (Wesseling & Van der Wooren 2017) that lead to a carbon intensive development pathway.

2017), with Chang et al. (2017) also including the Multi-Phase Concept[7] and Markard et al. (2012) expanding the range of transition frameworks to Technology Innovation Systems (TIS)[8], Arenas of Development and Practice Theory. To explore how the literature can inform donor approaches to planned interventions for low-carbon transitions, this thesis makes use of two of those frameworks, namely TM and the MLP.

Across the first paper comprising this thesis (see section 4.1), TM is utilised as an idealised model for planning and managing transitions. This approach enabled an empirically-based conceptual comparison to be conducted with mainstream planning and management approaches that prevail across the donor community, namely the so-called "Logical Framework Approach" (LFA). To illustrate the practices adopted by donors, the paper analyses the approach adopted by the Green Climate Fund and the NAMA Facility, two of the major institutions in developing-country climate financing, in operationalising the concept of transformational change through Nationally Appropriate Mitigation Actions (NAMA) interventions[9]. Through this comparison, the paper addresses the research questions of whether the designs of planned interventions by donors foster transformations and how such approaches can be improved. Although SNM also postulates theoretical prescriptions for transition governance, TM was adopted as a more appropriate theoretical framework for this paper on the basis that it is (a) the only branch of transition theories that is explicitly both prescriptive and normative – which espouses the underlying basis of the LFA as utilised by donors, and (b) a framework that enables comparisons with other planning methodologies.

While TM was useful in the first paper to unravel the differences between donor approaches and the dynamic strategies to govern transitions proposed by TM, the MLP was considered suitable as a heuristic framework in a second paper (see section 4.2). The niche-regime-landscape categorisations of the MLP enabled data collected to be organised, structured and delineated to analyse a case study of the sustainability of cement production in Tunisia. These concepts, as well as the MLP's focus on niche-regime-landscape dynamics, enabled the construction of a retrospective narrative account of the sequence and unfolding of the key events, processes and impacts over time that influence the development and diffusion of small-scale externally supported low-carbon measures - conceptualised as niches - with the potential to significantly improve the sustainability of cement production in Tunisia between 1990 and 2015.

Insights from both frameworks were useful within a third paper (see section 4.3) to analyse the means and extent to which a donor-supported cement-sector NAMA intervention, developed in Tunisia between 2012 and 2013, promotes transformational change to low-carbon development. This methodological choice raises the issue of whether theoretical insights from the MLP and TM can be used together or not, given that despite TM and the MLP share the same theoretical foundations (see section 1.2.1 and Wieczoreck

[7] While the Multi-Phase Concept (MPC) does not provide explanations of why transitions happen, it is essentially a framework that describes an ideal transition process (Rotmans et al. 2001). The MPC depicts transitions through an S-shaped curve, and posits that transitions unravel across four different phases – pre-development, take-off, breakthrough and stabilisation phase.

[8] TIS analyse technological change by focusing on the structure and function of innovation systems (Hekkert et al. 2007)

[9] In essence, NAMAs are mitigation mechanisms under the UNFCCC to encourage up-scaled climate change mitigation initiatives by developing countries. Defined by host countries, NAMAs typically consist of a mix of policies and measures. Recently, donors have labelled NAMAs as vehicles aiming at achieving structural changes in the direction of sustainability.

2017), they, however, build on different ontological perspectives and belong to different schools of thought within transition research. Indeed, based on an analysis of the scientific, epistemological and normative approach adopted by transition researchers, Loorbach et al. (2017) positions MLP studies as adopting a "socio-technical" approach, which contrasts with TM studies that adopt a more "socio-institutional" approach.

Based on Loorbach et al. (2017)'s delineation of the different schools of thought in transition research, this thesis sits at the intersection of the "socio-technical" and "socio-institutional" approaches. However, given that the MLP and TM are based on different ontologies, it could be argued that combining insights from both frameworks raises issues of incommensurability. For example, Geels (2010) opines that the MLP can make cross-overs with structuralism but not with functionalism, which both form part of the ontological basis of TM. Thus, although Geels (2010) does not explicitly claim that both frameworks are incompatible, he implies that part of the ontological basis of TM cannot be combined with the MLP. However, it is not yet clear within the literature whether transition frameworks can be combined or not (Chang et al. 2017). For example, some scholars have bridged theoretical divides by engaging in integration between (a) TIS and the MLP (Markard & Truffer 2008), and (b) SNM, which has a strong MLP basis, with TM (Raven et al. 2010). Theoretical cross-overs are thus possible, but within such attempts, there is a need to be reflexive on theoretical traditions and underlying assumptions. Along those calls for reflexivity, this thesis neither claims to combine TM and the MLP into a "grand theory" (van Raak, 2016) nor argues for resolving the ontological differences between the two frameworks. Instead, the analytical notions within both frameworks are pragmatically used for the purpose of answering research questions posed. Notwithstanding their epistemological and ontological differences, how the specific possibilities offered by TM and the MLP have enabled this thesis to study the role of development aid in promoting low-carbon transitions in developing countries are discussed in the following sections.

Utilising MLP's heuristic and analytical possibilities with TM's prescriptive possibilities

The heuristic and analytical properties of the MLP were well-suited to analyse the key factors influencing donor-supported low-carbon initiatives in the cement sector of Tunisia. In so doing, this approach allows the identification of the main features accounting for carbon lock-in. However, given that the third paper of this thesis focussed on a recently devised planned donor-intervention (2012-2013) which had not reached implementation stage, data was insufficient to conduct a historical MLP assessment of its transformative influence. To enable an analysis of the donor's design for transformational change, a theoretical framework that could offer prescriptive possibilities was required. SNM, which focuses on mechanisms underlying niche development (Schot and Geels, 2008), was found not to be entirely suited to answering the research questions due to the very limited level of development of niches observed in the empirical case study. However, a TM perspective, which does not only offer analytical possibilities to understand regime dynamics, but also has a normative orientation towards sustainability, was appropriate to complement the analytical possibilities of the MLP. Furthermore, the TM framework was also found useful as it comes close to how donor projects are actually implemented, containing similar features to TM concepts such as transition arenas, transition experiments and transition agendas towards sustainability. The expanded possibilities so derived, as well as conceptual similarities between TM and donors' design of planned interventions, enabled the use of concepts from both the MLP and TM to address the questions raised within this thesis. In

summary, the MLP was used to delineate the specific features across the Tunisian cement sector which cause regime resistance, while TM was utilised as an idealised model to assess the extent to which the cement NAMA addresses key stabilising features of regimes identified via the MLP.

Operationalising and utilising analytical concepts across the MLP and TM

On one hand, the MLP delineates between three concepts - landscapes, regimes and niches, which refer to macro-, meso- and micro-levels of analysis respectively, as well as focuses on their interactions. These functional levels and attributes of the MLP were useful in operationalising and analysing donor interventions within the case study analysed. Indeed, within the empirical part of this research, an energy and carbon intensive cement sector in Tunisia is conceptualised as a regime which (a) contributes to global societal challenges posed by climate change, (b) utilises fossil fuel resources, and (c) addresses a societal need for housing. Given that conventional MLP research typically addresses sectoral case studies, conceptualising the Tunisian Cement Sector as a regime proved rather unproblematic. Similarly, low-carbon measures implemented across the Tunisian cement sector were conceptualised as niches, while donor interventions, which bring a flow of ideas and finances external to the local context, were conceptualised as a landscape factor. This approach enabled the thesis to understand the factors that have influenced donors' efforts to promote low-carbon niches and destabilise carbon-locked regimes over time within a developing country context.

On the other hand, TM focuses on four analytical layers; strategic, tactical and operational governance activity levels, which are cyclically linked on a time dimension across reflexive governance activities (Loorbach 2010). TM suggests that transitions can be partly steered over the long-term through a transition arena – a concept that encapsulates both a methodology for transition governance and an institutional arrangement, the activities of which cut across those governance levels. Inspired by the characteristics of and activities conducted by a transition arena across the four TM activity levels - such as problem structuring, coalition building, actor mobilisation, formulation of transition images, agendas and scenarios, and monitoring of activities (Frantzeskaki et al. 2012; Loorbach 2010), analytical concepts were derived to study a donor-supported Tunisian cement NAMA intervention. This approach enabled an analysis of the extent to which the donor intervention aligns with or deviates from TM's prescriptions for transition governance.

The strategic, tactical and operational governance activity levels within TM address macro, meso and micro levels of analysis, which correspond to landscape, regime and niche levels across the MLP. Utilising these analytical concepts together enabled this thesis to assess how the donor intervention (operating at the macro level) addresses niches and regimes at the micro and meso levels through the activities of a transition arena. However, some theoretical assumptions were necessary to that end, which are discussed in the following paragraphs.

Temporal, multi-level and regime delineation considerations

Firstly, one issue that is raised when utilising analytical concepts from both TM and the MLP is their presumed different ways towards internalising temporal aspects. For example, reflecting on the MLP, scholars such as (de Haan & Rotmans, 2011; van Raak 2016) have criticized its framework as being quasi-static, and taking a series of snap-shots of transition dynamics, instead of fully recognising the inherently non-linear dynamics of transformative

change. Indeed, diagrammatic representations of the MLP framework do not specify a time dimension. Nevertheless, the MLP's analytical possibilities cater for transition dynamics, i.e. how transitions unfold over time, through narratives depicting causality chains of niche-regime-landscape interactions. Hence, the MLP does cater for a time dimension, though it is not explicitly depicted within conventional representations of the MLP framework. On the other hand, TM internalises the continuous character of non-linear dynamics of transformative change (stemming from complex systems theory) within a more dynamic governance framework. TM thus conceptualise transition dynamics as occurring in-between niches, regimes and landscape factors. Despite this conceptualisation of constantly evolving transition dynamics, three analytical layers are delineated within the TM framework; the macro, meso and micro levels, with the regimes being located at the meso-level. This seemingly inconsistent conceptualisation is recognised by Grin et al. 2010, who chose, in the absence of an alternative, to opt for utilising the multi-level concept for transition analysis. This thesis aligns with Grin et al. (2010)'s argument to that end.

Secondly, while the MLP focusses on socio-technical systems such as mobility, energy or agriculture, TM expands the unit of analysis and the bottom-up niche bias across the MLP (Geels 2011) to wider societal systems, such as regions, functional models, cities, etc. Hence, whereas the analytical focus on socio-technical configurations around the production of cement placed within this thesis aligns with conventional MLP research, a TM perspective would suggest addressing the sustainability of the whole supply chain of cement, including transport to local (or foreign) clients and modes of utilisation for example. To be able to analyse how donor-induced planned interventions for low-carbon development promotes the transformation of the cement sector in Tunisia through both MLP and TM lenses, the thesis conceptualises the cement production in Tunisia as a societal sub-system, contributing to greenhouse gas emissions across the cement production and use supply chain while ultimately fulfilling housing needs. Based on this assumption, the cultures, structures and practices-based definition of regimes within TM are scoped down to those constellations around cement production only, thus enabling a similar conceptualisation of regimes as that of the MLP.

Following this discussion on the different schools of thought within transition theory, the next sections positions the thesis across a research area that focus on transitions in developing countries, and more specifically, within a nascent literature analysing the role of development aid in transitions.

1.2.3 Transitions in developing countries

Within theories of sustainable transitions, there is a burgeoning literature concentrating on transitions to sustainable development in developing countries (Hansen & Coenen 2015). Indeed, Wieczorek (2017) identify at least 115 papers published between 2005 and 2016 on this topic. Early publications in around 2007-2009 (Genus & Nor 2007; van Eijck & Romijn 2008; van Alphen et al. 2008) underlined the usefulness of applying transition theories to developing-country settings and paved the way for other authors to pursue further research in such contexts. Motivated by the growing environmental impacts of rapidly developing countries across the Asian continent, the first wave of transition papers was stimulated especially by two special issues of the journals *Technological Forecasting & Social Change* (TFSC) in 2009 (e.g. Berkhout et al. 2009, Angel & Rock 2009, and Bai et al. 2009) and *Environmental Science & Policy* (ESP) in 2010 (e.g. see Patankar et al. 2010, Lebel et al. 2010, and Romijn et al. 2010)). A second generation of papers followed, putting the

emphasis on African case studies (Slingerland 2014; Eder et al. 2015; Amars et al. 2016; Tigabu et al. 2017), particularly in Kenya (Oyake-Ombis et al. 2015; Ulsrud et al. 2015; Kamp & Vanheule 2015) and South Africa (Lawhon 2012; Baker et al. 2014; Swilling et al. 2016). It is also interesting to note that the geographical scope of the literature on sociotechnical transitions now includes case studies from Latin America (Drinkwaard et al. 2010; Fry 2013), Central America (Lachman 2014) and the South Pacific (Poustie et al. 2016).

Developing-country contexts provide a different set of challenges to those which characterised the birthplace of transition theories typified by well-ordered, western democracies. For instance, (Wieczorek 2017; Ramos-Mejía et al. 2017; Klerkx et al. 2018) identify the following factors as key features characterising developing country settings[10]; (i) low financial, technological and absorptive capacities, (ii) competing developmental and political interests and their associated high levels of disagreement, (iii) patron-client relationships, (iv) low levels of physical and institutional infrastructure, (v) unevenness in regulations and compliance, (vi) the co-existence of informal institutions with formal ones, (vii) social and economic inequalities, (viii) the capture of development agendas by elitist groups, (ix) market imperfection, and (x) weak state apparatus, among others. Given those significant differences with developed counterparts, empirical settings in developing countries thus provide different conditions for transitions to unfold.

The particular characteristics of developing countries have been pushing researchers to expand the theoretical scope of transition theories by exploring different avenues to capture better the realities of such empirical contexts. This translates into attempts to use, extend and adapt different theoretical frameworks: from early use of the MLP and SNM, as in the special issues of TFSC and ESP, to more recent papers focusing on TIS (Schmidt & Dabur 2014; Gosens et al. 2015; Tigabu et al. 2017) and TM (Lawhon 2012; Poustie et al. 2016; Marquardt et al. 2016), and using transitions thinking for analysis rather than adopting any particular key framework (Ulsrud et al. 2015; Eder et al. 2015).

Such empirical explorations have enabled scholars to come up with valuable contributions to the transitions literature that are particularly relevant to the developing world, such as the influence of development banks and donors (van Alphen et al. 2008; Bai et al. 2010; Meijerink & Huitema 2010; Schmidt & Dabur 2014; Hansen & Nygaard 2014; Baker et al. 2014; Nastar 2014) and the impacts of globalisation (Rock et al. 2009). Moreover, the particular contexts of developing nations have also enriched the literature by providing nuanced understandings of other factors such as the importance of transnational perspectives (Hansen & Nygaard 2013; Gosens et al. 2015; Wieczorek et al. 2015), the impact of landscape pressures and structural conditions (Genus & Nor 2007; Nastar 2014; Slingerland 2014; Rock et al. 2009) and non-monolithic conceptualisations of regimes (Berkhout et al. 2010), among others.

Two recent theoretical reviews by Wieczorek (2017) and Ramos-Mejía et al. (2017), as well as the editorial of one special issue of Environmental Science and Policy Journal (Klerkx et al. 2018), synthesize the key lessons learnt when applying transition concepts to the developing world. These insights have been summarised in the following paragraphs in terms of (a) difficulties to mechanically translate and delineate regimes within developing country contexts, (b) regime boundaries being not confined to a particular country, (c) differing dynamics of niche structuration, protection processes and promotion strategies, and (d) the need for alternative network promotion strategies.

[10] while recognising that these factors do not occur homogenously across all developing countries.

Empirical challenges to the translation and rethinking of transition concepts

In the face of inefficiencies in state interventions, political and economic instability, as well as social inequality, regimes in developing states are less stable than in developed nations. Within such contexts, Wieczorek (2017) argues that it is not yet clear what regime dimensions create resistance to niche development and what needs to be destabilised. Indeed, studies by (Verbong et al. 2010; Herslung et al. 2017; van Welie & Romijn 2018) suggest that, in contrast with the transitions literature, regime instability can act as a barrier for niche development. On a related note, (Wieczorek 2017; Nygaard and Bolwig 2018) further point out that some degree of regime stability is required for niche development.

Furthermore, ill-functioning institutions and markets, as well as clientelist relationships amongst different actors in developing country contexts enhance competition for resources. The survival strategies of local actors, i.e. the struggle for provision of basic services, often lead to the co-existence of informal institutions along with formal ones, whereby informal institutions provide for some of the basic services not delivered efficiently through formal ones. These features of developing countries result in multiple, unregulated, dysfunctional and politically manipulated regimes, which differ significantly from Western-influenced conceptualisations of regimes, characterised by formal rules and stability. As a result, regimes within developing country contexts can be described as in a state of flux (Klerkx et al 2018), reflecting the more pronounced complexity of social relationships amongst developed country actors. Consequently, it is thus more challenging to delineate regimes in developing nation contexts[11], with Wieczorek (2017) even arguing for treating transition concepts as empirical questions instead of theoretical assumptions.

Regime boundaries

Generalised lack of resources, capacity and conducive policy frameworks restrict the ability of developing nations to support innovations. However, foreign investors, multinationals and donor interventions provide developing countries with non-domestic sources of innovation and capacity formation. These international actors create a number of cross-border relationships and interactions, which are described as "transnational linkages" within the transitions literature (Hansen & Nygaard 2013, Wieczorek 2015). Such transnational linkages expand the scope of regimes from local to global scales. Hence, developing country contexts amplify the transnational nature of regimes, which contrast with developed country counterparts, where sources of innovation are mostly domestic. Regimes, therefore, do not need to be limited to national boundaries, as is commonly analysed within MLP-related transition research.

Different dynamics of niche structuration, protection and promotion and governance implications

As theorised by Ramos-Mejía et al. (2017), niche structuration processes within developing countries are dependent on the level of institutional set-up and the survival strategies of different local actors. In the face of ill-functioning markets and institutions, clientelist community organisations and patriarchal households, niche dynamics will play out differently. For example, studies undertaken by (Verbong et al. 2010; Wieczorek et al. 2015;

[11] To attend to these challenges, (Ulsrud et al 2011; Sengers & Raven 2014) define regimes within developing country contexts through the eyes of analysed actors.

Kamp & Vanheule 2015) in India and Kenya point out that the niches analysed have remained fragmented and confined to the level of single experiments, resulting in their emergence in a highly disconnected manner. While such niche dynamics could result from donor interventions' short-term nature and limitations in funding (Klerkx et al. 2017), it could also be attributed to the inefficiency of government strategies towards ensuring the long-term sustainability of niche experiments beyond a project intervention. This latter argument is supported by Ramos-Mejía et al. (2017), who argue that long term transition planning and governance is more difficult in developing country contexts due to a tendency to prioritise security in the present, avoid risks and uncertainty management strategies. Hence, transition governance attempts in such empirical settings may be more complex than currently theorised, requiring careful design and micro-management of sustainability experiments and calling for alternative models for innovation projects such as through carbon financing.

Alternative network promotion processes

Within developing country contexts, communities are often exclusive and shaped by patron-client relationships. These elements can impede niche development by negatively influencing the way networks are developed around transition experiments. Using the example of Sengers and Raven (2014), Ramos-Mejía et al. (2017) argues that sustainability transition experiments reproduce the clientelistic or reciprocal behaviours of a regime instead of challenging them and suggest focusing on means to integrate equality and inclusion considerations within the literature. This lack of reflexivity suggests that it is important to analyse how networks function across developing countries, instead of focussing only on whether new networks are set up. Hence it is important that theories pertaining to transition governance internalise those differing dynamics.

In summary, undertaking transition research in developing-country settings has shown its usefulness in enriching existing theoretical concepts through exposure within new empirical settings. The scope of this literature further suggests that this line of research is an emerging field within transition studies that is still in its infancy. Therefore, there is a considerable potential to investigate in further detail how transitions unfold in contexts that are very different from the empirical settings within which transition theories were developed.

1.2.4 The role of donors in development aid

Within developing countries, donors potentially have a significant part to play in promoting transitions, especially given that the concept of transformational change is now widely used within a global agenda for sustainable transitions through the adoption of Sustainable Development Goals and the Paris Agreement. This thesis focuses on such role by investigating how the transitions literature can inform donor approaches for low-carbon initiatives in developing countries. With a view to set a baseline that will enable further analysis, the following section critically reflects on the historic and contemporary governance paradigms underlying donor interventions. However, transition research emphasising the role of donors in promoting low-carbon development (section 1.2.5) is even rarer than the broader literature on transitions in developing countries (section 1.2.3). Given this scarcity, inspiration and complementary insights are sought from the actor-oriented planned intervention literature (Long & Ploeg 1989).

Modern international development assistance has a long history, dating back to post World War II (Fuhrer 1996). Across time, the theoretical models underlying governance of development aid evolved from a linear conceptualisation of planned interventions - predominant in the 1960's and 1970's - to the growing recognition in the 1980's that, instead, such interventions unravelled through an ongoing socially constructed and negotiated process (Long 2001). Consequently, and as opposed to previous top-down, technology-parachuted demonstration programs, the policy argument in the early 1990's across aid was that of promoting participation (Mosse, 2004). The discourse within development agencies - such as from the United Nations, the World Bank and the European Union - subsequently shifted to mobilising metaphors such as "good governance" and "ownership" (van Gastel & Nuijten, 2005 in Mosse & Lewis, 2005). Driven by concerns arising from the evaluations of the efficiency of development aid, a new thinking emerged in the mid 1990's around impact assessments, project cycle management, value-for-money, or sustainable rural livelihoods (Mosse, 2004). However, by the 2000's and despite previous criticisms, development interventions were still visualised as a discrete set of activities taking place within defined time-space settings between donors and recipients rather than an intermingling flow of events and interests (Long 2001). Such a conceptualisation of planned interventions is enshrined within standardised management models such as the Logical Framework Approach, and as to date, is still the dominant theoretical paradigm underpinning the governance of planned interventions by donors[12].

In around 2011, a new discourse regarding transformational impacts of planned interventions emerged within donor agencies focussed on addressing the pressing issues posed by climate change and sustainable development goals. This new orientation of donor programs raises questions on whether existing donor cultures, structures and practices can effectively sustain low-carbon transitions in developing country contexts. These questions are theoretically unpacked in the following sections through a critical comparison with transition thinking and transition governance principles, and empirically examined across the three papers comprising this thesis.

Limitations in theoretical models underpinning governance of donor interventions

Based on lessons learnt from practice, scholars from the planned interventions literature have criticized donor interventions as being rigid and reductionist by oversimplifying a complex set of processes at play in the implementation of development projects (Elwert & Bierschenk 1988; Long 2001; Mosse 2004). Given that donor projects address change processes that are highly heterogeneous, often divergent, cyclical and dependent on context, these rarely materialise according to a set blueprint (Olsen 2006). As a consequence, donors often focus on what can be practically achieved within a given context (Hansen & Nygaard 2013). This suggest that the theoretical model underpinning current donor interventions do not actually reflect the change processes it is supposedly designed to address. Given this caveat, the adequacy of current donor approaches to address the uncertain, multiple, and complex processes of change occurring simultaneously at different levels that characterise transitions is questionable. This topic is explored within this thesis

[12] Coordinated efforts to improve aid effectiveness has, over the years, gained prominence, particularly via international partnership agreements such as the High Level Fora on Aid Effectiveness held in Rome in 2003, in Paris in 2005, in Accra in 2008 and in Busan in 2011 (OECD 2016). However, standardised means-end causal models such as the LFA have remained unquestioned as to-date.

across one paper by empirically studying the approaches adopted within two key providers of climate funding to the developed world.

Long (2001) further argues that the increasing use of the LFA for planned interventions has strengthened the belief that project design and implementation follows a linear, stepwise and logical order in the form of rational problem solving process through experts that (i) become aware of problematic symptoms, (ii) formulate problems, (iii) identify causes, (iv) generate, choose, and implement solutions, and (v) evaluate results. Such project cycle-based approach adopted by donors within planned interventions potentially align with some transition governance principles such as problem structuring, developing images and scenarios, actor mobilisation, coalition building, project execution and experimentation, and monitoring. However, its linear, means-end design also suggests that systemic features of highly complex processes inherent to socio-technical change are not internalised within the governance paradigm of donor interventions. Consequently, planned donor interventions potentially diverge from transition governance prescriptions such as (i) selective participation of actors operating outside policy circles, (ii) process monitoring instead of the current mid-term or ex-ante evaluation of planned interventions, (iii) inclusion of feedback mechanisms to re-orient means and goals based on lessons learnt, and (iv) long-term envisioning of cultural and societal change. These theoretical considerations are empirically examined in greater detail across one of the papers of the thesis, taking the example of a NAMA donor intervention designed between 2012 and 2013 to address the Tunisian cement sector (see Paper 3 in Part 2 of this thesis).

Limitations of aid delivery approaches towards innovation, diffusion and adoption of technologies

Adoption and diffusion of innovative technologies has been, and still is, a cornerstone of international development assistance programs. In the 1960's, such programs focussed on identifying variables related to innovative practices in developing nations. However, those interventions failed to account for the characteristics of technologies. As a result, donor paradigms shifted to designing technology transfer and diffusion programs as tuned to the needs of adopters in the 1970's (Tigabu et al. 2017). However, given their lack of attention towards commercialisation of technologies implemented, those programs failed to upscale beyond their project boundaries and thus, did not diffuse out. Recognising these loopholes, donor focus switched from technology-oriented approaches in the 1990's to policy and market-oriented ones in the 2000’s. This shift also entailed a boost in the number of agencies involved across such interventions (Kruckenberg 2015). However, addressing technology diffusion solely by correcting market failures is narrow and simplistic, as well as ignores the context-specific conditions under which technology transfer and diffusion occurs (Haselip et al. 2015). Prevailing donor paradigms on innovation thus stand to gain by adopting a transitions perspective, which extends beyond market mechanisms to simultaneous consideration of co-evolutionary processes of change across economic, technical, institutional, political, and regulatory framework conditions.

Within international assistance programs focussing on the adoption of renewable energy technologies, the latest approach favoured by donor agencies towards promoting innovation and technology transfer is geared towards sustaining cross-sectoral partnerships (Kruckenberg 2015). Such an orientation follows an expansion in the scope of planned interventions over time, moving from project-based interventions to programmes, sector-wide approaches, state-level partnerships and policy-based budgetary assistance (Long

2001). This evolution also denotes a belief that wider participation is required to effectively incur socio-technical change, which aligns with transitions thinking. Yet, transitions governance does not only suggest wider participation as a means to broaden the knowledge base needed to address systemic failures. Indeed, selective participation of frontrunners - i.e. actors operating outside conventional policy circles and that are able to contribute with out-of-the-box thinking, are also required. However, donor projects generally do not abide by such transition governance principles. In practice, donor planned interventions (i) reflect a contest over the dominance and legitimacy of competing images of development (Long 2001), (ii) conceal the agency of outsiders and political manipulation of elites (Mosse 2004), (iii) reconstitute relations of power and patronage (Mosse 2004), and (iv) depoliticise planning through a cloak of rationality (van Gastel & Nuijten 2005). Given those characteristics, discussions during project design and across project implementation could be constrained and disguised to address issues that either espouse the agenda of donor agencies or abide by political preferences within recipient countries. Therefore, there is a high probability that donor interventions do not question the fundamental reasons accounting for regime resistance and carbon lock-in, which is the very rationale behind promoting transitions.

In summary, governance paradigms behind donor interventions show some similarities to transition governance principles, but more importantly, the theoretical comparison undertaken reveals a number of fundamental differences between the two. There is thus scope for complementing donor approaches with transition governance-inspired prescriptions. Given the recent emergence of a sustainability transition discourse within donor agencies through ambitions to achieve transformational impacts to be achieved via climate change instruments, such cross-fertilisation is particularly relevant nowadays.

1.2.5 Development aid and sustainability transitions: an under-developed field

The role of development aid in transitions across developing countries has been attracting more and more attention lately (see section 1.2.4). In order to scope out what has been covered up to now and identify research gaps within this emerging body of knowledge, a short review of this particular corpus of literature follows.

The literature contains only eight academic publications that explicitly focus on donor interventions (van Alphen et al. 2008; Arkesteijn et al. 2015; Amars et al. 2016; Fridahl & Johansson 2016; Hansen & Nygaard 2013; Marquardt et al. 2016; Power et al. 2016; Tigabu et al. 2017). The emphasis in these publications falls into three broad categories: (i) those assessing aid effectiveness (van Alphen et al. 2008; Hansen & Nygaard 2013; Marquardt et al. 2016; Tigabu et al. 2017); (ii) those focusing on alternative ways of conceptualising aid (Arkesteijn et al. 2015; Power et al. 2016); and (iii) those concentrating on NAMAs, which, in essence, refer to planned interventions for sustainable transitions through climate instruments under the UNFCCC (Amars et al. 2016; Fridahl & Johansson 2016). This literature will be unpacked in the course of the following sections.

Evaluating aid effectiveness

Based on analyses of donor programs in the Maldives, Kenya, Rwanda, Malaysia, the Philippines and Morocco, papers by (van Alphen et al. 2008; Tigabu et al. 2017; Hansen & Nygaard 2013; Marquardt et al. 2016) focus on evaluating aid effectiveness in these countries based on the TIS, MLP and TM frameworks. While van Alphen et al. (2008)

examine renewable energy innovation systems in the Maldives, Hansen & Nygaard (2013) investigate donor interventions by the European Union, Danish International Development Assistance (DANIDA), and the Global Environment Facility (GEF) pertaining to the palm-oil biomass energy sector in Malaysia. Emphasising German development cooperation projects, Marquardt et al. (2016) study the role of foreign aid in energy policy-making and in the diffusion of policies and frameworks for renewable energy in the Philippines and Morocco. Lastly, focusing on programs from donor agencies that are geared towards the development and diffusion of improved cooking technologies, Tigabu et al. (2017) examine the role of official development assistance in the evolution of Technological Innovation Systems in Kenya and Rwanda. While these papers all highlight the significance of donor interventions in the development of niches and innovation systems, they also point towards a number of factors that impede donors' aims in sustaining transitions in developing countries. These include a lack of attention in donor programs towards addressing (i) how to promote local entrepreneurship and markets (van Alphen et al. 2008), (ii) how to tackle opposed interests of regime actors (Hansen & Nygaard 2013), (iii) how to address the role of middle-range actors (Marquardt et al. 2016), (iv) the short, uncoordinated and unpredictable nature of donor support (Tigabu et al. 2017; Hansen & Nygaard 2013), and (v) issues related to replicating the private-sector models of the North (Marquardt et al. 2016; Hansen & Nygaard 2013).

As is evident from this review, existing research has only touched the surface of this topic. Hence, there is a considerable potential for further academic enquiry into the role of donors in transitions.

Conceptualising aid

Through the cross-fertilisation of transition theories and other pertinent bodies of literature, papers by (Arkesteijn et al. 2015; Power et al. 2016) provide conceptual and theoretical contributions on the role of donors in promoting sustainability transitions. Indeed, by means of a theoretical review, Arkesteijn et al. (2015) question the ability of current development evaluation methodologies to encapsulate complexity features, while Power et al. (2016), on the other hand, theorise about emerging forms of South-South cooperation around clean energy by examining how Brazil, China and India are influencing transitions in Mozambique and South Africa.

These publications contrast with the papers on evaluating aid mentioned above through a deeper re-examination of the way donor support is conceptualised within the literature. However, there is still a large range of possibilities for academic work on sustainable transitions to reconsider how development aid aimed at accelerating transitions to a low-carbon economy is delivered.

Donor support through NAMAs

Based on the MLP and SNM frameworks, (Amars et al. 2016; Fridahl & Johansson 2016) focus on the potential to spur transitions of Nationally Appropriate Mitigation Actions (NAMAs) as new policy concepts within the climate change community aimed at achieving structural changes in the direction of sustainability. Specifically, Amars et al. (2016) examine the cultural legitimacy of internationally supported NAMA mechanisms through the solar energy sector in Tanzania, while Fridahl & Johansson (2016) scrutinise NAMA proposals and Intended Nationally Determined Contributions submitted to the Paris Agreement to explore how developing countries' intentions regarding climate actions are related to the insights of sociotechnical transition theories. While these publications have contributed to the

literature by providing an analysis of the perceptions and intentions of actors involved in donors' attempts to promote sustainable transitions, the fact remains that this topic is still, to a large extent, under-researched.

1.3 Research objectives

The scarce number of publications addressing donor-induced sustainability transitions in developing countries shows that this field of study is still at an embryonic stage. Taking into account the importance of development aid in channelling innovative ideas and finances to the developing world, especially in light of the forthcoming disbursement of 100 billion USD of climate financing pledges through planned interventions, it is surprising that such a crucial topic has not received more scrutiny than the existing literature suggests.

The review undertaken in section 1.2.5 reveals the following gaps in research. First, sectoral coverage across the literature is limited, with most papers focusing mainly on renewable energies and energy systems through case studies from Africa. Academic articles focusing on other significant contributors to greenhouse gas emissions, such as energy-intensive manufacturing industries, are still lacking. Secondly, the literature is dominated by research that uses sustainability transitions theories to bring new insights to the issue of how existing donor interventions may be amended. However, it is still not clear whether mainstream planning methodologies for development aid or related project formulations and designs explicitly tackle systemic features of lock-in. Thirdly, the literature assessing the links between NAMAs and sustainability transitions is still in its infancy. There is thus a need for further empirical analysis investigating what planned interventions to promote transitions through NAMAs mean in practice.

This thesis aims to contribute to filling these gaps by examining (i) the planning methodologies of key climate-funding bodies, (ii) factors influencing sustainability transitions through planned interventions by donors across the cement sector in Tunisia, and (iii) the design of a related NAMA targeting this cement industry.

1.4 Research focus and approach

This thesis uses a transitions perspective to examine donor interventions, with a particular focus on the cement sector in Tunisia, so as to illuminate the research gaps identified in the previous sections. The overall research question guiding this thesis is as follows:

How do external donor interventions influence sustainability transition to low-carbon development in the case of cement production in Tunisia?

This overall research question is addressed by means of a number of subsidiary research questions;

<u>Subsidiary research question 1:</u>

To what extent are current Logical Framework Approach-based management approaches of climate finance able to capture the characteristics of transformational change processes set out by the scientific literature on Transition Management, and consequently, how can such approaches be improved?

<u>Subsidiary research question 2:</u>

How have externally supported niches in the Tunisian cement industry developed and why they did not develop into viable ones?

Subsidiary research question 3:

How, and to what extent, does the Tunisian Cement NAMA promote transformational change to low carbon development in Tunisia?

These subsidiary research questions are tackled in three papers, the key features of which are summarised in Table 1.

Overall research question	Paper title	Subsidiary research questions	Focus and approach(es) adopted to answering the subsidiary research question
How do external donor interventions influence sustainability transition to low-carbon development in the case of cement production in Tunisia?	*Paper 1:* "The Implications of how Climate Funds conceptualize Transformational Change in Developing Countries "	To what extent are current LFA-based management approaches of climate finance able to capture the characteristics of transformational change processes set out by the scientific literature on Transition Management, and consequently, how can such approaches be improved?	This paper reviews the theoretical grounding behind the Green Climate Fund and the NAMA Facility's conceptualizations of transformational change (essentially the Logical Framework Approach) through NAMA interventions against the corresponding theoretical assumptions of Transition Management.
	Paper 2: "Transition towards sustainable cement production in Tunisia: the limitations of donor interventions as promoters of niche development"	How have externally supported niches in the Tunisian cement industry developed and why they did not develop into viable ones?	Focussing particularly on the role of external donor interventions, this paper uses the Multilevel Perspective framework to analyse the underlying influential factors in the development of four niches with the potential to significantly contribute to the improved sustainability of the Tunisian cement industry from 1990 to 2015.
	Paper 3: " Assessing Transformational Change Potential: The case of the Tunisian Cement Nationally Appropriate Mitigation Action (NAMA)"	How, and to what extent, does the Tunisian Cement NAMA promote transformational change to low carbon development in Tunisia?	This paper uses theoretical insights from literature on the Multi-Level Perspective and Transition Management literature to examine a donor-supported cement sector NAMA in Tunisia developed during 2012-13.

Table 1: Overview of research questions addressed

The overall research question addressed in this PhD thesis is answered through a number of sections. The current section sets the scene and positions the thesis in the context of current scholarly and real-world debates. The next section 2 depicts the country context within the period of investigation of the thesis. Section 3 then proceeds with the research design and methodological framework adopted to address the research questions dealt with by this thesis. Section 4 summarises the papers that have been drafted as part of this dissertation. The thesis ends with a conclusion which discusses the cross-cutting findings of the individual papers, points out the policy implications of the research, the lessons learnt when applying sustainability transition theories to developing country contexts and development aid, as well as proposes avenues for further research.

It is not the purpose of this PhD thesis to come up with a blueprint for producing structural and systemic change – also called “transformational change” or “paradigm shifts” within practitioner circles – in developing countries. Instead, the thesis uses and extends concepts from theories of sustainable transitions to developing-country contexts and development work. The main outcome of this study is that it offers a possible explanation for how theoretical inspiration from relevant academic work can be used to inform real-world development approaches such as donor programs, especially those concerned with operationalising transformational NAMAs, as well as policies and measures that comprise Nationally Determined Contributions under the UNFCCC. In so doing, this PhD thesis also explores possible contributions to the theoretical and analytical frameworks on which it draws, as well as examining areas where further research is warranted.

The following section details introduces the country context for the case study addressed within this thesis, followed by another section detailing how insights from theories of socio-technical transitions have been used to address the overall research question posed by this thesis.

2.0 Country context: Sustainability transition in the cement sector of Tunisia

Within the period of investigation covered by the thesis (1990 - 2015), the Tunisian cement industry - and by extension, its emissions of greenhouse gases - has been influenced by a complex interplay between technical, economic, political, regulatory, institutional and social factors. These interacting systemic elements make the Tunisian cement sector particularly interesting to analyse from a transitions perspective. As a background to the empirical studies conducted and to position the thesis within the Tunisian context, the next section provides an introduction to the cement industry, including the growth of the sector in Tunisia, its political and economic context, and the involvement of donors in the sector.

2.1 Growth of the cement industry in Tunisia

Tunisia is a middle-income North African country with a population of 11.5 million in 2017 and population growth rates of 1.01% annually (CIA 2018). Minerals such as limestone, clay, sand and gypsum, which are raw materials for the manufacture of cement, are found in large quantities over its 164 150 km^2 territory (Nouira 1972). The availability of essential mineral resources and cheap labour, along with Tunisia's close proximity to shipping routes, provided the country with favourable conditions for a cement industry to develop since the 1930's. As early as 1933, "Les Ciments Artificiels Tunisiens" was the first cement plant to be set up in Tunisia, followed by "Les Ciments de Bizerte" in 1953. The need for construction materials to address growing urbanisation in Tunisia (Moez 2010), coupled with the availability of cheaper fossil fuels following the discovery and exploitation of petroleum and natural gas reserves in the 1960's and 1970's (Rekik et al. 2014), led to a rapid expansion of the cement sector. Between 1970 and 1990, five more companies were set up, namely "Les Ciments de Gabes" in 1973, "Les Ciments D'Oum El Kelil" in 1976, "Les Ciments de Jbel Oust" in 1978, "Les Ciments D'Emfidha" in 1983 and "La Société Tuniso-Andalouse de Ciment Blanc" (SOTACIB) in 1986. "Carthage Cement" is the latest one, created in 2008 as a private entity. Table 2 summarises the key characteristics of Tunisian cement firms.

Over time, the cement industry developed rapidly into one of the key industrial activities in Tunisia, employing around 3200 people (excluding rock quarry activities) (APII 2014) and with an estimated 60 years of raw material supply available (Cemnet n.d.). Growing needs for construction material for development have led to an increase in production capacity of firms (Table 2), especially through plant expansions at Les Ciments de Bizerte and Les Ciments d'Emfidha, as well as the setting up of a grey cement manufacturing unit at SOTACIB and the coming into operation of Carthage Cement. Consequently, the production of cement rose from around 6.2 MT in 2003 to 7.9 MT in 2012 (Figure 1).

No	Firm	Ownership	Year set up	Production Capacity (MT/year) in		Annual Turnover (million Euros)	Staffing	Actual Production of clinker (in million tonnes)		
				2009	2014			Total	Exportation	Base year
1	Les Ciments Artificiels Tunisiens	Colacem (Italy)	1933	0.75	1.0	30 (in 2012)	180	0.75	around 5 %	2012
2	Les Ciments de Bizerte	State-owned (Tunisia)	1952	0.92	1.5	19 (in 2015)	535	0.57	0.05	2015
3	Les Ciments de Gabes	Secil (Portugal)	1973	1.0	1.4	69.9 (in 2015)	373	1.18	0.29	2015
4	Les Ciments D'Oum El Kelil	State-owned (Tunisia)	1976	1.0	1.25	n/a	519	0.75	0.13	2014
5	Les Ciments de Jbel Oust	Votoramtim Cimentos (Brazil)	1978	1.2	1.8	83.6 (in 2011)	222	1.73	n/a	2011
6	Les Ciments D'Emfidha	Cementos Portland Valderrivas (Spain)	1983	1.7	2.9	80.3 (in 2015)	319	1.80	0.19	2014
7	La Société Tuniso-Andalouse de Ciment Blanc	Cementos Molins (Spain)	1986	0.65	1.3	93.2 (in 2015)	588	n/a	n/a	n/a
8	Carthage Cement	Société Bina Corp (Tunisia)	2008	0	2.4	57 (in 2014)	329	1.30	0.20	2014

Table 2: Overview of cement firms in Tunisia[13]

[13] Note: Data for production capacity have been sourced from CC (2010), USGS (2017) and SOTACIB (2018). Data for Annual Turnover, Number of employees and Annual Production have been obtained from corporate websites, annual reports, and stock exchange publications from CAT (2018), CoB (2018), Secil (2016), CIMPOR (2011), GCPV (2014), CM (2015), and BVMT (2018). SOTACIB is the only company producing white cement, which further expanded its targeted market in 2011 with grey cement production. Carthage Cement started production in 2010.

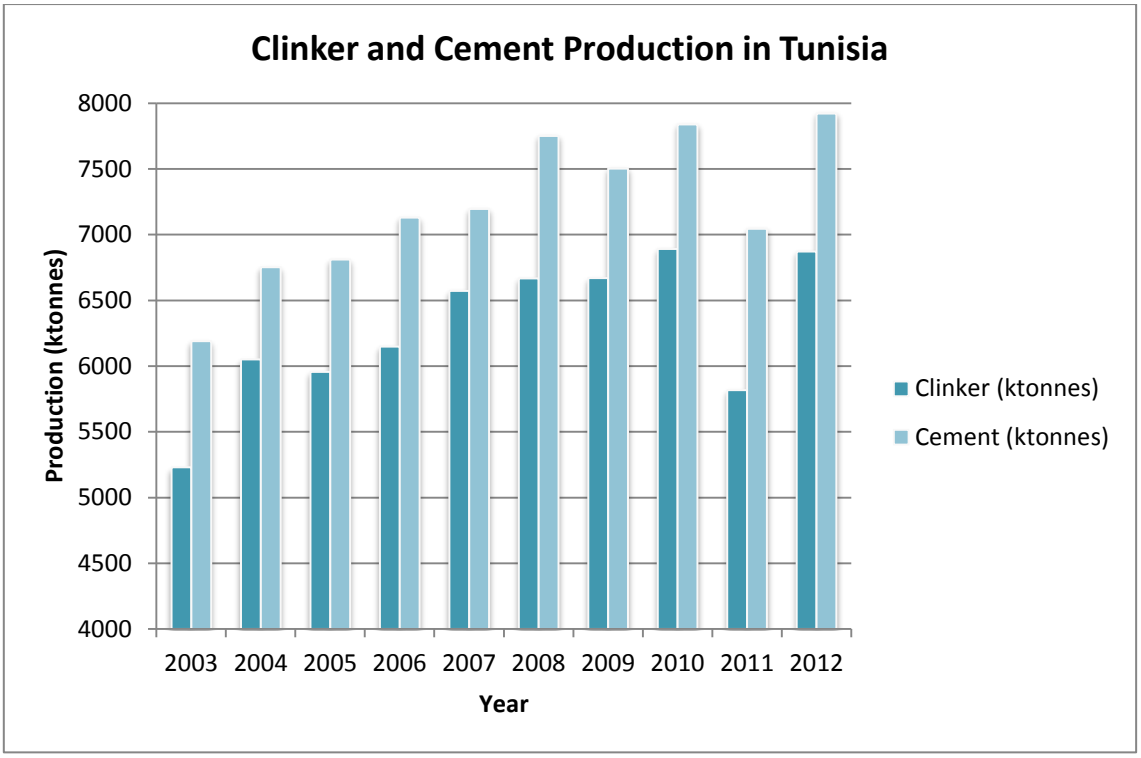

Figure 1: Production of cement between 2003 and 2012 (adapted from data in Klein et al. (2013a))

2.2. The influence of globalisation and the Tunisian revolution on the cement sector

Between 1990 and 2015, the political and economic situation in Tunisia was characterised by profound changes, which had an impact on the cement sector. This context involved rapidly changing political ideologies ranging from a dictatorship to a particular form of democratic and accountable political system. Indeed, between 1990 and 2011, Tunisia was governed by President Ben Ali, who himself obtained power from the then President Habib Bourgiba in 1987 after 30 years in power. At the start of Ben Ali's reign in the 1990's, the government at that time pursued accelerated economic growth and diversification of the economy by engaging more deeply into the world economy. In line with this new strategic orientation towards neo-liberal market-oriented policies, Tunisia adhered to the World Trade Organisation in 1994 and engaged into structural reform programs with the assistance of foreign donors. Those combined conditions led Tunisia to become one of the fastest growing countries in the Middle East and North Africa (MENA) region, with GDP increasing from USD 12.3 billion in 1990 to USD 43.2 billion in 2015 (WB 2017). The cement sector was profoundly impacted with those factors through the sale of five cement companies to foreign groups, a subsequent flow of foreign technology and knowhow and an increase in production capacity (Table 2).

Within the context of liberalisation of the Tunisian cement sector, Government gave its approval for cement companies to engage in exportation of Tunisian cement products. Subsequently, an export market for Tunisian cement emerged, primarily targeting Algeria and Libya, along with some sales to Europe and African countries (Klein et al. 2013a). Due to low costs of energy, labour and minerals, Tunisian cement prices are very competitive as

compared to cement producing countries in the Middle East and North Africa region and over Europe. Indeed, domestic prices for Tunisian cement of around 53 USD/Tonne[14] are lower than that of Algerian and Libyan neighbours - estimated between 84 and 91 USD/Tonne, and significantly lower than European prices ranging from 117 to 151 USD/Tonne (Amen Invest 2012). While this price differential suggests that Tunisian firms have a financial interest in exporting their products, exportation of Tunisian cement has not expanded significantly over time, ranging between 0.7 MT and 1.4 MT between 2003 and 2008 (Moez 2010). This is due to firms being restricted by their maximum production capacities and also by Government quotas, with the state allowing exportation only after servicing local demand.

The authoritarian political leadership period (1990 - 2011), along with the democratic transition period (2011 - 2015) negatively affected the economic performances of Tunisian cement factories. Firstly, the apparent development across Tunisia within Ben Ali's reign was rife with corrupt practices, with Cavatora & Haugbølle (2012) arguing that the promising policies put in place in the 1990's had degenerated in the 2000's into an economic system enabling Ben Ali's close relations to take advantage of numerous sectors of the economy through networks of patronage. Within the cement sector, Carthage Cement, which was partly owned by the brother-in-law of the former dictator, suspiciously benefited from fiscal incentives by government (Rijkers et al. 2014). Mainly as a result of growing income inequality, corruption, cronyism, human rights abuses, unemployment, difficulties to access the labour market, and a more educated and technologically savvy workforce, social unrest grew (Cavatora & Haugbølle 2012). By 2011, Ben Ali was ousted out of power within what is now referred to as the Jasmin Revolution. The revolution incurred a period of instability that resulted in frequent stops in production of cement (Klein et al. 2013a) and the shares within Carthage Cement were subsequently confiscated by Government after the revolution. The export of Tunisian cements also diminished in the aftermath of the revolution to around 0.6 MT by 2012 (APII 2014) to provide for an increase in local demand due to a rise in illegal constructions (UNECA 2014)[15].

2.3 Emissions of greenhouse gases from the cement industry and its sustainability transition challenges

2.3.1 Intrinsic lock-in features of the global cement industry

The cement industry is a typical example of an energy-intensive processing industry (EPI)[16] (Wesseling et al. 2017). Such EPIs are characterised by a strong reliance on high energy requirements and are therefore processing industries with high carbon intensity. The production processes of cement (summarised in Figure 2) require significant amounts of energy to reach the required temperatures - of the order of around 1450 °C - for chemical decomposition of a mixture of limestone and clay to occur to produce clinker and eventually

[14] Cement prices for the domestic market are fixed by Government, with annual increases of around 5 -7 % being permitted by the state (Moez 2010).

[15] Concurrently, foreign demand for Tunisian cement products decreased as a result of (i) the up-scaling of Algeria's own cement industry, and (ii) the 2011 civil war in Libya (Santi et al. 2012).

[16] EPIs are industries that convert natural resources into basic material building blocks upon which society is made of (Wesseling et al. 2017). Iron and Steel, Aluminium, Chemicals, Glass, Paper and Pulp are other examples of such energy-intensive processing industries.

cement. Those energy requirements are typically fulfilled through combustion of fossil fuels, leading to the release of greenhouse gases. In addition, the chemical decomposition process during clinker production further releases carbon dioxide (CO_2), while electricity requirements to power plant machinery are another source of emissions - although indirect - from cement manufacturing. Therefore, the cement industry is, by its own intrinsic nature, dependent on energy and carbon intensive.

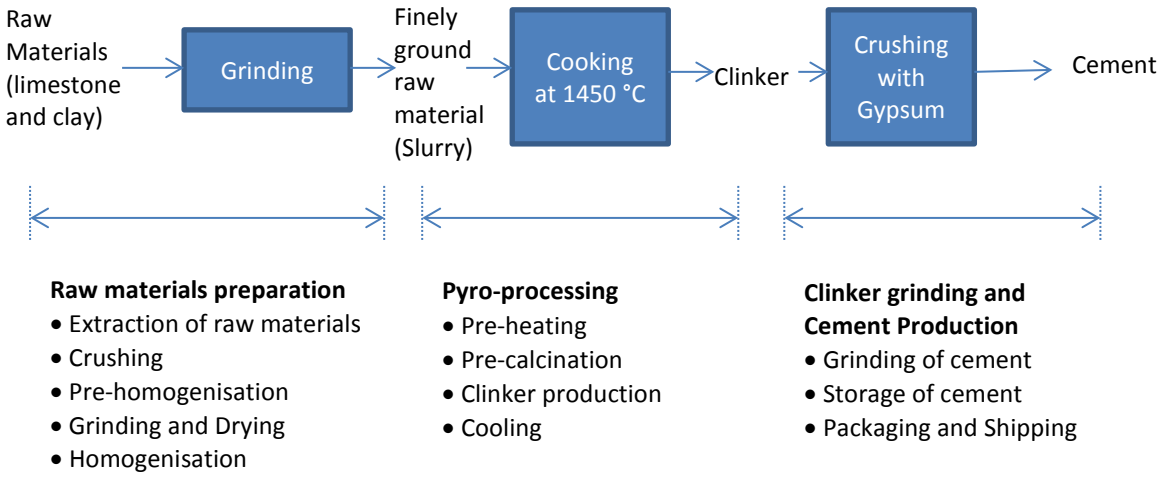

Figure 2: Processes within cement production (adapted from (Benhelal et al. 2013; Moez 2010))

In addition to cement production's inherent carbon intensity, the global cement industry is characterised by other stabilising features that further enhance its lock-in into a high carbon development pathway. Those comprise of (a) an aversion to risky investments, (b) a lack of viable alternatives and limited market for low-carbon cements, (c) the influence of a politico-industrial complex of cement production, and (d) the uniformity of cement products. These are discussed in the following sections.

Risk aversion

Given that cement production is a typical capital intensive endeavour which involves extensive payback periods ranging from 20 to 40 years, the resulting high sunk costs restrict the potential for shifts to alternative, financially viable, technical options (Dewald & Achternbosch 2016; Wesseling et al. 2017). Such long term investment cycles contrast with cement prices, which are generally kept quite low due to (i) the necessity for cement products for construction and their associated widespread utilisation across society, as well as (ii) the low-value added of cement material (Dewald & Achternbosch 2016). In combination, these factors result in a situation whereby the profit margins of firms are highly dependent on demand for cement products, thereby giving rise to uncertainties which limit the investment visibility of firms wishing to engage in innovative practices (Dewald & Achternbosch 2016; Wesseling et al. 2017; Wesseling & Van der Vooren 2017). Consequently, the cement industry is characterised by a conservative mind-set, with firms typically preferring to avoid a potential loss of market share through risky investments.

Lack of alternatives to cement and limited market-pull for low-carbon cements
The limited-substitutability of cement products also acts as a stabilising factor to the industry's high carbon intensity. Indeed, the combined effect of widespread use of cement and a lack of alternative products result in that cement's embedded carbon is not often considered during purchase and utilisation (Dewald & Achternbosch 2016; Wesseling et al. 2017). In short, industrial consumers do not usually request for sustainable cements. In a case study analysing clean concrete innovations in the Netherlands, Wesseling & Van der Vooren (2017) illustrate such limited market-pull through the risk aversion of cement procurers towards cleaner cements, as well as their unwillingness to pay a premium. Those factors result in that the demand for cleaner cements is not significant enough to trigger a response from the industry.

The political-industrial complex of cement production
On the one hand, Governments are usually reticent towards imposing strict regulations to reduce emissions from the cement sector as they do not wish to weaken the competitiveness of domestic cement industries - which operate within a globalised and competitive market (Wesseling et al. 2017). On the other hand, cement firms usually have well-organised lobby groups that make use of their power to oppose policies and measures which may threaten their market position (Fry 2013; Wesseling et al. 2017; Wesseling & Van der Vooren 2017). This resulting political-industrial complex of cement production reinforces the status-quo rather than promoting low-carbon innovations within the sector.

Uniformity of cement products
The uniformity in cement products is also a cause of carbon-lock in across the industry. As opposed to other sectors such as the car industry where product differentiation is a key motivation for innovation, cement products are required to abide by a limited number of specific norms and certifications. Consequently, the cement industry is characterised by low product differentiation and innovation is not a key driver of competition amongst firms (Dewald & Achternbosch 2016; Wesseling et al. 2017; Wesseling & Van der Vooren 2017). In other terms, sustainability is not a competitive advantage in the cement industry.

In summary, as a result of those key stabilising features of the global cement industry, firms have little motivation to engage into low-carbon innovative practices. Therefore, making the industry sustainable is typically a difficult task.

2.3.2 Key unsustainability features characterising the cement industry in Tunisia

In view of the characteristics of cement production unpacked in section 2.3.1, it is thus not surprising that the cement industry is a significant contributor of greenhouse gases globally - with global average specific emissions of the order of around 0.852 tonnes of CO_2-equivalent/tonnes of clinker produced. Correspondingly, the specific average emissions within the Tunisian cement industry are also high - of the order of 0.842 tonnes of CO_2-equivalent/tonnes of clinker[17] produced (Klein et al. 2013b).

[17] To enable a comparison with global averages, the value quoted exclude emissions from electricity consumption. When emissions from electricity consumption are factored in, the specific emissions from the Tunisian cement industry in 2012 amounts to 0.934 tonnes of CO_2-equivalent/tonnes of clinker produced (Klein et al. 2013b).

Given the Tunisian cement industry's high carbon intensity and its rising production (Figure 1), emissions in greenhouse gases from the sector have consequently increased (see Figure 3 for a breakdown of emissions released by source), amounting to around 13% of Tunisia's total emissions of GHGs in 2012 (MoELPSD 2014). Sector-specific data indicate a 43 % increase in total emissions from the cement sector; from 4.5 $MtCO_2$-eq in 2003 to 6.4 $MtCO_2$-eq in 2012 (Klein et al., 2013b) and a relative increase in per tonne of clinker or cement produced of around 30% for the same time span. Those values suggest that the Tunisian cement sector is following an increasingly carbon intensive pathway.

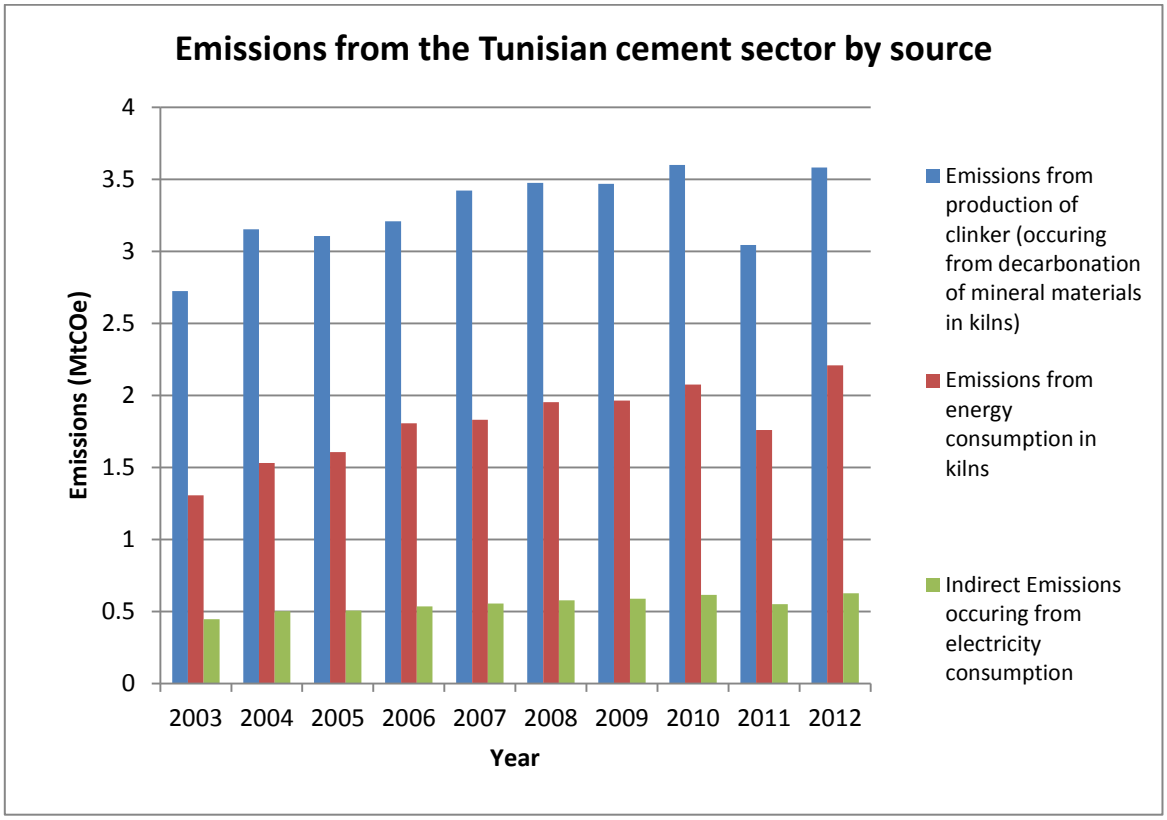

Figure 3: Emissions of greenhouse gases from the Tunisian cement sector (adapted from Klein et al. 2013a)

Although increased production to attend to domestic demand mainly[18] is the key reason behind the rising trends in emissions from the three emissions sources depicted in Figure 3, increasing emissions from energy consumption in cement kilns have also been heavily influenced by a change in fuel source utilised across the cement sector. Indeed, between 1990 and 2003, the energy requirements for cement production in Tunisia were sourced from heavy fuel oil (49 %) and natural gas (39 %) mainly, with the remaining 12 % being provided by electricity from the grid (Klein et al. 2013a). However, within that time period, the broader energy system within Tunisia experienced profound changes, which impacted the cement industry's preferred energy source and consequently, its emissions of greenhouse gases. Indeed, the availability of domestic fossil fuel resources decreased

[18] The percentage of exported Tunisian cements varies between 12 and 19 % of total production of cement in Tunisia (Moez 2010).

considerably following stagnation in production since the 1980's and an increasing energy demand of around 6 % annually during the 1990's to cater for demographic and economic growth as well as rising standards of living. These factors resulted in that, as from 2000, Tunisia became deficient in terms of energy balance (Rekik et al. 2014). This situation caused increased pressure on state budgets and forced the Tunisian Government to reduce spending on energy subventions[19]. As a consequence, prices of natural gas incurred a steep rise as from 2004 (UNFCCC 2011) and industrial consumers were faced with increased expenditure on energy. To cater for the loss in revenue, cement companies gradually shifted as from 2004/2005 from a mix of heavy fuel oil and natural gas to using petroleum coke (petcoke) within their cement kilns - a fuel source that is 25 % and 80 % more carbon intensive than heavy fuel oil and natural gas respectively. Since then, petcoke has been the preferred energy choice amongst Tunisian cement firms (MoAE 2011). The increased use of petcoke and the industry's inherent dependency on energy are thus key persistent unsustainability features that characterise the Tunisian cement sector.

2.4 Historical involvement of donors within the cement sector in Tunisia

While international cooperation focussing on sustainable development and resource management has a long history in Tunisia (EC 2012), its influence on the cement sector dates back to the 1990's after Tunisia adhered to the World Trade Organisation and developed a cooperation agreement with the European Union. To meet the terms of the agreement with the EU, the Tunisian Government pursued economic reforms initiated in 1987 with the International Monetary Fund and World Bank (Jelili 2003). These donor-supported reforms crystallised into privatisation of 5 cement firms between 1998 and 2005 (Section 2.2). In parallel, the EU provided 50 million Euros in 2004 to the whole industrial sector - including the cement sector - as a grant to support an industrial modernisation plan (MoESD 2007). Donor agencies such as the German development agency (GIZ), the German development bank (KfW), the French development agency (AFD), the World Bank, the United Nations Development Programme (UNDP), and the European Union subsequently engaged in a series of technical and financial assistance projects aiming at greening the Tunisian industrial sector. These donor-supported projects have contributed to the emergence of a number of initiatives within the cement sector revolving around the promotion of energy efficiency, the use of wind energy, refuse-derived fuels (RDF) and olive pomace in the cement sector (all of which are analysed in Paper 2 - see Part 2 of this thesis).

From around 2003, GIZ, the World Bank and UNDP engaged into consultancies and capacity building activities involving state actors and cement firms so as to integrate environmental concerns into cement production and improve its energy efficiency (World Bank 2004, KfW 2009, UNDP 2004). To further promote the competitiveness of Tunisian industries, around 109 million Euros in loans and credit lines were subsequently provided to the broad industrial sector by AFD, GIZ/KfW and the World Bank between 2008 and 2015 (AFD 2008, KfW n.d., World Bank 2004). Such financial support was channelled through funds managed by the state and from which cement firms directly benefited from in order to improve on their energy efficiencies.

[19] Subsidising energy prices has historically been at the core of the development strategy of Tunisia as a means of social protection (Schmidt et al. 2017).

Further, from around 2004, AFD, UNDP and GIZ supported Tunisia in (a) establishing a so-called Designated National Authority for Clean Development Mechanism (CDM) projects and (b) promoting CDM projects in Tunisia (Kratou 2012; Michaelowa 2003). Those donor programs specifically targeted the development of CDM wind projects in the cement sector. Additionally, between 2009 and 2014, UNDP assisted the Tunisian Government in the implementation of a 2 million USD project - funded by the Global Environment Facility - aiming at reducing Tunisia's energy-related GHG emissions through diversification of energy sources and developing core competencies of Tunisian companies in wind energy development (UNDP 2015). Given its high energy consumption, the cement industry was a key target within this project and cement firms received technical capacity building related to wind project formulation (*Ibid*).

In 2006, GIZ provided technical and financial assistance for the establishment of a planning group, which comprised of key representatives of the cement industry and the ministries of environment, energy and industry. The purpose of the group was to identify different options to improve the sustainability of cement production in Tunisia (MoAE 2011), out of which the use of RDF emerged as a viable alternative to petcoke used to fire cement kilns. Subsequently, the planning group actively lobbied for the acceptance of RDF use in cement kilns in relevant government agencies related to waste management. This actor network also engaged into joint publications, such as practical guidelines for the use of RDF in the cement sector (CNPC 2007; MoAE 2011). Furthermore, GIZ sponsored a visit for the benefit of this planning group in 2009 to cement factories in Germany and Belgium showcasing practical examples of RDF use.

In around 2008 and building on donor support for the development of CDM projects in Tunisia and the possibility of obtaining project co-financing, cement firms also explored the possibility of utilising olive pomace, a biomass residue by-product of the olive industry with a high calorific value (Pattara et al. 2010). Given that Tunisia has ranked amongst the six largest world producers of olive oil, it produces significant amounts of olive pomace, estimated at around 650,000 tonnes annually from the total 1 750 oil mills (UNFCCC 2011; Jackson et al. 2015). Prior to 2011, olive pomace was readily available in large quantities and at low costs and occasionally even free of charge (UNFCCC 2011).

Finally, in 2012, GIZ extended technical and financial support for the formulation of a Tunisian cement sector NAMA study in 2012 (GIZ 2013). The key objectives of this study were to synergistically address the barriers towards the implementation of greenhouse gas emissions reduction measures in the cement sector and concurrently, take advantage of emerging windows of opportunities for financing under the UNFCCC (MoE & GIZ 2012; GIZ 2013). The recommendations formulated therein focussed on four main measures that could be applied to the cement sector so as to significantly decrease its emissions: (i) the promotion of energy efficiency, (ii) the setting up of wind parks, (iii) the use of RDF, and (iv) the adoption of blended cements. Inspired by the Cement NAMA recommendations and with the support of GIZ, the Tunisian Government submitted a 6.65 million euros technical cooperation project proposal in 2014 to the NAMA Facility with the explicit aim to support transformational change in the cement sector. Failure to attract financing from the NAMA Facility then prompted a search for alternative sources of support, which materialised in 2015 through the European Union agreeing to finance further development of the NAMA through a readiness plan.

Despite those donor-support programs, the industry's emissions of greenhouse gases have not been significantly influenced over the period of investigation, whereby

emissions have generally followed a business-as-usual trajectory, with increases in greenhouse gas emissions following the overall production output (Figures 1 and 3). The fact that little results have been achieved so far may reflect that it is still the early days of a sustainability transition, corresponding to a pre-development phase. However, given the significant amount of direct and indirect investments incurred by donors through interventions aiming at increasing the sustainability of the cement industry in Tunisia, this spurs interest into exploring their effectiveness in terms of greenhouse gas emissions reductions, as well as their role in stimulating a sustainability transition in the cement sector (which are explored further in Papers 2 and 3 - see Part 2 of this thesis).

3.0 Research design and methodological framework

3.1 Research design

3.1.1 Research cycle

This study draws on an iterative process between key elements of the research design (see Figure 4 for a schematic representation of the research cycle adopted). For example, one key aspect of this back and forth process involved a complete re-orientation in research focus. Indeed, the original emphasis of this thesis was geared towards exploring methodologies through which the sustainable development impacts of NAMAs could be assessed. This initial framing led to the publication of a conference proceeding (Boodoo 2014) and two book sections (Olsen et al. 2015; Mersmann et al. 2014) produced as part of mandatory work at UDP (works that are not intended for academic assessment). To address this initial topic, a continent-wide scoping exercise was undertaken to identify African states with the most advanced NAMAs. This search was complemented with further information gathered from participation in an academic conference in South Africa in January 2014 focusing on mitigation actions in the developing world. Tunisia emerged as a promising case study from this scoping exercise (see section 3.2.2 for the rationale for choosing Tunisia). However, following a subsequent pre-field trip to Tunis in 2014, it was observed that data supporting the original research focus was too poor at that point in time for the construction of a thesis as a whole. Consequently, this situation prompted major changes in research design so as to achieve a better fit with the possibilities of empirical data collection. This process included (a) a major shift in focus from NAMAs to donor support for low-carbon development, (b) the use of different theoretical frameworks, from the sustainability assessment literature to theories of sustainable transitions, and (c) the formulation of new research questions and research methodologies.

In order to answer the overall research question resulting from the iterative process mentioned above, theoretical concepts were drawn from two strands of theories of sustainable transitions, namely the literature on Transition Management and Multi-Level Perspective (see sub-section 1.2.2). Case-study methodologies were applied to support data construction pertaining to the role of donors in supporting low-carbon transitions in the developing world and to the factors influencing such planned initiatives. Primary data collection was undertaken through semi-structured interviews and both direct and participant observation, while secondary data was obtained from scientific articles, publicly available documentation and reports collected on site. The data thus generated were analysed with the aim of filling gaps in the existing literature highlighted in section 1.3.

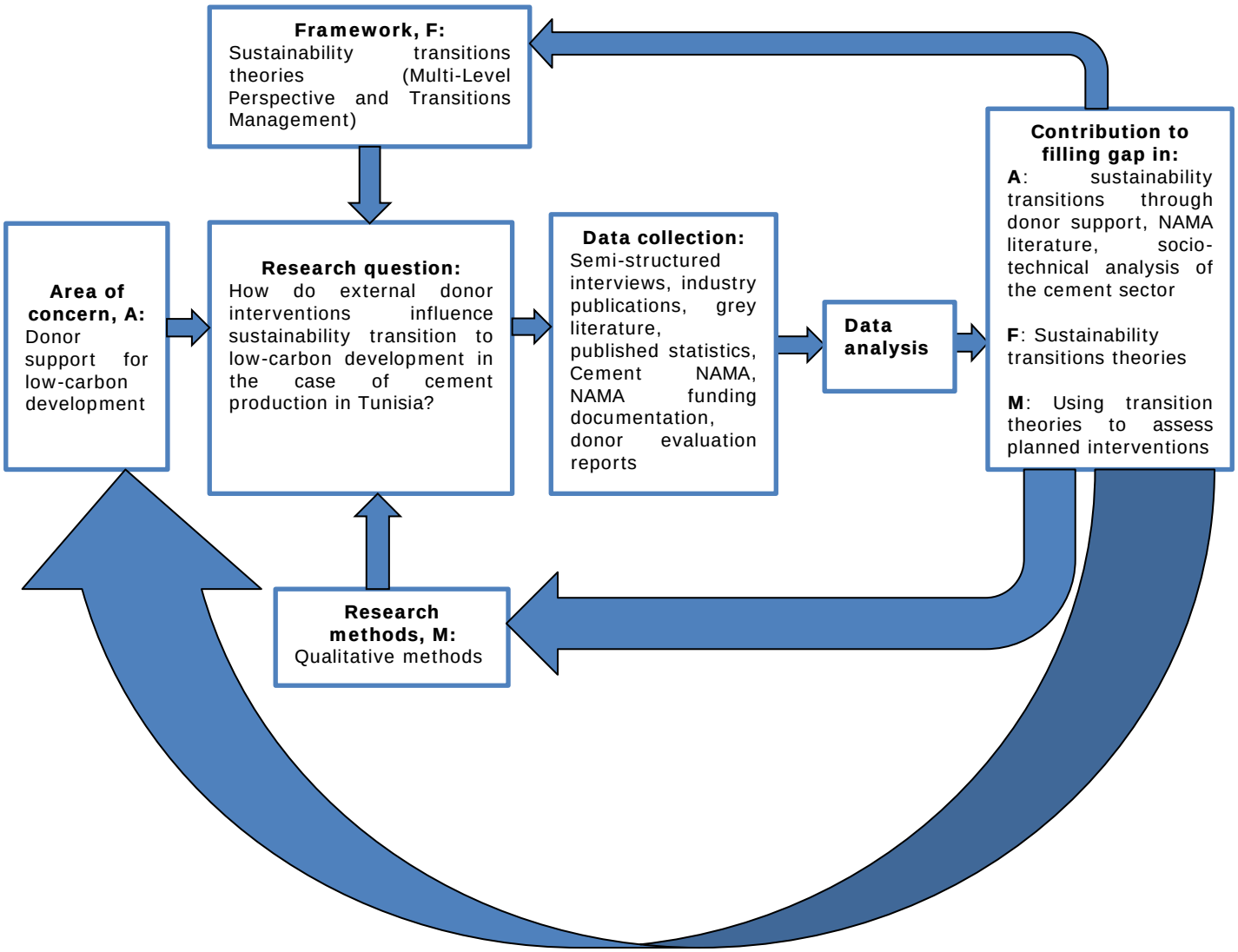

Figure 4: Research cycle

While the research questions and contributions of this dissertation mentioned in Figure 4 are treated in Chapters 1 and 5 respectively, the remaining elements of the research cycle are unpacked in the ensuing sub-sections of this chapter.

3.1.2 Theoretical approach and key concepts

The overall research question guiding this thesis is addressed in the three papers that constitute this dissertation, based on the relevant sustainability transitions literature. While Paper 1 is essentially based on a critical theoretical review of how sustainability transitions across developing countries are conceptualised by donors through two key climate funds, Papers 2 and 3 empirically investigate the influence of donor agencies on transitions to low-carbon development in the Tunisian cement sector (depicted in Table 3).

Overall Research question	*How do external donor interventions influence sustainability transition to low-carbon development in the case of cement production in Tunisia?*		
Addressed in	*Paper 1*	*Paper 2*	*Paper 3*
Informed by	*Theory*	*Empirical data*	*Empirical data*
Theoretical framework	*TM*	*MLP*	*TM and MLP*

Table 3: Key theoretical frameworks utilised across individual papers

The overall research question is mainly informed by sustainability transition theories in order to conceptualise the key characteristics of planned interventions. Future-oriented long-term planning inevitably involves governance aspects, such as which actors to include in a project or programme, how to identify relevant issues to be tackled, how to design possible ways to tackle such issues and which implementation modalities to favour, among others. Taking into account these features of planned interventions, insights from the Transition Management literature are adopted, based on TM's explicitly forward-looking perspective, along with its proposed managerial approaches to guiding structural transformation processes. Transition Management therefore provides this study with a key framework and theoretical inspiration from which to analyse donor support aimed at achieving a purposive transition.

This PhD thesis thus uses the theoretical basis of TM and its governance activity prescriptions (Loorbach 2010) as idealised features through which transitions to low-carbon development can be understood. In particular, the TM perspective is used to (a) undertake comparisons with mainstream planning methodologies across the donor community, and (b) provide analytical concepts that are used to analyse the design of a donor-supported cement NAMA in Tunisia. In short, the TM model is compared with current donor planning methodologies, modalities and design. This analytical approach enables the identification of caveats in the current design of planned interventions by donors, thus showing how these donor interventions may be improved, as well as pointing towards areas of further research across TM. This TM-informed approach is essentially utilised in Papers 1 and 3, which explore, from both a theoretical and an empirical perspective, the extent to which existing donor planning fosters transitions, thereby enabling cross-cutting findings to be distilled between theoretical claims and real-world observations.

However, in Paper 3, the use of TM in isolation proved insufficient to answer the subsidiary research question (*viz.* "how and to what extent does the Tunisian cement NAMA promote carbon development in Tunisia?"). To complement the TM perspective in Paper 3, insights from the MLP were required to identify the key reasons for the limited niche development within the cement sector identified in Paper 2. Alternative perspectives exist in the sociotechnical literature, such as “Arenas of Development” (Jørgensen 2012) or “Practice Theory” (Shove and Walker, 2010). However, these are based on a flat ontology that does not distinguish between the different levels of a system (Geels 2011). The use of SNM, which focuses on mechanisms underlying niche development (Schot and Geels, 2008), was found not to be entirely suited to answering the research questions due to the very limited level of development of niches observed in the empirical case study (see also Section 1.2.2).

3.1.3 Analytical procedures

A crucial process in the data collection and data generation phases of this research involved the translation of analytical concepts of interest into interview guide questions. This process involved (a) in the first instance, identifying how scholars have defined key background concepts, (b) followed by an interpretation of what those concepts mean in the context of this thesis, and (c) the subsequent formulation of probing and follow-up questions (see Annex 1 for an example of how this process unfolded, and Annex 2 for indicative questions posed).[20] The key concepts investigated in this thesis comprised (a) the Multi-Level Perspective's niche, regime and landscape factors, as well as their interactions, and (b) Transition Management's analytical dimensions, comprising the transition arena and the arena's activities at the strategic, tactical, operational and reflexive governance activity levels. These are described in detail in the subsequent paragraphs.

To operationalize the niche concept, interviewees were asked to elaborate on their involvement with or knowledge of specific local initiatives that had been implemented and had the potential to significantly reduce carbon emissions from cement production. In accordance with the MLP, these low-carbon measures were conceptualised as socio-technical niches. The analysis focused on the years 1990 to 2015, which correspond to the period in which data triangulation was possible. Drawing on prior information obtained from various documents, probing questions addressed sector-specific initiatives spanning changes in management practices and new technical equipment implemented at the plant level to energy-auditing schemes adopted throughout the sector. Interview questions addressed the main technologies and actors involved, as well as the regulatory aspects and broader institutional conditions related to the development of the individual niches.

However, the conceptualisation of niches within this PhD differs fundamentally from mainstream MLP studies whereby a niche is theorised as a concretely manifested specific technology promoted by various niche actors (see e.g. Raven & Gregersen 2007). Indeed this dissertation conceptualises four different technological approaches identified across the Tunisian cement industry, which have mostly not yet materialised into tangible experiments, as niches. This approach was utilised in this thesis for two reasons. First, though there were few indications of physical manifestations of niches, the data collected revealed the existence of concrete socio-technical configurations around four technological approaches. In this case, the 'niches' comprise of fragmented and isolated individual experiments at an early stage of niche development, which, importantly, had been driven and/or supported by external donors, rather than endogenous actors as is normally the case in most studies in the literature. Given that the MLP does not explicitly preclude a niche needing to be a hard technology in operation, this alternative conceptualisation of niches was adopted. Secondly, the factors accounting for restricted niche development in the Tunisian cement sector were rich enough to unveil four different niche stories. While traditional single-niche stories enable a deep analysis of the relevant factors underlying the promotion of transitions, the multiple-niche approach adopted here allows the analysis of a broader set of factors influencing niche development across a case study.

The regime concept was operationalized during interviews by asking questions regarding the main organisations, physical infrastructures, formal rules and regulations, informal practices, business culture and dominant actors and technologies related to

[20] These questions were refined based on the informant's degree of involvement in the case and also on new information gathered during data collection.

cement production in Tunisia. In this dissertation, and following the conventional approach in the MLP literature, the empirical boundary of the regime was operationalized to comply with national borders.

To operationalize the landscape concept, interview questions addressed the various external factors influencing the national context, such as the foreign-driven privatisation of the domestic cement industry and macro-economic development patterns. Data on these issues were obtained from documentary sources prior to conducting the interviews. As more information was gathered, the interview questions were refined so as to focus on identified niches, regime conditions and landscape impacts. To understand niche dynamics specifically, interviewees were also asked to describe the main driving and impeding factors underlying the development of these niches at the niche, regime and landscape levels respectively.

To obtain an initial mapping of the regime architecture in this case study, pertinent insights regarding multi-regime dynamics were used from the MLP literature (Raven & Verbong 2009; Konrad et al. 2008; Raven 2007), and a broad definition of regimes at play was pragmatically adopted through the different societal functions being pursued. The donor-facilitated Cement NAMA was conceived as a landscape-level intervention along the lines set out by Grin (2010). The NAMA was further visualised as creating a transition arena through which the development of promising low-carbon niches are anchored, while providing a platform through which the various interests of a previously loosely connected heterogeneous group of concerned actors could be discussed around the common objective of greening the Tunisian cement sector.

To operationalise TM's governance activity levels, interviewees were prompted to detail their involvement and experience with the formulation of the Tunisian cement NAMA. Drawing inspiration from methodologies used by Bos et al. (2015), the arena's activities at the strategic, tactical, operational and reflexive governance activity levels were operationalised using the different elements comprising TM's governance activity levels. For example, to operationalise strategic activities, probing questions addressed how the NAMA was organised, governed and managed, including methodologies followed, as well as how it addressed the political, cultural, technological, industrial and market barriers. To operationalise tactical activities, interviewees were asked to describe the basis on which an agreement was reached between the actors involved. To address operational and reflexive activity levels, interviewees were asked to elaborate on the institutional/organisational structure that was set up to implement the NAMA.

Furthermore, the suggestion by Adcock & Collier (2001) to move iteratively back and forth between the analytical frameworks and the empirical data was adopted as a means to ensure that the concepts being investigated were meaningfully captured. The procedures adopted in this thesis further involved changing and extending coding categories as they appeared in subsequent iterations during data collection and analysis by combining the "qualitative content analysis" method as described in Gläse (2013) with the tabular approach described by Miles & Huberman (1994). To illustrate this process, Table 4 shows how the gathered data pertaining to the MLP were analysed by creating a mix of categories and placing the evidence collected within these categories, while Table 5 shows the results of a similar exercise for TM categories (see also Annex 3 for an indicative example of the data sets thus generated).

Analytical category			Excerpt from		
Main	*Sub-category*	*Examples*	*Interview data*	*Data from documents*	*Pertinent observations*
Landscape level	Globalisation	Privatisation			
	CDM landscape	Interest in obtaining carbon credits			
	Donor programs	Relevant donor support activities			
	Other landscape factors	Other examples			
Niche level	Energy efficiency (EE)	Investment in EE measures			
	Wind energy niche	Feasibility studies			
	Refuse Derived Fuel (RDF)	Lobbying for RDF use			
	Olive pomace	Experimentation at industry level			
Regime level	Waste regime	New waste management strategies			
		Unclear mandates across waste actors			
	Energy regime	Resistance to liberalising electricity production			
		Renewable energy policies			
Niche-Regime-Landscape interactions	Stabilising mechanisms				
	Destabilising mechanisms				

Table 4: Matrix used to operationalise MLP categories

Level	TM Governance activity level		Excerpt from		
	Systemised concept	Sub-activities at given activity level	Interview data	Data from documents	Pertinent Observations
Strategic	Answers why a transition is needed, maps current flaws in a system and establishes sustainability criteria	Establishment of a transition arena			
		Problem structuring			
		Envisioning of futures			
Tactical	System structures are broken down to sub-systems, new coalitions foster new ways of thinking, formulation of concrete targets or objectives, transition pathways devised through back-casting and forecasting.	Coalition building			
		Development of images and transition agendas			
		Development of transition scenarios			
Operational	Identification of where experimentation is needed, actual implementation of experiments, coordination	Mobilisation of actors			
		Execution of activities			
Reflexive	Evaluation of situation at different levels, their interrelation and misfit, and adjustment in vision, agenda and coalitions	Monitoring of the process			
		Evaluation and re-orientation			

Table 5: Matrix used to operationalise TM concepts

Another procedure followed in the analytical phase of this research involved an investigation of the frequency of occurrence of events (based on the analytical categories of interest) scoped out from the interview data, as in Table 6 (see also Annex 4 for an example of the tables thus generated). This process also enabled triangulation within the primary data collected.

Analytical Category		Frequency of occurrence across					
Main	*Examples*	*Interview 1*	*Interview 2*	*Interview 3*	*Interview 4*	*Interview 5*	*Interview N*
Landscape level	Effect of privatisation on niche development and regime changes						
	Effect of CDM investments on niche development and regime changes						
	Effect of donor activities on niche development and regime changes						
	Effect of other landscape factors on niche development and regime changes						
Niches level	Investments in EE measures						
	Feasibility studies on Wind energy						
	Lobbying for RDF use						
	Experimentation with olive pomace use						
Regimes level	Impacts of resistance to liberalising electricity production						
	Impacts of unclear mandates across waste actors						
	Impacts of new waste management strategies						
	Impacts of renewable energy policies						
	Other impacts						

Table 6: Matrix used to analyse the frequency of occurrence of events of interest

In summary, those analytical procedures described above contributed towards enhancing the construct reliability of this study, that is, whether operational procedures have been adopted that meaningfully capture the concepts investigated (Yin 2013).

As a further strategy to enhance the rigour of this thesis, supplementary measures were adopted to establish causal relationships within the narratives presented within it, thus ensuring its internal validity. For instance, particular care was taken during data analysis to cross-examine primary data gathered from industry and public informants with potentially less biased sources of information such as independent consultants and donor organisations. Moreover, the search for patterns in the interview data was triangulated with data gathered from multiple sources of evidence, which, in total, comprised (a) twenty semi-structured interviews with key actors from across the cement sector in Tunisia, (b) documentary material such as published statistics, firm and consultancy reports, material handed over by interviewees, donor evaluation reports, pertinent publicly available reports and scientific articles, (c) direct observations made during a visit to a cement factory, and (d)

participation at three donor-funded workshops[21] in Tunisia related to the topics addressed in this thesis. Additionally, to enable the construction of the more robust narratives that are included in this thesis, further analyses of collected data were undertaken through (i) the creation of different data displays pertinent to the arguments put forward in this study (for example, see Annex 5), and (ii) a mapping of the chronology of key events of interest within the case study devised (Annex 6).

The next section describes the data collection and case-study methodology adopted by this study.

3.2 Data collection and case study methods

3.2.1 Field procedures

Primary data collection for this thesis was initiated during a two-week pre-field trip undertaken from the end of March to mid-April 2014 in Tunis, Tunisia, during which six interviews were held with actors from government and donor organisations, including one independent consultant involved in low-carbon initiatives in the Tunisian cement sector. The primary objectives of this trip were to refine the initial research design based on actual empirical insights, to test some interview guides and techniques, and to obtain a better picture of the local context. This initial pilot study also provided a means to (i) explain the nature of the study to respondents, (ii) identify potential gate-keepers to other pertinent local actors and institutions active in the cement sector in Tunisia, and (iii) devise a case-study protocol and a data-collection plan, including logistical arrangements for a longer field trip scheduled in the subsequent year.

This initial field trip resulted in a new research design being crafted. A case study protocol, comprising an overview of the study, procedures that could be adopted to gain access to the field, required sources of information, reminders and interview guide questions, was also formulated for a second in-depth data-collection phase. The bulk of primary data collection subsequently took place from April to May 2015 in Tunisia, during which period fourteen further semi-structured, face-to-face interviews were conducted with representatives of key cement industry actors and donor organisations actively involved in the cement sector in Tunisia. Key challenges in this particular phase of data collection included (a) initial limited responses from the responsible authorities as a result of the political instability that followed the Tunisian revolution of 2011, and (b) limited opportunities to travel to distant cement firms due to security concerns in the aftermath of the terrorist attacks in 2015. These challenges were addressed by identifying new gatekeepers and maximising opportunities to meet with cement industry actors through workshops held in the vicinity of the city of Tunis.

Snowball sampling methods guided the identification of key local actors. An introductory letter was forwarded to identified interviewees prior to scheduled meetings (or submitted at the start of the interviews when the email addresses of respondents were not

[21] These were a UNDP-supported "NAMA support to the Tunisian Solar Plan" workshop held on 4 April 2014 at the Hotel Le Concorde in Tunis, a EU-supported "Development of carbon markets in the MENA region: perspectives of new market mechanisms" workshop held on 23-24 April 2015 at the Ramada Plaza Hotel in Gammarth, and a UNEP-supported "Technology Needs Assessment for adaptation and mitigation" workshop held between 27-30 April 2015 at the Tunis International Centre of Environmental Technology (CITET) offices in Tunis.

available) explaining the nature of the case study, as well as formally soliciting the interviewees' readiness to participate in the research. The interviews were held in various locations ranging from a hotel lobby during a workshop break, a cafeteria of a government body, government offices, industry premises and private offices located across two cities, namely Tunis and Ariana. These interviews lasted from forty minutes to three hours and were digitally recorded when permission was granted, with the remaining interviews being documented through extensive field notes.

In interviews, particular attention was paid to minimising bias and avoiding the creation of expectations. For example, in Tunisia, French and an Arabic dialect are the most commonly spoken languages. Therefore, French was used while conducting interviews so as to enable respondents to express themselves more fluently. So as to check for differences in narratives, interviewees were also asked similar questions that were phrased differently. In all interviews, the purpose of the research was clarified with respondents at the start of meetings so as not to create any expectation of potential benefits other than being sent copies of any articles that would be produced. Furthermore, as far as possible, care was taken so as to blend into the local culture, such as appearing in suits when holding meetings.

Transcription was initiated on the day the interviews were held to enable reflection on the appropriateness of interview questions and to re-orient those questions according to new information gathered. The remaining interviews were transcribed and analysed after returning to Denmark. A case-study database was kept to help in undertaking subsequent analyses. This database essentially comprised digital audio recordings, translated transcripts of interviews and secondary data collected throughout the research. The privacy and confidentiality of participants were protected and ensured by anonymising data gathered during both analysis and reporting.

In combination, the field procedures described above contributed to ensuring the reliability of this study. As described by (Yin 2013), reliability is the degree to which a study and its methodology are so well-defined that others could, in principle, follow the same steps and reach the same findings and conclusions. Through (i) documenting the operational procedures followed in conducting the research, (ii) making use of a case-study protocol, and (iiI) keeping a case-study database, the thesis has been provided with a clear audit trail that contributes towards strengthening its reliability.

3.2.2 The case-study methodology

According to (Yin 2013), case studies are appropriate when (a) the focus of the study is on the "how" and "why" questions, (b) a researcher does not have an influence over the actions of those involved in the study, (c) the aim of the study is to illuminate important contextual conditions of relevance to the phenomenon being studied, and (d) the boundaries are not clear between the phenomenon and the context. This study meets these criteria. To begin with, it uses the transitions literature to investigate *how* donor interventions influence sustainability transitions in a developing-country context and *why* donor programs have not had more impact in the case of the Tunisian cement sector. Secondly, since the investigation was conducted into events that have already happened or frameworks that have already been set by donors, the research has not been able to influence the past actions of the participants involved in the study. Finally, the contextual conditions that influence donor programs, the boundaries of which are not clearly demarcated, lie at the core of this study. Hence, the use of a case-study methodology was

chosen as the most appropriate research strategy with which to answer the overall research question.

With regard to the empirical explorations of the thesis (i.e. in Papers 2 and 3), the overall research question is answered by means of a case study of multiple donor-induced planned interventions for low-carbon development targeting the transformation of the cement sector in Tunisia. This study case focuses on donor support aimed at nurturing low-carbon transitions in a developing-country context. Hence, the main research question explores theoretical and analytical insights through which donor support to low-carbon transitions in developing countries may be understood.

The subsidiary research questions in the individual empirical papers provide two embedded themes for further analysis that stem from the overall case study. On the one hand, Paper 2 describes multiple donor-support programmes for low-carbon transitions carried out in the Tunisian cement sector between 1990 and 2015. This question addresses a gap in research pertaining to donor support to an energy-intensive industry in a developing-country context (alluded in section 1.3). Paper 3, on the other hand, illustrates the case of donor support through a NAMA intervention targeting the Tunisian cement sector. While the NAMA was not explicitly described as a transition-promoting intervention, NAMAs are increasingly being framed as vectors of transformational change to low-carbon and sustainable development by the UNFCCC and key climate funds such as the Green Climate Fund and the NAMA Facility. Therefore, by bringing in insights from the sociotechnical transitions literature, the assumption is that this approach can enrich the NAMA community and attend to the paucity of academic literature that explores what designing for transformational change (or paradigm shift) concretely means (thereby attending to the corresponding gap in the NAMA literature mentioned in section 1.3).

In summary, this thesis is based on a single-case study with two thematic focus areas, as depicted in Figure 5 (Adapted from Yin (2013)).

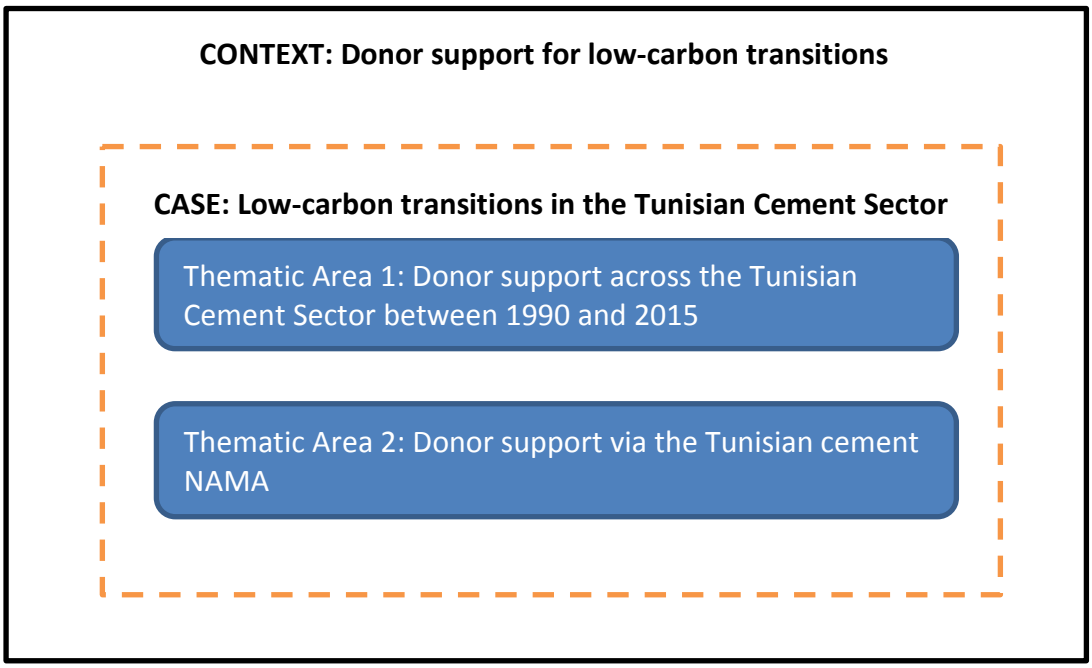

Figure 5: Case-study design

Thematic Area 1: Donor support across the Tunisian cement sector

The Tunisian cement sector possesses a number of pertinent characteristics that justify choosing it for an academic study based on a socio-technical analytical perspective. First, despite the promotion of a number of low-carbon development measures by donors (such as GIZ, the World Bank, UNDP, the EU, among others), government (through public policies, financial incentives, creation of institutions, etc.) and industrial actors (through new technologies, modernisation of equipment, undertaking trials, regrouping and lobbying, etc.), it has remained a rapidly growing and carbon-intensive sector (MoELPSD, 2014). This observation spurs an interest in investigating the underlying reasons that account for the apparent lack of efficiency of the development of low-carbon measures.

Secondly, the Tunisian cement sector constitutes an object of analysis that is both wide enough to be framed as a socio-technical system and specific enough to enable reasonable data collection from a number of key actors (identified via interviews conducted during a pre-field trip undertaken in 2014) and by means of a review of publicly available documents. These comprise of the nine cement factory units belonging to eight different industrial groups (see Table 2), a cement-producers' union, donor agencies that are particularly active in the sector, energy agencies and key ministries interacting with the industry, such as the Ministry of Energy, Industry and Mines, the Ministry of Environment and Sustainable Development, and local authorities responsible for waste collection.

Lastly, the cement industry has a long history in Tunisia, dating back to the 1930s (see Section 2.1). Over time, the industry has witnessed major changes such as a wave of privatisations and the depletion of national fossil-fuel reserves, making this case a particularly interesting one to analyse using a socio-technical approach. Furthermore, data collection enabled triangulation over a 25-year period, which corresponds to a long-term perspective consistent with transition studies.

Thematic Area 2: The Tunisian cement NAMA

As explained in Section 3.1.1, the focus of this thesis has evolved considerably from the start of the PhD. To address the original focus of the thesis, which was on methodologies to assess the sustainable development impacts of NAMAs, a continent-wide scoping for countries with the most advanced Nationally Appropriate Mitigation Actions across Africa was undertaken in 2013/2014. With six NAMA initiatives under consideration at that point in time, Tunisia emerged as a front-runner in NAMA development in Africa. These NAMAs targeted the cement, buildings,[22] solar, transport, wastewater and forestry sectors. Interviews conducted during the April 2014 pre-field trip revealed that the cement NAMA, which covers mitigation measures across the Tunisian cement sector, was the most advanced. Given that this stage of development implied a more mature level of thinking behind NAMA design, the cement NAMA emerged as an appropriate basis for further analysis.

Initiated in 2012, the Tunisian cement NAMA was developed through technical and financial assistance from the German Development Cooperation Agency (GIZ) (section 2.4). A technical working group was established in 2013 under the coordination of the Tunisian energy management agency (Agence Nationale pour la Maitrise de l'Energie, ANME) to examine viable mitigation options for the Tunisian cement sector and make

[22] Recently, the Tunisian buildings NAMA was submitted to the NAMA Facility for consideration. In March 2017, the NAMA Facility agreed to fund the development of a detailed project proposal targeting 134 MW of additional photovoltaics in the building sector, to be implemented over 2019-2023 (NAMA Facility 2017).

recommendations. Though implementation had stalled in 2014, in mid-2015 the European Union agreed to extend 7.6 M Euros of financial support to Tunisia with a view to developing the cement NAMA further (EU n.d.). The slow development of the Tunisian cement NAMA echoes that of NAMAs more broadly internationally. Presently, despite the steady increase in the number of NAMAs registered with the UNFCCC's NAMA registry from its launch in 2012 to reach 182 submissions as of January 2018 (see Figure 6 below), NAMA implementation is still relatively rare. Indeed, only 18 NAMAs[23] had secured funding as of January 2018, with the remaining NAMA submissions seeking either (i) recognition (10 NAMAs), (ii) support for implementation (83 NAMAs) or (iii) support for preparation (71 NAMAs) (UNFCCC Secretariat 2018).

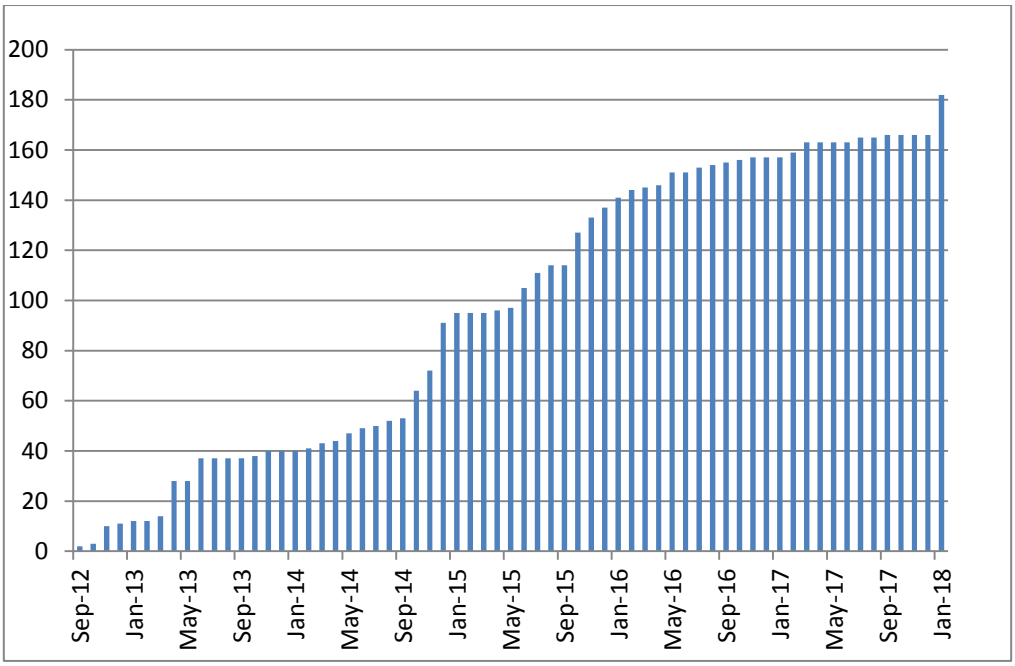

Figure 6: Cumulative number of NAMAs registered over time with the NAMA Registry
(UNFCCC Secretariat 2018; UNEP DTU Pipeline 2018)

[23] Most of the supported NAMAs focus on the energy sector, with the involvement of donor entities such as the NAMA Facility, the Global Environment Facility, the Inter-American Development Bank or development cooperation agencies from individual countries such as Japan, Spain, Australia and Austria. Furthermore, based on different data sources, (Afanador et al. 2016) point to a total of 19 NAMAs having secured financing as of November 2016.

4.0 Thesis findings

4.1 Paper 1

The concept of transformational change is rapidly gaining importance in international climate finance, although a robust operationalization of the term is still lacking. Without a fresh look at how to approach processes of change for transformational impacts in developing countries, there is a high risk that the concept will come across as a new donor conditionality, thus missing out on the opportunity to guide the implementation of climate action in developing countries to satisfy ambitious goals for mitigation and sustainable development. Especially in the field of funding for NAMA development and implementation, losing such an opportunity may lead to sub-optimal results. Given the limited funding available, this situation should be avoided. To attend to this gap, Paper 1 investigates the approach adopted by two of the major institutions in developing-country climate financing, namely the Green Climate Fund (GCF) and the NAMA Facility, in operationalising the concept of transformational change through NAMA interventions.

Through a theoretical comparison of the influence of the mainstream management approaches that prevail across the donor community, namely "logical framework approaches" (LFA), with pertinent planning methodologies rooted in academic work on ways of managing sustainability transitions, Paper 1 addresses the research questions of whether traditional donor planning interventions foster transformations and how such approaches can be improved. To this end, inspiration is drawn from the Transition Management literature. While the TM literature has mostly centred on studying policy experiments in developed countries, its coverage in other empirical settings, other sectors and countries and at other scales is still limited. Paper 1 therefore addresses two knowledge gaps: (a) an empirical one pertaining to the current state of confusion regarding operationalising transformational change within key climate funds; and (b) a concurrent knowledge gap in the Transition Management literature by applying its theoretical perspectives to a new setting, namely the funding of NAMAs in developing countries.

This paper finds that the two planning approaches differ in how change processes are envisaged at the theoretical level, that is, (i) either as linear processes within the LFA case, or (ii) as complex processes, with multiple causality and feedback loops, in the TM tradition. The article suggests that the LFA's limitations lie in its rigidity and its fundamental assumptions of powers of foresight and authoritative control. Therefore, the key conclusion of this paper is that the logical framework-based approach adopted by the Green Climate Fund and the NAMA Facility contains implicit assumptions about causality, which do not adequately cater for the uncertainties, non-linearity and feedback loops inherent in transition processes. In Paper 1, it is further argued that the inherent rigidity of LFA-based management approaches in planning and evaluating donor interventions hinders learning and adaptation within NAMAs, favouring system optimisation instead of also promoting system innovation.

This paper identifies opportunities to make these funds more effective through the integration of more reflexive and adaptive elements as a means of catering to the uncertain and co-evolutionary nature of processes of transformational change. This would allow strategic re-orientation based on lessons learnt through a planned transition initiative as an alternative to the blueprint planning that characterizes both the GCF's and the NAMA Facility's *modus operandi*. The paper also suggests that managing transitions involves

experimenting, so that policy design for transformational change can be viewed as a process of discovery for the actors involved. In summary, the systems perspective adopted in sustainability transition theories is recommended as a more rewarding approach to understanding how attempts at incurring transformational change in developing countries play out.

Paper 1 contributes to the nascent literature exploring links between NAMAs and transformational change objectives by (i) exposing the limitations behind the current thinking underpinning NAMA funding, and (ii) suggesting better ways to operationalise and implement processes of transformational change. While the NAMA acronym is likely to be phased out in the long-run due to its absence from the text of the Paris Agreement, the policies and actions on which NAMA interventions are based remain essential features of any ambitious climate measures. Hence, the findings of this paper are policy-relevant not only for NAMA implementation, but also for broader Nationally Determined Contribution (NDC) processes, as countries now turn to implementing the political commitments set out in the Paris Agreement.

This paper also contributes to the Transition Management literature by critically reflecting on its applicability to governing sociotechnical transitions in the developing world. Further research is suggested regarding how to reconcile donor accountability concerns with TM's innovative open-ended approach and how to contextualize the application of TM principles in developing-country contexts.

4.2 Paper 2

Paper 2 extends the theoretical discussion initiated in Paper 1 (on the influence of management approaches underpinning donor interventions) and provides the basis for a regime-level analysis in Paper 3 (on whether the Tunisian cement NAMA attends to causes of lock-in in the cement sector). Using the Multi-Level Perspective as an analytical framework, this paper examines the key factors that have influenced the development of four niches with the potential to improve the sustainability of the Tunisian cement sector from 1990 to 2015. By focusing on the role of external donor interventions in the development of (i) an energy efficiency niche, (ii) a wind energy niche, (iii) a refuse derived fuel niche (RDF) and (iv) an olive pomace niche within the Tunisian cement sector, this paper addresses a gap in the literature by exploring the role of donors in promoting sustainable transitions.

The paper finds that the niches analysed experienced a period of relative momentum, influenced by a complex interplay between technical, economic, political and social factors. Of those factors, donor interventions, conceptualised as a landscape factor of particular relevance to the developing world, played a key role in each of the niches examined. Indeed donors encouraged niche development by providing advice, consultancy and capacity-building activities to promote changes in the political and regulatory set-up. Donors also engaged in promotional activities aimed at raising the expectations of niche actors by creating knowledge-sharing platforms and supporting the creation of cooperative arrangements, such as industry associations and lobby groups. Furthermore, donor programmes directly incentivised cement companies to pursue feasibility studies and plant investments through the provision of co-financing for specific projects. However, the niches were halted before reaching a stage where they could create a significant, transformational impact on improving the sustainability of cement production in Tunisia. Indeed, for the most

part, the niches were not even manifested in tangible niche-level experiments on the ground.

The paper identifies four main inhibiting factors that account for stifled niche development in spite of the numerous donor programmes implemented over time in the Tunisian cement sector. The first limitation relates to the rapid and considerable reduction in carbon credit prices, which prompted cement companies to reassess their interests in investing in CDM-related projects, especially with regard to wind energy. Secondly, the rise of an export market for olive pomace caused a significant increase in prices, while reducing the ability of firms to obtain long-term biomass fuel-supply contracts. As a result, the reduced economic viability of using olive pomace in cement kilns convinced cement companies not to pursue further development of this niche. Thirdly, the active opposition of the national utility company to the inclusion of Independent Power Producers, which resulted in prolonged project approval processes, meant that cement companies did not proceed with the development of previously planned wind-farm projects. Finally, the prevailing instability in the waste management regime, characterised by long-standing conflicts among the actors and agencies involved, made it impossible for cement companies to establish arrangements for the collection and distribution of RDF for use as a fuel in cement kilns.

The findings in Paper 2 suggest that, despite the fact that donor agencies are crucial actors who can provide key resources for promoting sustainable transitions in developing-country contexts, as external actors they are constrained by a number of context-specific factors. These factors are not easily resolved given the short time-frame, the limited decision-making authority and the often uncoordinated nature of successive interventions.

This article contributes to socio-technical transitions theories by (a) proposing a detailed understanding of the role and limitations of donors as a key landscape factor involved in niche development, and (b) suggesting that, contrary to mainstream belief in the MLP literature, landscape factors may have a more direct influence on niche development than previously assumed. Furthermore, the paper differs from the prevailing positive discourse prevalent in the donor-focused grey literature in suggesting that development practitioners and donor agencies need to reflect critically on the levels of ambition and expectations of various programs, especially regarding global mitigation efforts through implementation of the Paris agreement. Further research centred on landscape factors and on the effectiveness of development aid in promoting niche development is suggested.

4.3 Paper 3

Building on the analysis undertaken in Paper 2, Paper 3 addresses the scarcity of empirical studies of how transformational change policies and actions are designed and supported in practice. This gap in knowledge is filled through an analysis of the means and extent to which a donor-supported cement-sector NAMA intervention, developed in Tunisia between 2012 and 2013, is promoting transformational change to low-carbon development. To analyse the influence of the NAMA on existing regimes, (i) the concept of multi-regime interactions is applied within the Multi-Level Perspective school of thought, (ii) the theoretical prescriptions for regime transformations coined within the Transition Management literature are used as an idealised model to steer sustainable transitions, and (iii) the cement NAMA is conceptualised as a planned intervention that aims to challenge the current carbon-locked way of producing cement.

The key finding of this article is that the Tunisian cement NAMA is not likely to induce transformational changes since underlying factors accounting for carbon lock-in have not yet been properly addressed. While (i) the establishment of a transition arena, (ii) undertaking problem structuring, (iii) envisaging possible futures, (iv) building coalitions, (v) mobilising actors, (vi) integrating some evaluation features, (vii) planning consultations, sensitisation programs and pilot plants and (viii) creating independent institutions have been found to act as transitions promoting NAMA design elements, these factors mainly only scratch the surface of regime-level barriers without adequately addressing their underlying causes. Indeed, the absence of financiers and commitments from key actors, as well as the postponement of hard decisions, have been identified as key barriers to the effective transition management of the cement industry. Furthermore, the lack of commitments from the key actors involved suggests that the cement NAMA is failing to take into account the potential countervailing strategies of regime actors such as the Tunisian electricity utility company, which has historically resisted the emergence of Independent Power Producers.

A close examination of the methodological and coordination approach used within the NAMA points out further drawbacks. First, given the deliberate appropriation of the transition agenda by industry incumbents during the NAMA's formulation, underlying reasons for path dependency may have been overlooked. This suggests that the NAMA's design has not been adequately tuned towards avoiding being locked into sub-optimal measures. Secondly, the cement NAMA's design adopted a control-oriented approach, along the lines of the logical framework thinking that prevails across causal models in development cooperation. Its lack of consideration of (i) the long-term envisioning of cultural and societal change, (ii) experimentation, and (iii) feedback mechanisms further suggests that the NAMA is at best likely to favour system improvement measures (incremental adjustments) as opposed to a combination involving system innovation measures.

Measures are suggested so as to reorient the Tunisian cement NAMA towards system innovation. These include reviewing (a) the NAMA action plan together with funding partners, (b) promoting the self-contemplation of cement industry actors when proposing mitigation options, and (c) re-designing the NAMA's current Monitoring, Reporting and Verification mechanism by integrating more feedback loops. This paper thus provides an empirical contribution to NAMA scholarship, while also offering a conceptual contribution through an analytical framework that can be used to study donor interventions. In conclusion, Paper 3 argues that designing policies and actions for transformational change requires (a) the early involvement of finance actors, (b) care in avoiding sub-par systems, and (c) a review of donor modalities.

By applying the TM perspective to a developing-country context, this paper highlights issues that are not usually addressed in this body of literature. For example, the absence of prior coordinated approaches to introduce structural reforms to the Tunisian cement sector suggests that the workings of a transition arena in a developing-country context may be even more challenging than in a developed one. Additionally, the policy entrepreneurial role of donors is, relatively speaking, not well theorised within TM scholarship, with developed-country applications of the framework not capturing such actors. This study therefore suggests further related research on these topics.

5.0 Conclusions

5.1 Main Findings

This thesis has set out to investigate how donor interventions influence sustainability transition in developing countries through the case of external donor support to low-carbon production in the cement sector of Tunisia. This overall research question was studied through (i) a theoretical review of management approaches across the donor community in Paper 1, and (ii) an empirical exploration of the impacts of donor interventions on low-carbon transitions in the Tunisian cement sector in Papers 2 and 3. While Chapter 4 summarises the findings of individual articles, this chapter provides a synthesis of the arguments made in the papers in relation to the overall aims of this research. To explain the contributions of this thesis, its main findings have been organised into two key themes that are relevant to practitioners, policy-makers and the sustainability transition research community: (a) how donors promote sustainability transitions, and the limitations of such approaches; and (b) the lessons learnt when applying transition theories to developing-country contexts. These will be discussed in the following sub-sections, which include a reflection on the limitations of this study and areas where further research is warranted.

5.2 How donor interventions promote low-carbon transitions, and the limits of such approaches

The findings of this thesis contribute mainly to the literature through a reflection of the role of donors in promoting low-carbon transitions, which as yet has seen only limited academic coverage (see section 1.2.5). This gap in knowledge stands in contrast to the increasing amount of bilateral and multilateral climate financing being dedicated to addressing the growing contribution of the developing world to global emissions of greenhouse gases.

Donor support mechanisms for low-carbon transitions

First, the research presented in this thesis reveals how the technical and financial assistance programs of aid organisations are addressing the factors that are hampering low-carbon development measures across recipient countries, such as a lack of local expertise, of coordinated action and of available funding. For example, to deal with a scarcity of locally available knowledge on undertaking scientifically informed baseline assessments and scenario-building exercises, donors have facilitated access to relevant international expertise within the formulation of the Tunisian cement NAMA that enabled cement-sector actors to quantify and assess viable mitigation options for the sector. Donors have also been instrumental in mobilising previously loosely connected local actors around low-carbon development initiatives by creating knowledge-sharing platforms, task forces, new institutions and regulatory frameworks, as well as through capacity-building activities. Through these interventions, local actors have been able to address climate mitigation measures in a more coordinated and synergistic manner, leading to a number of niches emerging within the Tunisian cement sector. Furthermore, this thesis has underlined the importance of extending financial support to developing countries in promoting local mitigation projects. Grants and credit lines provided by donors have enabled cement industries to undertake energy audits, invest in more environmentally friendly equipment and carry out feasibility studies to develop wind-farm projects, for example.

While such development assistance programs are manifestations of support extended to recipient countries, this thesis also shows how Logical Framework Approaches (LFA) within climate funding modalities provides a more subtle and indirect means through which the donor community can encourage transitions to low-carbon development. By imposing LFA as an essential feature of access to climate finance, donors compel project developers to think rationally and to structure project formulation for implementation in the developing world. This feature was particularly illustrated in this study through the approval procedures set out by the Green Climate Fund and the NAMA Facility.

Through these support mechanisms, donors have contributed to increasing the expectations of local actors regarding low-carbon transition in the Tunisian cement sector. Such expectations have been translated into regime actors engaging in activities to promote the development of low-carbon measures and industry incumbents playing an active role in pursuing initial project planning, direct investments and lobbying efforts. While these findings suggest that international support agencies are playing an important role in transitions (Berkhout et al. 2010) as policy entrepreneurs (Meijerink & Huitema 2010) or by providing support to niche development (Hansen & Nygaard 2013), more importantly this thesis also draws attention to a number of challenges that donor-induced transitions face.

The limitations of donor approaches for low-carbon transitions

Despite the paucity of research on how donors attempt to stimulate sustainable transitions in the developing world, the few research articles published to date have nonetheless pointed to a number of drawbacks to such interventions. These constraints can be articulated around a lack of attention in donor programs towards addressing the full range of actors involved in transitions, measures tuned to the local context, and long-term concerns inherent in transitions (Marquardt et al. 2016; Hansen & Nygaard 2013; van Alphen et al. 2008; Tigabu et al. 2017).

Along the broad lines of the findings of this literature, this thesis provides refined understandings of the factors that limit donor attempts to promote transitions. First, the deferral of hard decisions by local actors and the absence of financial actors from the formulation of planned donor interventions are major impediments to the credibility and ease of implementation of such programs. This was particularly observed in the case of how the Tunisian cement NAMA was drawn up, whereby difficult choices regarding formal policy decision-making and industry commitments were put off to a later stage, and the crucial perspectives of finance actors were not factored in. As a result, operationalisation of the NAMA's action plan stalled, and initial attempts at securing funding for implementation were turned down. Secondly, this thesis suggests that current donor strategies to promote low-carbon regime architectures in the developing world are limited. Indeed, this research depicts the relative inadequacy of current donor interventions in effectively addressing the local political processes and actors' interests that hinder the development of low-carbon measures in developing countries. Such limitations were particularly evident within the energy and waste management regimes in the case study investigated, which were characterised by internal conflicts. Lastly, the short-term nature of donor support, combined with uncoordinated action between donors, suggests that, in their current form, such interventions cannot mobilize enough momentum to overcome regime resistance and lock-in. Indeed, the findings of an analysis of development aid extended to the Tunisian cement sector between 1990 and 2015 show that scattered donor interventions, as well as related

issues of duplication and sub-par resource use, have contributed to the limited effectiveness of low-carbon measures.

In contrast to the existing literature, this study has revealed two additional factors that constrain donor efforts to sustain transitions. First and foremost, the difference in concepts and thinking between the non-linear, long-term characteristics of sustainable transitions and the short-term, means-end approach favoured by current donor modalities through the use of LFA reveals a knowledge gap among donors. While LFA play a crucial role as planning tools in development aid, their use as analytical tools to examine the complex relations within transformational processes is problematic. Inherent assumptions of foresight and control that are prevalent in LFA diverge from the understanding across the literature that changes in transitions are typically difficult to predict. To illustrate this dichotomy, this study unveiled the crash of carbon credit prices and the rise of an export market for olive pomace as unforeseen structural conditions that caused the demise of two promising externally supported low-carbon measures - a CDM wind energy niche and an olive pomace niche - within the Tunisian cement sector. Such difficulties in predicting the outcomes of planned interventions highlight the importance of adaptation and learning over time to inform implementation measures and modalities.

This argument leads to the second empirical conclusion of this thesis. A lack of reflexivity to break away from the stickiness of path dependency during the design of planned interventions was identified as another critical element hindering donor-supported sustainable transitions. This observation was substantiated through the lack of consideration given to experimentation and feedback loops within the funding modalities of the Green Climate Fund and NAMA Facility, as well as in donor programs implemented across the Tunisian cement sector. This limited integration of social learning within donor interventions ignores the mutual dependencies between their planned implementation processes and expected outcomes. Furthermore, the deliberate appropriation of the transition agenda by industry incumbents within the coordination approach of the Tunisian cement NAMA provides another illustration of the reflexivity deficit of donor interventions. This capture entailed the restricted ability of participating firms to reflect in an unbiased manner on their existing practices, cultures and structures that contribute to carbon lock-in.

The influence of donor interventions on low-carbon transitions

In summary, by studying donor interventions through the lenses of theories of sustainability transition, this research points out that development aid enables low-carbon measures to take off within developing-country contexts. Donor support, whether direct or indirect, enables niche development, promotes regime-level changes through political and regulatory reforms and, more broadly, provides a basis for rational thinking and project structuring. Concurrently, this study also reveals that current donor approaches suffer from a number of caveats restricting the impacts of donor action. The support offered does not fully address the challenges of a fundamental shift to more sustainable modes of production and consumption across recipient countries, such as path-dependency and lock-in. The lack of reflexivity observed in the design of planned interventions is of particular relevance to this claim. Also, in the transitions literature, it is found that such limitations may constrain transition initiatives -- in this case, donor support programs -- in optimising sociotechnical systems, instead of also promoting the essential system innovations required to produce transformational impacts (Kemp et al. 2007; Voß et al. 2009).

These findings are relevant for policy-making internationally. Since the historic climate deal reached at the 21st Conference of Parties to the UNFCCC in 2015 was ratified earlier than expected in 2016, countries are now moving to an execution phase of Nationally Determined Contributions. These recurring five-year political commitments are meant to represent the most ambitious mitigation goals of the signatory parties, with successive NDCs being required to show progress over previous ones. Given this requirement for sustained increases in levels of ambition over time, there is a need for a paradigm shift in devising technical and financial support mechanisms to achieve low-carbon development in the developing world. In contrast to expectations within the climate community for wide transformational impacts, this thesis suggests that the implementation of planned policies and actions to operationalise the pledges set out in the Paris Agreement run the risk of underperforming due to the limitations in donor support that have been highlighted. To avoid such a situation, from the findings of this thesis, donor agencies may learn to reflect critically on their ambition levels and modalities for support to planned interventions. The findings of this thesis thus provide knowledge and new insights that may enhance the impacts of donor activities in the developing world.

5.3 Applying sustainability transition theories to developing country contexts and the need for further research

As mentioned in section 1.2.3, applying transition theories to developing-country settings enables researchers to envisage alternative operationalisations of transition concepts specific to political, economic, cultural and technological settings in a developing country. This thesis has followed in the steps of the growing number of scholars who are engaged in this field by applying the Multi-level Perspective and Transition Management frameworks to the study of donor support for low-carbon transition of the cement sector in Tunisia. The key insights generated when applying its concepts to a developing country context are summarised in the following paragraphs.

Utilising MLP concepts in developing country contexts

Whereas the landscape concept is frequently used as a residual category in empirical research to describe the broad context or background for regimes and niches, this thesis differs by conceptualising donor interventions as a key landscape factor providing a flow of finances and innovative ideas to the developing world. Through this approach, the landscape factor has been observed to exert destabilising pressures directly on both niche and regime dynamics. This understanding of landscape factors contrasts with traditional interpretations across the literature, whereby landscape influences on niches are viewed as more diffuse and indirect, as opposed to the influence of regimes on niches, which are stronger and more direct. Given the dearth of scholarly work on the matter, these findings suggest that further research is required to enlighten the often elusive and ill-defined concept of landscapes.

Within the case study investigated, what further differentiates the niches analysed in this thesis from most studies in the literature is that they have been driven by external donors rather than local actors, thereby attending to a lack of local expertise, of coordinated action and of available funding in developing country contexts. The results obtained have shown that the four niches examined were fragmented and isolated, with their development expanding and contracting erratically over time, depending on contextual

conditions. In the end, however, those niches have been restricted to a very early stage of development - corresponding to niche level experiments, as is more commonly referred to within MLP literature (Verbong et al. 2010; Wieczorek et al. 2015). These observations can reasonably be expected to occur in many developing countries that submitted Nationally Determined Contributions to the UNFCCC in the build up to the Paris Agreement in 2015. Indeed this process of framing national political commitments has been undertaken very rapidly, leading to many countries devising new mitigation projects and targets under the condition of financial, technological and other support being provided. Therefore, in line with the findings of this research, studies pertaining to the operationalisation of NDCs through donor support for low-carbon transitions may need to build on loosely connected socio-technical configurations, rather than on fully materialised niches. In turn, this calls for further academic enquiries into pre-niche formulation processes and their theoretical conceptualisations within transition studies.

While transition theories often conceptualise regimes as monolithic, this thesis contributes to an emerging research agenda that is investigating multi-regime interactions (Raven & Verbong 2007; Konrad et al. 2008; Slingerland 2014; Sutherland et al. 2015). However, given that this literature is still under-developed, further research on the topic is required. Additionally, while it is commonly assumed within transition theories that disrupting regime stability is a key element of niche development and uptake, this thesis unveils a different story by showing that, in developing-country settings, regimes can prove to be more fluid (Klerkx et al. 2018). In the case study investigated here, it was observed that an excessively unstable regime can also inhibit the unfolding of transitions. This was particularly evident within the waste management regime in the Tunisian cement sector, where the development of a refuse derived fuel niche lost significant momentum as a result of a series of conflicts within the regime. Such features of multiplicity and dysfunctional regimes (Wieczorek 2017) differ from regime understandings in well-structured developed nations, reflecting the complexity of social relationships in developing countries (Ramos-Mejía et al. 2017). These findings suggest that further focussed research is needed on (i) regime instability as a topic in its own right, and (ii) the levels to which regime instability can cause niche development to decline.

Utilising TM concepts to study transitions and donor interventions

This thesis has also made use of TM as an analytical tool to compare and contrast its approach towards governing transitions with those embedded within donor agencies and instruments aiming at incurring wide ranging transformational changes towards low-carbon development. In so doing, TM is not viewed as an all-encompassing, general solution towards addressing the climate change challenge. Rather, this comparative approach has been adopted as a way to analyse how existing donor governance paradigms influence low carbon transitions, thereby enabling an examination of how methodological and design approaches, as well as practices either promote or limit transitions towards sustainability. By applying this approach within the thesis, TM has been a useful framework in the case study investigated, especially as a means to understand the span of technical and societal changes in a developing country context. Following the theoretical comparison of TM principles of transition governance with governance paradigms behind donor interventions in section 1.2.4, the findings obtained within this thesis have empirically illustrated how (a) caveats in donors' methodological approaches, (b) the short-term and uncoordinated nature of donor interventions, as well as (c) the use of standardised management models, limit the

ability of donors to effectively contribute towards sustaining transitions in developing countries (section 5.2). To overcome these weaknesses, some recommendations are suggested.

Firstly, to avoid capture of transition agendas and effectively provide participants with a space whereby they may question and reflect on existing cultures, structures and practices that contribute to lock in, one suggestion is to complement donor approaches with TM principles of selective participation of "frontrunners" - agents who are able to question deep existing structures, operate outside traditional policy circles and resist transition agenda capture. However, operationalising such a concept within a developing country setting may be limited by the underlying conditions from which transition governance activities are initiated. In comparison with transitions in developed countries, the case study confirms that within developing ones, niches are located at a further distance from regimes (section 5.3.1). This was particularly evident in the Tunisian case, whereby there were no prior coordinated networks geared towards addressing emissions of greenhouse gases from the cement sector synergistically. Such a situation prompted donors and local coordinating agencies to take extra care at creating new actor networks and avoiding the exit of participants through direct confrontations. As a result, (a) the transition arena essentially comprised of members of traditional policy circles, and (b) transition agenda capture by industry incumbents was a deliberate feature of NAMA design via pre-decided technological options deemed acceptable by firms. These observations suggest that TM features of selective participation, as well as the creation of transition arena platforms whereby mechanisms contributing to lock-in are openly discussed and reflected upon, is a more complex endeavour in developing country contexts. Given the lack of methodological guidance within the TM literature to cater for such particular settings, this finding suggests that further research on how to operationalise transition arenas and broader TM principles within developing country contexts is warranted.

Secondly, to enable niches to develop beyond mere system optimisation, donors could also consider complementing the current rigid, short-term, project-based approaches towards planning interventions in developing countries with a more exploratory, long-term one based on reflexive evaluation elements. Given that transitions typically unravel through short periods of instability and chaos, followed by reorganisation to a new equilibrium, learning, anticipation and adaptation - i.e. reflexive elements - are essential features of transition governance. However, the theoretical review of dominant donor paradigms undertaken in section 1.2.4 has revealed that while donor approaches focussing on innovative technologies have, over time, increasingly expanded in scope to include a wider range of factors influencing innovations in developing countries, the theoretical paradigm underlying the governance of donor interventions is still locked into standardised LFA models. Using the example of key climate funds and the Tunisian cement NAMA, this thesis has shown that elements of such models transpire across donor thinking through linear planning, short-termism and limited integration of social learning. For example, the action plan of the Tunisian NAMA depicted a 7-year linear blueprint without dynamic scenario building, thereby restricting experimentation and reorientation based on lessons learnt during implementation. Therefore, it is highly unlikely that current donor governance approaches can sustain system innovations. In turn, this calls for a rethinking of donor modalities by including more feedback loops within their project management models.

In summary, the TM model, which internalises characteristics of transitions within its governance activities, can thus be used for inspiration to complement donor instruments.

However, the complexity of social relationships amongst actors in developing countries means that the political processes of managing transitions (Meadowcroft, 2009; Smith and Stirling, 2010; Voß, Smith, and Grin, 2009) will be different and therefore require fine tuning in the application of TM. Given that transition management prescriptions were not explicitly adopted within this case study, it was thus not possible to empirically examine such processes in more detail. Therefore, and to conclude, there is scope for further research into (a) the policy entrepreneurial role of donors, along the lines of (Meijerink & Huitema 2010; Marquardt et al. 2016), and (b) the particular political circumstances of donor-driven transitions.

5.0 References

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PART 2: ARTICLES

Paper 1: The implications of how climate funds conceptualize transformational change in developing countries

The implications of how climate funds conceptualize transformational change in developing countries

Zyaad Boodoo[a], Florian Mersmann[b], Karen Holm Olsen[c]

[a]UNEP DTU Partnership, Technical University of Denmark (corresponding author)
[b]Wuppertal Institute for Climate, Environment and Energy
[c]UNEP DTU Partnership, Technical University of Denmark

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Abstract
The search for globally coordinated mitigation strategies that could contribute effectively towards bridging the gap between current emissions reduction efforts and a rapidly closing 2°C climate target remains contentious. The participation of developing countries through Nationally Appropriate Mitigation Actions (NAMAs) is emerging as a crucial feature to attain this goal. Against this background, two of the major NAMA funding agencies have embraced 'transformational change' and 'paradigm shifts' as policy concepts. Yet, their operationalization within aid management approaches has not been fully justified. Concurrently, academic interest in theories of sustainability transitions has been growing, out of which the Transition Management (TM) approach provides the theoretical inspiration to study, and eventually promote, systemic transformational changes. However, there is still limited knowledge with which to contextualize the steering of such transitions to different settings. This article engages in these debates by reviewing the theoretical grounding behind the Green Climate Fund and the NAMA Facility's conceptualizations of transformational change through NAMA interventions against the corresponding theoretical assumptions of TM. Based on a critical review of relevant literature, it is argued that the logical framework-based approach adopted by the funds contains implicit assumptions of causality, which do not adequately cater for the uncertainties, non-linearity and feedback loops inherent in transition processes. The incorporation of more adaptive and reflexive elements is proposed as an alternative. This paper contributes to existing knowledge by critically reflecting on the applicability of TM towards governing sociotechnical transitions in the developing world and by exposing the limitations behind the current thinking underpinning NAMA funding. In conclusion, the systems perspective adopted in sustainability transition theories is thus recommended as a more rewarding approach towards understanding how attempts at transforming paradigms through support to climate policies and actions in developing countries are played out

Keywords: Climate change mitigation policies and actions, Transition Management, Logical Framework, Transformational Change, Development Aid

1. Introduction: understanding the notions of transformational change (TC)

The adoption of the 'transformational' concept by two major players of climate financing in developing countries through Nationally Appropriate Mitigation Actions (NAMAs) is the starting point for this paper. NAMAs have emerged as a mitigation mechanism under the United Nations Framework Convention on Climate Change (UNFCCC) to encourage up-scaled mitigation initiatives by non-Annex 1 parties. Being defined by a host country, there is no formal definition of NAMAs.[1] However, they typically consist of a mix of policies and measures, thereby implying a strong role for government interventions geared towards providing a conducive environment for private investments, and with the potential to contribute significantly to reducing greenhouse-gas emissions. In that sense, NAMAs expand the scope of internationally coordinated mitigation options by developing countries from the project thinking of the Clean Development Mechanism to NAMA policies and measures to achieve national climate and development goals. Despite the fact that NAMAs have not been explicitly acknowledged under the recently agreed Paris Agreement, they are nonetheless accepted by developing countries, international organizations and the UNFCCC as a mitigation instrument with which to operationalize the political commitments countries have agreed to within Nationally Determined Contributions (NDC).

Since their first conceptualization in the Bali Action Plan (UNFCCC 2007b), NAMAs have been associated with a number of desirable characteristics. For example, they are required to be measurable, reportable and verifiable, while being integrated into the context of a nationally defined sustainable development agenda (UNFCCC, 2007b, p. 3). Transformational[2] objectives have recently been flagged as another crucial feature (GCF 2014a; NAMA Facility 2015). Winkler and Dubash (2015) trace the origins of this terminology within climate circles back to September 2011, in the build-up to the creation of the Green Climate Fund (GCF). Subsequently, authoritative actors and scholars involved in climate mitigation issues have formulated interpretations of the term.

Related guidelines of major entities concerned with climate, such as the Intergovernmental Panel on Climate Change (IPCC), the UNFCCC Secretariat, the GCF and the NAMA Facility, reveal that, to date, there has been neither an agreement on the exact meaning of TC, nor consensus on what it entails. However, the definitions employed reveal that the term is broadly described either with reference to the characteristics of a mitigation or adaptation initiative or in terms of its outcomes in order to become transformational. The IPCC distinguishes between transformation as a change in the underlying properties of natural and man-made systems and transformation pathways relating to development trajectories implying *'a set of economic, technological and behavioural changes*' (IPCC, 2014, p. 128). The UNFCCC secretariat understands TC within the context of NAMAs as mitigation actions with a sectoral or national focus being undertaken through the crucial leadership of government (UNFCCC, n.d.). While differentiating between mitigation and adaptation components, the GCF uses the term *'paradigm shift*' (GCF, 2014b, p. 6) to describe the fund's ultimate ambition and the degree to which NAMAs promote low-emissions sustainable-development pathways. The NAMA Facility adopts a similar pathway understanding, distinguishing TC as a self-reinforcing process distinct from other characteristics of NAMAs (NAMA Facility 2014).

While recognizing the importance of defining TC, Winkler and Dubash (2015) caution against rigid understandings which could undermine country ownership. Mersmann and Wehnert (2014) suggest a process-based interpretation and define TC as '*a structural change that alters the interplay of institutional, cultural, technological, economic and ecological dimensions*' (Mersmann and Wehnert, 2014, p. 10). Building on this, Mersmann et al. (2014) have contextualized their initial definition to NAMAs by including a goal direction provided by concerns for sustainable development, while TC is understood as a descriptive concept covering the processes and depths of change required. These different ways of depicting TC within the climate context are indicative of the early days of attempts to operationalise urgent and coordinated mitigation responses with significant long-term developmental impacts on the developing world.[3]

A universal definition of TC contrasts with principles of sovereignty within the UNFCCC. Concerns for carbon-colonialism (Winkler and Dubash, 2015), the mismatch of expectations between support-providers and NAMA-developers (Fridahl, Hagemann, Roser, and Amars, 2015) and the careful word-crafting employed by the GCF and the IPCC (IPCC 2014b)[4] exemplify the potential controversies deriving from this dichotomy. However, categorising TC as yet another political concept along the lines of terms such as 'nationally appropriate' or 'sustainable development' is problematic. While recognising that intentional vagueness or constructive ambiguity (Robinson 2004) promotes wider actor participation, a lack of clarity on TC also entails a risk of the term becoming rhetorical, ungrounded and representing a means to circumvent formal mitigation targets. This argument is especially relevant when issues of the comparability, accountability and replicability of NAMAs are at stake. Acting as the link between the developing world's mitigation initiatives and access to financing, climate funds' understandings of transformational NAMAs, as well as the approaches adopted in granting access to finance, therefore have a crucial role to play.

Established in 2010 and 2012 respectively to channel financial pledges from developed countries of the order of USD 100 billion a year by 2020, the GCF and the NAMA Facility are two of the major players in developing-country climate-financing (Green Climate Fund n.d.; NAMA Facility 2016). While the GCF was born out of pressures from developing-country negotiators to capitalize on the financial pledges made at COP 15, the NAMA Facility was initially created by the German and UK governments with the additional aim of tackling hurdles limiting access to finance from existing public and private channels to support the implementation of innovative NAMAs. Confronted with a need to achieve short-term and tangible mitigation and development impacts while being accountable for the effective and efficient use of public support, the climate funds have embraced the concept of TC within their approval structure. However, in this article, it is argued that the operationalization of TC for funding NAMAs through the two funds may be hampered by the reliance on logical framework thinking as a long-standing causal model in development cooperation. Criticisms of the Logical Framework Approach (LFA) (Gasper 2000) raise issues regarding its scientific coherence and its ability to capture long-term transformational processes. A growing body of knowledge that explicitly tackles such processes has been gaining prominence, namely theories of sustainability transitions.

Academic work on means to promote and manage transitions covers a range of different approaches (Markard, Raven, and Truffer, 2012). Within such scholarship, theories of

sustainability transitions have developed rapidly in recent years.[5] In essence, these theories have mostly been used to study transitions based on historical data. However, out of this body of knowledge, Transition Management (TM) emerges as the only theoretical framework that is explicitly prescriptive and normative. Devised as a governance approach towards sustainable development (Loorbach 2010), TM thus offers the possibility to undertake a comparison exercise with another planning methodology.[6] The TM literature has mostly focused on studying policy experiments in developed countries, especially in the Netherlands. Scholars have thus queried its relevance in other sectors and countries and at other scales. Currently, attempts to link transition theories with development aid have been rare, with a few notable exceptions (Arkesteijn, van Mierlo, and Leeuwis, 2015; Byrne, Smith, Watson, and Ockwell, 2011). Despite its limitations as a relatively new and yet to be developed method (Frantzeskaki, Loorbach, and Meadowcroft, 2012), the TM approach does provide fertile ground to enable a comparison, at a theoretical level, with assumptions made by climate funds targeting TC. An assessment of how TM, as a model rooted in theory, can offer a new perspective on TC compared to current approaches to climate finance has not been attempted before. In so doing, this article also contributes to Byrne et al. (2011)'s call for a *'more systematic evaluation of multilateral funds and mechanisms that are designed to foster low-carbon innovation in developing countries*' (p. 62). To this end, the research question pursued in this paper is the following: *To what extent are current LFA-based management approaches of climate finance able to capture the characteristics of transformational change processes set out by the scientific literature on Transition Management, and consequently, how can such approaches be improved?*

The main argument of the article is that the TM approach is better suited than current LFA-based approaches to operationalizing TC in developing countries. Section 2 details the methodology that is proposed to capture and compare the theoretical assumptions behind TM and the LFA-influenced operationalization of TC within the funds. Section 3 covers the literature reviewed and unpacks the conceptualizations of TC within the GCF and the NAMA Facility. Section 4 presents the results obtained and compares the two management approaches, while Section 5 exposes the limitations behind the current thinking in NAMA funding, argues for adopting a TM perspective, and suggest avenues for further research. The article concludes by proposing better ways to integrate processes of transformational change within the current approval structures of the climate funds.

2. Methodology

Methodologically, this article hinges on a critical review of the relevant literature, with a focus on how TC is conceptualized. The theoretical assumptions behind TM are identified by analysing a sample of its most influential publications. The exercise is guided by tracing TM's intellectual roots to Rotmans, Kemp and Van Asselt's seminal paper (Rotmans, Kemp, and Van Asselt, 2001), which subsequently spurred the development of TM's theoretical foundations into a model of governance. The state of the art of TM is drawn across the most frequently cited articles and review papers within the Scopus Database that stems from Rotmans et al. (2001)'s work. Out of this selection, the most influential scholarship that explicitly discusses the theoretical basis of TM is subsequently screened out (summarized in Appendix 1). While the term 'transition management' is covered with varying degrees of focus across the literature on sustainability transitions, a sample of papers that present the origins of TM is better able to discuss its theoretical grounds.

With a view to unpacking the GCF and the NAMA Facility's conceptualizations of TC, relevant documents defining their approach are reviewed. These consist of the GCF's governing instrument, its operations manual, the decisions of its board and its results management framework. Corresponding literature from the NAMA Facility is explored from its general information document, application forms, published fact sheets and reports. Based on these documents, it is evident that the two funds have adopted a mixture of the LFA and Theory of Change (ToC) approaches to operationalize TC through NAMAs.

In essence, the theoretical roots of LFAs and ToC hinge on a similar conceptualization of processes of change (see section 3.3.). This resemblance is unsurprising, since they both originate from the same family of approaches within 'programme theory' (Prinsen and Nijhof, 2015; Vogel, 2012). This common feature also indicates that both approaches are based on similar fundamental theories. Based on this understanding, these theoretical assumptions are identified through a review of the LFA literature first to showcase how LFA thinking prevails through the funds' understanding of TC, and secondly to undertake a like-for-like comparison with the assumptions made within TM.

The body of literature that relates to the LFA is richer and more diverse than that on TM. Adopted as a practical project-evaluation tool by USAID in the late 1970s (Rosenberg and Posner, 1979), it has since been adopted by major development aid agencies. Its longevity and broad application has resulted in its extensive coverage within the grey literature. However, since the focus of the current exercise relates to a drawing out of the LFA's underlying theoretical assumptions, an alternative method that focuses only on academic publications is applied, thereby deliberately screening out grey publications related mostly to practical applications of the approach and focusing instead on more in-depth discussions of the LFA's logic. The search is restricted to peer-reviewed articles (articles, reviews and articles in press) published from 1999 to date on the Scopus Database for 'logframe', 'logframes', 'log frame', 'log frames', 'logical framework', 'logical frameworks'. To ensure a balance between the TM and LFA reviews, an equivalent sample of the most cited articles that explicitly discuss the theoretical rationale behind the LFA (*summarised in Appendix 2*) is examined.

Based on this exercise, three analytical dimensions are identified as central in capturing the underlying theoretical assumptions of how TC is conceptualized according to both approaches.[7] These consist of: (1) how change processes are envisaged, (2) the proposed management responses that follow these change processes, and (3) how the roles of various actors are envisaged. To explore the prevalence of linear LFA thinking in the two funds, the three analytical dimensions are used to explore how the two funds understand TC. The results of this exercise are compiled in Table 1.

The next section reviews the literature, followed by a summary of the results of the comparison exercise.

3. Theoretical and empirical perspectives

3.1. *Sustainability transition theories*

Core research strands dealing with sustainability transitions boast a number of different approaches and schools of thought. To delineate the contours of this field, sustainability transitions are defined as '*long-term, multi-dimensional, and fundamental transformation processes through which established socio-technical systems shift to more sustainable modes of production and consumption*' (Markard et al., 2012, p. 956). Sustainability transition theories provide useful ways of analysing transitions.[8] However, the theoretical frameworks provide different analytical possibilities. For example, while 'Arenas of Development' theory (Jørgensen 2012) explore transitions through the performance of actors in stabilizing or changing relations, 'Practice Theory' (Shove and Walker, 2010) correspondingly focuses on the dynamics of social practices. 'Technological Innovation Systems' (TIS) analyse technological change by focusing on the structure and function of innovation systems (Hekkert, Suurs, Negro, Kuhlmann, and Smits, 2007), while 'Strategic Niche Management' (SNM) suggests that the setting up of protective spaces can enable technologies to flourish within sustainable innovation pathways (Schot and Geels, 2008). Assuming that sustainable development requires simultaneous consideration of inter-related social and technical issues, SNM posits that niches can allow nurturing and experimentation with the co-evolution of technology, user practices and regulatory structures. Specifically, SNM focuses on the design and dynamics of niches such that previously unconnected actors from different fields create networks, articulate shared expectations and learn by doing so as to favour the emergence of more sustainable patterns. TM expands the SNM approach within cyclical participatory processes of searching, learning, testing, exploring and adapting problems and solutions (Loorbach 2010).

Scoping the review down to literature that adopts an explicitly forward-looking perspective, TM emerges as the only branch in transition studies which is not solely limited to retrospective analyses and that relates the most to governing a purposive transition (Smith, Stirling, and Berkhout, 2005).

3.2. *TM's perspective on transformational change*

Originating in policy experimentation in the Netherlands, TM is a hybrid research field in the transitions literature. Building on multilevel perspective studies, it was coined on the basis of an idealised 'S' curve characterizing transitions through time within phases such as pre-development, take-off, acceleration and stabilization (Rotmans et al. 2001). Taking a social challenge such as energy security as its point of departure, TM emphasizes the dynamics of co-evolutionary processes of change that are informed by lessons learned through implementation (Rotmans and Loorbach, 2009). By bringing strategic thinkers from different backgrounds to interact and gain a wider insight into the issues at hand within 'transition arenas', TM posits that these actors will be empowered to redefine their problems and perspectives and subsequently to re-assess the goals that have been set. Such goals are further translated into long-term visions that guide the formulation of strategic activities while ensuring public support via 'transition agendas'. Through back-casting these visions to present situations, transition paths (or 'transition scenarios') are devised and strategies to realize the visions attempted through 'transition experiments'. Continuous monitoring and evaluation of processes and outcomes is used to program revisions.

These features are delineated across activity levels targeting multilevel perspective categories of landscapes, regimes and niches respectively: long-term strategic envisioning of cultural and social change, mid-term tactical activities translating these visions into pathways, and short-term operational activities focusing on actors and the actual execution of projects (Loorbach 2010). Such activity clusters are tied across time within cyclical phases, and their elements are reassessed through reflexive activities via monitoring and evaluation.

TM is rooted in an understanding of transitions as being inherently systemic, and it attempts to incorporate this feature within a cyclic model. Transitions are claimed to occur within a participatory and deliberative process of social learning that occurs within protected spaces for experimentation. Such processes occur when key actors (or 'frontrunners'), in a search to find solutions to a social challenge, question and engineer a shift in the deep structures upon which their belief systems, ideologies and opinions are based. Through trial and error, and by aligning problems and solutions along the way, TM suggests that novel practices can mutually reinforce each other such that niches can compete with or change dominant practices. These features are based on a number of theoretical assumptions that branch out into a growing body of knowledge covering TM.[9]

3.3. *Logical Framework Approaches and Theories of Change*

Originating in corporate and military planning, the LFA's ability to provide structure, hierarchy and rational thinking when designing projects has led to it becoming a classic tool in aid management. In a nutshell, LFAs assume a linear causality chain for a particular project activity. Despite numerous conceptions of the LFA model (Crawford & Bryce, 2003), its fundamental theoretical perspective has remained the same (*Ibid.*). Within the international development community, it is understood as a tool through which programme inputs can lead to programme goals via activities, outputs and outcomes in a logically coherent way. These elements shine through both the GCF and the NAMA Facility's approaches to granting NAMA financing.

For example, the board of the GCF decided that '*... in designing a logical framework for results management, the Fund will develop indicators to measure the impact of the Fund…*' (GCF 2014a, p. 2), which are embedded within a logic model that describes '*…how inputs and activities are converted to changes in the form of results achieved at the project/programme, country, strategic impact and paradigm shift levels*' (GCF 2014a, p. 3). The NAMA facility, on the other hand, specifies that it will assess NAMA Support Programmes '*on the basis of the logframe, the M&E plan and the reports provided…*' (NAMA Facility, 2015, p. 23.), which subsequently feeds into its overall ToC model, described as

> *showing what the facility is meant to do and what it is to achieve on different objective levels (road map). It is based on a series of 'what-if' relationships that, if implemented as intended, lead to the desired outcome.* (NAMA Facility, n.d.-b, p. 1)

ToC primarily expands the LFA to incorporate longer chains of cause and effect relationships, focusing attention on the longer term impacts of an intervention and on its underlying assumptions, and arguing for the improved integration of complexity features and beneficiaries' views (Prinsen and Nijhof, 2015). ToC advocates also claim that the approach is more critical, reflexive, and potentially bridging the attribution gap of the LFA (Vogel 2012). However, the ToC approach is simultaneously criticized for being data-

intensive, experiencing caveats in attributing the failure of an intervention to the theory itself or to weak management, and still exhibiting limited usefulness in capturing complex processes and stakeholder perspectives (Prinsen and Nijhof, 2015). These criticisms detract from the value of its claimed benefits.

Furthermore, the argument that ToC can bridge the attribution gap between the outputs and outcomes of a planned intervention is doubtful. Isolating and assigning the effect of a single intervention from various mutually reinforcing processes occurring at different intervention levels and from different partners within international aid is widely recognised as difficult to capture. Describing the Danish development assistance experience (Ulbæk and Nøhr, 2014) use the notion of contribution rather than attribution. In short, while ToCs claim to constitute an improvement as compared to the LFA approach, both approaches are grounded on an understanding that a planned intervention can be articulated through sequential cause and effects relationships (Weiss 1997). The next section unpacks the conceptualizations of TC within the GCF and the NAMA Facility, followed by an analysis of how the theoretical assumptions of the LFA approach impact on how the funds conceptualize TC.

3.4. Climate funds' conceptualizations of transformational change

Within the documentations of the two funds (section 2), two different dimensions are distinguished through which TC transpires: first, through the performance assessment conditions; and secondly, through the management approach. Within the first dimension, Mersmann and Wehnert (2015) identify two further levels of operationalization of the concept: fund governance level and intervention level.

Performance assessment conditions

Both the GCF and the NAMA Facility specify that their fund-level impacts will be monitored and evaluated, with the former aiming to influence global emissions levels and the latter targeting impacts at the country level. Zooming into the operational conditions imposed at the intervention level, both funds lay down evaluation requirements for NAMAs submissions according to pre-defined criteria. Notwithstanding the GCF's additional mandate for adaptation, the major difference between the sub-criteria used by the two funds relate to the GCF's requirement for a proposed intervention to set out its contribution to knowledge and learning. While, in another publication (NAMA Facility 2014), the NAMA Facility has stated that it also considers systemic learning processes to be an important factor conducive to TC, they are not articulated explicitly within their funding criteria (NAMA Facility, 2015, p. 17) at an intervention level. Capturing lessons learnt is envisaged as the mandate of the Technical Support Unit of the facility (NAMA Facility, 2015, p. 9). However, the modalities of such knowledge exchanges are not made explicit. The GCF also does not specify how lessons learnt within a planned intervention can be harnessed and fed back to revise its design. These features indicate that both the GCF and the NAMA Facility focus on reaping lessons learnt across NAMAs, rather than within a NAMA initiative.

Management Approach embedding the fund, and intervention levels of the operationalization of TC

Within the methodologies employed by both agencies, a causal model-based approach to structuring and approving NAMA financing (GCF, 2014b, p. 51 and NAMA Facility, 2015, p. 6)

has been explicitly adopted. As such, both funds have devised performance management frameworks that infer linear causality linkages within and between intended levels of intervention. While the NAMA Facility has expressed a requirement for NAMA proposals to be framed so as to feed into its overall ToC (NAMA Facility n.d.), the GCF has set out its mitigation logical framework across vertically linked hierarchies of inputs, activities and outputs at the country level, which feed into the fund's impact level and ultimately into a global paradigm shift level (GCF, 2014a, p. 11). Furthermore, both funds require applicants to produce a logical framework matrix (see NAMA Facility, n.d.-a (2015) and sections H.1.1 and H.1.2 in paragraph 4.6 of GCF, n.d.). These common features clearly demonstrate the influence of LFA thinking in the conceptualization of TC at the intervention level. However, when moving up the linkages that connect to a fund level, the two entities slightly diverge in their thinking. In incorporating some feedback loops within its ToC model, the NAMA Facility explicitly describes how it envisages incorporating lessons learnt from different NAMAs that have been implemented. The GCF also mentions that lessons learnt will be used to revise its methodology (GCF, 2015, p. 7). However, to date, its intervention logic does not explicitly provide for feedback mechanisms.

In short, both funds are attempting to govern developing country-driven, large-scale mitigation actions within country-defined sustainability principles. The assumption is that the proposed transformational NAMAs can be expressed in terms of a phased sequence of causes and effects, with the traditional LFA approach being adopted at the intervention level, and expanding to notions of ToC at a wider fund level. With a view to better exploring how LFA thinking shines through the funds' conceptualization of TC, the relevant LFA literature has been reviewed based on the methodology specified in Section 2 to reveal its theoretical basis. These are further detailed in Appendix 2.

Based on the analytical categories identified earlier, the theoretical assumptions behind TM, LFAs and their operationalizations within the GCF and the NAMA Facility are unpacked. These results are compiled and compared in Table 1, which is followed by a discussion section.

4.0. Comparing and contrasting the TM approach and the LFA-influenced funds' approach

Analytical Dimensions	***Theoretical assumptions within:***			
	TM approach (circular approach)	***LFA (linear approach)***	***Intervention Level of GCF and NAMA Facility***	***Fund Governance Level of GCF and NAMA Facility***
Change Processes	• Multiple, simultaneous, and occurring at different levels • Complex, non-linear with multiple causalities and feedback loops • Inherently uncertain • Modular, sequential and path-dependent • Iterative, Co-evolutionary, adaptive and self-reinforcing	• orderly, relatively well understood • predictable, controllable change • chain of linear causality • change are factored along hierarchal vertical and horizontal logics • change processes are dependent on pre-set assumptions	• Same assumptions for change processes as LFA thinking applies when the use of the LFA matrix is mandated (GCF n.d.) and (NAMA Facility n.d.; NAMA Facility 2015) • Requirement for specifying a ToC, implying an expansion of the chain of causality, with some feedback loops (GCF, 2015, p. 10) and (NAMA Facility, 2015, p. 20)	• GCF has made its mitigation logic model explicit (GCF, 2014a, p. 11) while the NAMA Facility has devised a ToC model (NAMA Facility n.d.)) • The same theoretical assumptions of change processes as the LFA methodology, except the NAMA Facility's explicit expression of feedback loops
Management Approach	• Objectives and pathways are not rigid • Strategic re-orientation by articulating pressures informed by interactive learning processes • Integrated by combining top-	• top-down linear style of management that assumes powers of control • assumes universality of scientific rationality and that the world exhibits objective cause-effect relationships • assumes that the sum of efficient inputs must at some future time lead to intended results	• Similar assumptions at a management approach dimension as that of LFAs apply. • Exception: logic of the project design may be amended either at mid-course or end of project stages GCF: mid-course evaluation on case by case basis (GCF, 2014c, p. 10); NAMA Facility includes	• The same assumptions for management approach as that of LFA apply • Exception: the funds' logic may be amended occasionally (GCF accounts for the possibility of review over time (GCF, 2014c, p. 21) NAMA Facility's Technical Support Unit is mandated

	down with bottom-up perspectives • Existing governance structures can be creatively destroyed • Focus on system innovation rather than optimization • Relies on market forces • Relies on decentralized decision-making • Assumes political feasibility of experimentation	• assumes the logic of the project design will maintain its coherence during implementation • factors external to the intervention, risks and uncertainties are considered as assumptions required for a project story to happen • assumes that it is possible to define objectively verifiable indicators and means of verification corresponding to a pre-defined targeted level of impact • assumes powers of attribution	possibilities for mid-course or end of project evaluations (NAMA Facility, 2015, p. 23)	to review the fund's performance (NAMA Facility, 2015, p. 9)
Role of Actors	• Actor interests are assumed to be well organized • Conflicts are viewed as necessary, are encouraged and assumed to be controllable • A strong role is assumed for government and frontrunners operating outside	• assumes an influential role during design phase • assumes that target groups are adequately defined and continuity in participation • assumes clear objectives are defined and a high degree of consensus on what is feasible, valuable and measurable • assumes limited interactivity and changes in actors' and networks' interests and	• Access to funding from GCF is granted through accredited entities via approval from a National Designated Entity. Proof of a consultative process is required (see governing instrument on (UNFCCC, 2011, p. 64), including a multi-stakeholder engagement plan (para E.5.3 of funding proposal template on (GCF n.d.)) • Access to funding from the	• Actors at the national level do not have a significant role to play at a fund level. • The GCF's conceptualization of TC may be reviewed through an Independent Evaluation Unit (GCF, 2014c, p. 20) • The NAMA Facility may reap lessons learnt through implementation and review its ToC through its Technical Support Unit

	dominant policy networks • Facilitation is claimed to be able to bring a change in perspectives	logics • restricted iterative learning except when project managers reassess project design • assumes strong leadership and facilitation skills • assumes high powers of foresight	NAMA Facility is granted through delivery organizations and implementing partners (NAMA Facility, 2015, pp. 11 - 12). The NAMA Facility requires strong commitment from national government (NAMA Facility, 2015, p. 12), involvement of local public or private entities, possibly a national development bank, stakeholders defined, roles and objectives clearly spelt out, realistic project hypotheses, activities, outputs, and long-term impacts spelt out (NAMA Facility, 2015, p. 17 - 19). • The same assumptions as those of LFA apply	• With only the GCF having explicitly detailed its mitigation logic according to results based management framework, the same assumptions as those of the LFA will apply.

Table 1. Contrasting the theoretical assumptions of TM, LFAs and the funds' conceptualizations of transformational change.

Change processes

While both the TM and LFA are simplified models which adopt a high level of generalization for the purposes of managing change processes, they differ in how such processes are assumed to occur. The LFA sees change as being essentially orderly, predictable, and dependent on foreseen conditions. The methodologies adopted by the two funds do not completely follow this approach, as exemplified by the requirement for NAMA proposals to be framed according to a logical framework matrix and concurrently for such interventions to mention their ToC. While the former requirement infers straightforward linear causality, the latter implies the integration of some feedback loops. Nonetheless, both requirements suggest a conceptualization of change processes within the two funds as orderly, understandable, predictable and controllable, as well as dependent upon pre-set assumptions inherent in LFA thinking. TM differs considerably from this perspective: change processes are considered fundamentally unpredictable due to multiple processes occurring simultaneously at different levels. Its systems perspective, which simultaneously considers social and technical processes, is claimed to be a better way to integrate features of uncertainty, complexity, multiple causalities and feedback loops. This fundamental difference in theorizing change processes leads to different assumptions about proposed responses, whether along a management approach or in terms of the role of actors.

Management Approach

While aiming at providing a structure and hierarchy to objective oriented planning, both the TM and LFA approaches adopt a technocratic perspective towards handling planned interventions. However, their management approaches are based on different theoretical assumptions.

The LFA is essentially a top-down engineered approach that claims high powers of control. It focuses on the intended effects through intended routes based on hypothetical cause–effect relationships discovered through structured observation. It is built on an a priori project narrative that asserts the logic of a designed intervention, assuming it will maintain its coherence during implementation. The LFA adopts a positivistic methodology that assumes the universality of scientific rationality. By postulating that complex processes can be divided into a series of quantifiable fragments adding up to a desired objective, the LFA adopts a reductionist perspective that oversimplifies complex and non-linear human-centred change characteristics (Armytage 2011). It also assumes that it is possible to define indicators and means of verification objectively. The LFA approach remains silent on issues that can arise during implementation, but still claims to have powers of attribution with respect to higher-level objectives. These features are prevalent within the two funds' conceptualizations of TC, which are incorporated within their individual logical framework-based causal models. The main difference with the totally rigid interpretations of LFAs lies in the possibility for the GCF and the NAMA Facility to undertake some design revisions over time at both the intervention and fund governance levels.

On the other hand, TM internalizes context by viewing transformational processes as co-evolutionary, self-reinforcing and adaptive. Goals and strategies are not rigidly defined, and an iterative methodology is proposed, based on strategic reorientation through articulated pressures, and guided by interactive lessons learnt during implementation. TM thus combines top-down with bottom-up approaches and focuses on system innovation rather

than optimization. This claim rests on the assumption that decentralized decision-making and the creative destruction of governance structures is politically possible. Another key difference lies in the explicit recognition within TM of the importance of experimentation in managing transitions, which incurs both a high risk of failure and a high potential for gain. The approach adopted by the two funds, on the other hand, does not explicitly assume trial and error features but assumes rather that consensus prevails on pre-determined goals, strategies and indicators of progress.

Role of actors

The TM and LFA approaches both claim to be able to take into account the concerns of multiple actors. However, there is little guidance in either regarding the rationale for participation and the mechanisms to integrate differing priorities. Project designers using the LFA are assumed to have high powers of foresight and the ability to define clear objectives. This assumes a high degree of consensus among the actors involved in implementation regarding what actions are feasible, valuable and measurable. Another important assumption is that of continuity in participation by the same actors from the design stage throughout the project cycle. Actors are assumed to be most important at the design stage, whereas interactivity during implementation is considered less significant, with assumptions of limited change in interests, logics and other political dynamics over time. This feature limits interactive learning. Through embracing LFA thinking and ToCs within the GCF and the NAMA Facility's operationalizations of TC, these features are implicitly reproduced within the funds. In the absence of clear stakeholder participation guidelines by both funds, it is difficult to ascertain the role of actors in evaluations of TC at the fund governance level. While the GCF's adoption of a results-based framework suggests that evaluations of the funds' performance are strongly linked to LFA's theoretical assumptions regarding the role of actors, the NAMA Facility has not made public how its Technical Support Unit will undertake a similar assessment.

On the other hand, TM views actors' concerns as being dynamic in nature, evolving with knowledge gained during implementation. Such a view assumes that actors' interests are well organized and that facilitation alone can bring about a major change in perspectives. TM also assumes a strong role for government, as well as for actors operating outside dominant policy networks. These actors are also assumed to be able to influence those policy regimes. None of the funds adopt the TM approach in order to enable actors outside the NAMA intervention to play an active role as change agents, but rather rely on the LFA approach, which does not support interactive and reflexive learning, management or the implementation of change.

5.0 Discussion

5.1. Criticism of the climate funds' understandings of transformational processes

The academic literature has highlighted the various shortcomings of the LFA (Bell, 2000; Crawford and Bryce, 2003; Dale, 2003; Gasper, 2000b; Hermano, López-Paredes, Martín-Cruz, and Pajares, 2013, Olsen 2006). These include criticism of its rigidity, which hinders learning and adaptation, an overemphasis on treating the framework as additional paperwork instead of as a planning process, difficulties in setting appropriate indicators and timelines, specifying clear goals and responsibilities, and managing the different priorities of numerous stakeholders and beneficiaries. By adopting LFAs and ToC within their approaches

to finance NAMAs, those criticisms also apply to the GCF and NAMA Facility management approaches for TC.

Building on Hermano et al.'s (2013, p. 29) claim that the LFA is '*an inefficient and limited framework for managing international development projects*', the inclusion of transformational objectives within traditional LFA-influenced approaches to manage aid is problematic. Knowing the LFA's limitations for conventional development projects, these caveats are likely to be more pronounced when imposing even wider objectives. However, the claim that the LFA's failings relate more to its misuse (Hubbard, 2001), still does not cater for the argument that its limitations lie in its rigidity and its fundamental assumptions of powers of foresight and authoritative control (Gasper 2000). By merely adding transformational objectives to traditional aid management practices, the GCF and the NAMA Facility have adopted a positivist methodology and envisage transformations as based on assumptions of linearity. This perspective is inconsistent with the aim of achieving radical, fundamental changes in developing countries, while recognizing that current structures and dynamics are not operating in a sustainable way.

Notwithstanding the limitations related to potential misapplications of the two planning approaches, the theoretical comparison undertaken in this paper stresses the key influence of how change processes are viewed. Assumptions about such processes shape the responses being proposed within the two planning approaches. Presumptions of foresight and control within the LFA, which shine through the approach adopted by the two funds, are diametrically opposed to TM's assumptions that TC processes are fundamentally unpredictable. These theoretical considerations rest on the dichotomy in change processes being viewed either as linear or as complex, with multiple causality and feedback loops.

The LFA approach also ignores the path-dependent nature of transformational processes claimed by the scientific literature on socio-technical processes. The lack of integration of co-evolutionary processes, interactivity and feedback is claimed to be conducive to promoting lock-in into sub-optimal solutions, favouring the optimization of given systems instead of system innovation (Meadowcroft 2009). This argument is particularly relevant in the context of climate change, which is recognized to be a persistent or wicked problem, characterized by uncertainty and by a multiplicity of actor interests, values and complexity (Head 2008). In his seminal paper, Unruh (2000) depicts how traditional top-down economic modelling approaches that ignore the path-dependent evolutionary nature of technological and social systems lead to carbon lock-in. By adopting a similar top-down, control-oriented management approach without adequately incorporating interactive feedback mechanisms, the approach adopted by the funds is likely to lead to lock-in at the expense of more efficient alternatives that typically unravel through lessons learnt across implementation and a change in perspectives from the actors involved.

5.2. Understanding TC through NAMAs in developing countries from a TM perspective

In transition studies, TM is proposed as an approach to managing the transformation of regimes. That is, it suggests a theoretically coherent way to steer highly institutionalized means of realizing social functions away from their currently unsustainable patterns. The aim of incurring TC through climate funding entities echoes such ambitions. However, the current approaches adopted by climate funds, which are embedded in traditional LFA

thinking, are not adapted to capturing the uncertainties and complexities inherent in transitions. As a model that integrates such features, TM therefore provides constructive inspiration.

However, being a relatively new approach within transition studies based on theoretical deduction and limited empirical studies, TM exhibit caveats intrinsic to its novelty. These shortcomings have mainly been related to its assumptions of competencies of facilitation, limitations following its high level of abstraction and its associated shortcomings regarding democratic legitimacy, power and politics (Meadowcroft, 2009; Smith and Stirling, 2010; Voß, Smith, and Grin, 2009). On the other hand, despite years of established practice in development aid, the LFA has also been criticized along the same lines (section 5.1). The current preference amongst donors to stick to LFA-based approaches while expecting transformative results is thus up for debate.

Being in the early days of NAMA development, the prescriptive nature of TM offers a timely advantage in using its theoretical framework to study how interventions aimed at TC are played out in developing countries. By adopting sustainable development as a normative long-term goal, TM also incorporates UNFCCC's ultimate objectives within a scientifically coherent model that explicitly acknowledges and incorporates the social sphere in pursuing sustainability goals (Frantzeskaki et al. 2012). Yet, an application of TM in developing-country contexts can be seen as problematic. Differences in political, institutional, cultural and economic circumstances are distinctive of the developing world. Disparities and fragmentations of interests are at odds with the consensual context assumed by TM when it was developed in the Netherlands, when it was characterized by '*collaborative policy making, a focus on long term planning and innovative environmental policies'* (Loorbach, 2010, p. 162). However, the reverse argument is also valid: by moving away from engineered approaches that focus mainly on the technological and economic spheres to planning that combines top-down with bottom-up approaches, TM allows for a plurality of perspectives to be considered interactively. A closer incorporation of feedback mechanisms to inform policy re-orientation[10] and NAMA design is better able to capture the traditionally less organized political realities of developing countries. This argument is valid not only during planning stages or sporadic re-assessments of project designs that are typical of LFAs, but also across all implementation phases. Also, unplanned and unforeseen issues that typically emerge during implementation can thus be better integrated and factored in through more flexible project designs, re-assessments of objectives and the means to achieve those objectives.

Such features of open-endedness, inclusivity and equity are well adapted to better integration of the diverse ideological and geographical spreads that constitute parties to the UNFCCC. These characteristics are equally suited to the variety of in-country contexts within which NAMAs are to be framed. Issues raised regarding imposing development paradigms (Winkler and Dubash, 2015) and ill-tuned expectations between concerned actors (Fridahl et al. 2015a) can be alleviated. Additional support is found from a perspective of accountability, through TM's features for continuous assessment (Loorbach 2010), which tally with the requirement for NAMAs to be monitored, reported and verified. Concerns to do with steering modern society away from its currently high carbon lock-in towards low carbon use and sustainable development also align well with TM's strategic reorientation

features, which propose a theoretically sound governance model to avoid sub-optimal solutions. By explicitly targeting a change in pathways of development based on lessons learnt within an intervention, TM thus provides for a methodology that better integrates the complex interplay of processes from a planned development initiative aiming for high-level impacts. The commonly criticized difficulties of attribution within the development assistance literature can be attended to within a scientifically grounded model.

Clearly, the features depicted above show that TM offers a promising approach that has the potential to shed some light on the black box of implementation that traditional aid management approaches shun. However, the criticisms voiced also draw attention to its requirements for further methodological development. Indeed, how to (i) reconcile donor accountability concerns with TM's innovative open-ended approach, and (ii) contextualize the application of TM principles within developing-country contexts are issues that have remained silent in TM to date. These are avenues for further research.

6.0 Conclusion

6.1 Do traditional planning methods foster sustainability transitions?

The concept of transformational change is rapidly gaining importance in international climate finance. Without a robust operationalization of the term and a fresh look at how to approach change processes for transformational impacts in developing countries, there is a high risk that the concept of transformational change will come across as a new donor conditionality, thus missing out on the opportunity to guide the implementation of climate action in developing countries towards ambitious goals for mitigation and sustainable development. Especially within the field of funding for climate policies and actions for NDC implementation, a lost opportunity such as this may lead to sub-optimal results, which should be avoided, considering the limited available funding.

The question raised in the article of whether traditional approaches to aid management (i.e. LFA) are able to capture the characteristics of processes of transformational change can now be answered conclusively. The critical literature review revealed the theoretical foundations of both LFA and TM approaches. Clearly, the two approaches differ at a fundamental level in their conceptualizations of processes of change. The first key conclusion is that the non-linear causality assumed within theories of sustainability transitions such as the TM approach provides a better way to capture processes of transformational change than LFA assumptions of foresight and control inherent in the approaches adopted by the climate funds. The adequacy of a TM-inspired design is illustrated in this article not only through the limitations of the LFA, but importantly also through the advantages of integrating TM features within management approaches across climate finance. Notwithstanding the potential misuse of current LFA-based management approaches, we argue that the rigidity that follows from using such a framework in the planning and evaluation of donor interventions (i) hinders learning and adaptation within NAMAs, and (ii) favours system optimization instead of system innovation. TM’s flexible features attend to such concerns and allow a more interactive consideration of the unforeseen events and changing political realities that might unfold during the implementation of NAMAs.

6.2 Re-packaging transformational change in climate finance for implementation of Nationally Determined Contributions

While this article has demonstrated the benefits of a TM-inspired approach to operationalizing transformational change in developing countries through NAMAs, its findings also bears policy relevance to broader NDC processes. Indeed, NAMAs are increasingly viewed as the means to implement NDCs. However, the NAMA acronym is likely to be phased out over the long-run due to its absence within the Paris Agreement. Nevertheless, given that the policies and actions through which NAMA interventions are based upon remain essential features of any ambitious climate measures, the TM-inspired approach adopted in this paper provide useful insights that could help managing transitions through NDC planning and implementation.

Firstly, adopting a sociotechnical TM perspective suggests that TC is understood as deep, long-term, structural changes that address the root causes of carbon lock-in through a series of incremental steps. In principle, the LFA or ToC could at least be used to undertake initial planning of projects on the ground. However, country project managers have to be sensitized to the complexities and non-linear characteristics of change processes, as well as to how the implementation of climate policies and actions feeds into a longer-term system view of planned interventions for TC.

In light of the findings of this article, we also propose to include more reflexive and adaptive components. This would allow strategic re-orientation based on lessons learnt through a planned transition initiative as an alternative to the blueprint planning that characterizes both the GCF and the NAMA Facility. Furthermore, despite both funds recognizing the importance of learning mechanisms, performance management frameworks are formulated such that lessons learned are reaped across, rather than within climate interventions. TM advocates the integration of lessons learned *within* a transition initiative in order to cater for its co-evolutionary nature. Thus, the means to capture knowledge better during the implementation of a NAMA or another climate measure should see a stronger integration, so as to inform strategic action and re-orientation more interactively. In this article, we are therefore building on and expanding Mersmann and Wehnert (2015)'s call for the integration of the qualitative aspects of an envisaged transformation within an intervention design.

Finally, TM recognizes that managing transitions involves experimenting, as with technologies, practices and governance structures. Though there is a high risk of failure, the potential for gains is also claimed to be high. In that sense, policy design for TC can be viewed as a process of discovery for the actors involved, reflecting the necessary features of industrial policies involving green growth (Rodrik 2014). Hence, applying TM thinking across climate finance requires the very deliberate engagement of all the actors involved.

This article contributes to current debates within international climate policy on how to operationalize and implement transformational change processes better. With both funds being set up under the pressure of time and in highly political contexts, practical considerations may have restricted the hands of the designers of the NAMA Facility and of the GCF. Looking towards the future, the funding mechanisms may consider the points raised in this paper in order to better reflect the challenges and opportunities raised

through the transformational change agenda. With the advent of the Paris Agreement in late 2015, a window of opportunity may have opened in this regard, as climate policies and actions across the world now move towards an implementation phase of political commitments set out within Nationally Determined Contributions. Not all of them will be transformational, nor should every climate action endeavour to be. However, if countries aim at low-carbon transformation, this article provides valuable hints as to how to manage such a process.

End Notes

[1] For a compilation of NAMA typologies, see Table 1 in Boodoo (2014). The origins of NAMAs are described in Coetzee and Winkler (2013).

[2] Searching for conceptual clarity, 'transformational change', 'paradigm shift' and their derivatives, such as 'transformational' and 'transformative', have been considered synonymously in this paper.

[3] This transformational rhetoric is also presented as a mobilizing metaphor in the wider development community, especially through efforts to rally broad support around the Sustainable Development Goals, which were adopted consensually in September 2015 (UNGA 2012; UNGA 2015). However, this paper focuses on the context of NAMAs and its empirical application being restricted to the operationalization of TC within major climate funds.

[4] Which use the terms 'paradigm shift' and 'fundamental' change respectively essentially to describe transformational mitigation responses.

[5] Markard et al.'s (2012) analysis of 540 journal articles published between 1998 and 2011 dealing with sustainability transitions indicates a steep rise in related peer-reviewed publications, reaching between 60 to 100 academic articles annually.

[6] While TM can be used as an analytical tool with which to analyse potential interventions aiming to facilitate transitions, it has also been designed as a management approach. The LFA, on the other hand, is not solely interpreted as the classical matrix assigned to it, but rather understood as an objective-oriented planning and appraisal procedure which feeds into the logical frame matrix. In this article, we undertake a comparison of the theoretical assumptions behind TM and LFAs based on an understanding of both as management approaches.

[7] This review expands the key features of the transitions identified by (Twomey and Gaziulusoy, 2014) across new analytical categories to suit the purpose of this paper.

[8] ‘Transitions’, ‘transitions theory’ and ‘transition studies’ will, in this paper, refer to the body of knowledge defined in Markard et al. (2012) as ‘sustainability transitions’.

[9] A search for ‘transition management’ on Scopus revealed between 17 and 46 new publications every year within the 2005-2014 period.

[10] Mechanisms that leave some leeway for errors and revisions of policies are also recognized as characteristics of efficient green industrial policy (Rodrik 2014).

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Appendix 1

Scoping down the literature review through the methodology suggested in Section 2, the most influential articles covering TM's theoretical roots are presented in Table 2. TM's conceptual origins are discussed in Rotmans et al. (2001), and further academic discussions that have led to its framing as a model are covered in Kemp, Parto, and Gibson (2005), Smith et al. (2005) and Loorbach (2010). Meadowcroft (2005) and Kemp, Loorbach, and Rotmans (2007) further explored its early potential uses as a management tool, reflecting on its relevance in addressing contemporary environmental concerns, and presenting TM as a model to manage co-evolutionary processes towards sustainable development respectively. In-depth discussions pertaining to specific elements of the TM model have been covered by Wiek, Binder and Scholz (2006), who focus on the function of scenarios, Kemp, Rotmans and Loorbach (2007), who concentrate on steering features, and Späth and Rohracher (2010), who have discussed guiding visions. The limitations of the multi-level perspective as one of the bases of TM are outlined in Genus and Coles (2008). Lessons learnt from empirical TM cases are covered in Kern and Smith (2008), J.-P. Voß, Smith and Grin (2009), and Loorbach and Rotmans (2010). Avelino and Rotmans (2009), and Smith and Stirling (2010) debate at length the relationship between power and politics within TM, while reflecting on the model's limitations. Nill and Kemp (2009) make a comparison of TM with other evolutionary policy approaches, while Rotmans and Loorbach (2009) explore the model's relationship with complexity theory. Stephens, Hernandez, Román, Graham and Scholz (2008) extend TM's theoretical coverage to explore the role of higher education as a change agent. Finally, Markard et al. (2012) discuss TM's theoretical basis as one that is coherent with the body of knowledge that constitute theories of sustainable transitions.

No.	Author	Citations	Article title	Journal title	Article's coverage of Transition Management
1	(Rotmans et al., 2001)	470	*More evolution than revolution: transition management in public policy*	Foresight	Conceptual origins of TM based on a case of low energy supply in the Netherlands
2	(Smith et al., 2005)	446	*The governance of sustainable socio-technical transitions.*	Research Policy	Development of the TM model based on an analysis of agency and power in the governance of regime transformation
3	(Loorbach, 2010)	139	*Transition Management for Sustainable Development: A Prescriptive, Complexity-Based Governance Framework*	Governance	Refinement of the TM approach and framework and definition of the theoretical basis of TM as a new governance approach for sustainable development
4	(Kemp et al., 2005)	132	*Governance for sustainable development: moving from theory to practice.*	International Journal of Sustainable Development	Examination of interrelationships between sustainable development and governance, including setting the basis for TM's conceptual framework
5	(Markard et al., 2012)	121	*Sustainability transitions: an emerging field of research and its prospects.*	Research Policy	Delineation of contours of sustainable transition theories, including how TM fits into this body of knowledge
6	(Kemp, Loorbach, et al., 2007)	114	*Transition management as a model for managing processes of co-evolution towards sustainable development.*	International Journal of Sustainable Development and World Ecology	Presents TM as a practical model to manage processes of co-evolution
7	(Nill and Kemp, 2009)	104	*Evolutionary approaches for sustainable innovation policies: from niche to paradigm?*	Research Policy	Assesses the theoretical rationale, instrumental aspects and policy constraints of evolutionary policy approaches, including TM
8	(Meadowcroft, 2009)	98	*What about the politics? Sustainable development, transition*	Policy Sciences	Discusses the contribution of TM to long-term socio-technical transition processes

			management, and long term energy transitions.		to sustainability, with focus on political implications
9	(Smith and Stirling, 2010)	95	*The politics of social-ecological resilience and sustainable socio-technical transitions.*	Ecology and Society	Focuses on TM's relationship with political dimensions of sustainability
10	(Genus and Coles, 2008)	95	*Rethinking the multi-level perspective of technological transitions.*	Research Policy	Analyses transition research and the limitations of the multi-level perspective as one of the basis of TM
11	(Kern and Smith, 2008)	94	*Restructuring energy systems for sustainability? Energy transition policy in the Netherlands.*	Energy Policy	Uses TM to analyse an energy transition project by the Dutch Ministry of Economic Affairs
12	(Loorbach and Rotmans, 2010)	75	*The practice of transition management: examples and lessons from four distinct cases.*	Futures	Discusses four empirical cases of TM to highlight pros and cons of attempts to manage transitions
13	(J.-P. Voß, Smith, and Grin, 2009)	75	*Designing long-term policy: rethinking transition management.*	Policy Sciences	Assesses TM experience and discusses its implications for long-term policy design
14	(Stephens et al., 2008)	71	*Higher education as a change agent for sustainability in different cultures and contexts.*	International Journal of Sustainability in Higher Education	Uses principles of TM to explore the role of higher education as a change agent in specific locations
15	(Rotmans and Loorbach, 2009)	68	*Complexity and Transition Management.*	Journal of Industrial Ecology	Articulates relationships between TM and complex systems theory
16	(Wiek et al., 2006)	64	*Functions of scenarios in transition processes.*	Futures	Focuses on the functions of scenarios within TM
17	(Meadowcroft, 2005)	62	*Environmental political economy, technological transitions and the state.*	New Political Economy	Reflects on TM as a means to understand and address contemporary environmental concerns
18	(Späth and Rohracher, 2010)	58	*'Energy regions': The transformative power of regional discourses on socio-technical futures.*	Research Policy	Uses TM to structure an analysis of guiding vision in a regional development case in Austria

19	(Avelino and Rotmans, 2009)	57	*Power in Transition: An Interdisciplinary Framework to Study Power in Relation to Structural Change.*	European Journal of Social Theory	Discusses how to integrate notions of power into transition studies, especially in TM
20	(Kemp, Rotmans, et al., 2007)	57	*Assessing the Dutch Energy Transition Policy: How Does it Deal with Dilemmas of Managing Transitions?*	Journal of Environmental Policy and Planning	Focuses on how TM deals with steering based on Dutch government experimentations

Table 2. Scoped sample of the most influential peer-reviewed articles on the theoretical foundations of Transition Management.

Appendix 2

Applying the methodology specified in section 2, publications that explicitly discuss the theoretical basis of the LFA were covered by a wide range of journals. While most papers have built upon its utilization within traditional development aid to reflect on the approach's pros and cons, some authors have broadened its use to less conventional areas, from sports-for-development (Levermore 2011), peacebuilding activities in conflicted settings (Grove and Zwi, 2008) and health care (Dey, Hariharan, and Brookes, 2006), to the broader public sector (Wield 1999). Within the international aid-centred literature, the focus has been on different aspects of the LFA. In (Gasper 2000) and (P. Crawford and Bryce, 2003)'s influential contributions, the LFA has been examined as a planning, evaluation and management tool with respect to its potential for learning and its overall efficiency respectively. Other papers have evaluated the LFA as a method of development planning (Dale, 2003), as a programme or project cycle management, while reflecting on means to improve it based on lessons learnt from practice (Dearden and Kowalski, 2003) and as an integral element in results-based management (Armytage 2011). The implications and dynamics of using LFAs from the perspective of NGOs have been covered by (Bornstein 2003), (Bornstein 2006) and (Holma and Kontinen, 2011). Authors such as (Landoni and Corti, 2011), (Jacobs, Barnett, and Ponsford, 2010) and (Hermano et al., 2013) dig into LFA theory by comparing its application within different project management standards or tools. Other publications have zoomed onto particular aspects such as the LFA's limitations in evaluating democracy and governance (Crawford 2003), its assumptions of certainty (Curtis and Poon, 2009), the risks and external factors column of the matrix (Curtis 2001) and its philosophical origins (Bell, 2000).

No	Author	Citations	Article title	Journal title	Article's focus and coverage of LFA
1	(Gasper 2000)	71	*Evaluating the 'logical frame approach' towards learning-oriented development evaluation*	Public Administration and Development	The article focusses on a systematic evaluation of the LFA as a planning and evaluation tool.
2	(Crawford and Bryce, 2003)	57	*Project monitoring and evaluation: a method for enhancing the efficiency and effectiveness of aid project implementation*	International Journal of Project Management	The article reviews the key limitations of conventional LFA for monitoring and evaluation purposes, especially as applied to international aid project management
3	(Crawford 2003)	26	*Promoting Democracy from Without - Learning from Within (Part I)*	Democratization	Based on a review of evaluation studies undertaken by bilateral and multilateral development agencies from Canada, US, Sweden and the EU, this article assesses the limitations of the LFA as a means of evaluating democracy and governance.
4	(Levermore 2011)	17	*Evaluating sport-for-development: approaches and critical issues*	Progress in Development Studies	Focussing on the extent of evaluation of sports-for-development, this article reviews the literature on development assistance, with focus on strengths and weaknesses of participatory and logical frame approaches.
5	(Bornstein 2003)	17	*Management Standards and Development Practice in the South African Aid Chain*	Public Administration and Development	The article focusses on the management approach adopted by South African NGOs and the extent of influence of donor conditions on such approach. It includes an assessment of the dynamics of logical frameworks.
6	(Dale, 2003)	16	*The logical framework: An easy escape, a straitjacket, or a useful planning tool?*	Development in Practice	The article critically evaluates the LFA as one methodology of development planning.
7	(Bell, 2000)	16	*Logical frameworks, Aristotle and Soft Systems: A note on the origins,*	Public Administration	Published as a note in reply to (Gasper 2000), Bell traces the philosophical origins of the LFA to

			values and uses of logical frameworks, in reply to Gasper	and Development	Aristotle's doctrines and argues for participatory LFA approaches
8	(Dey et al. 2006)	11	*Managing healthcare quality using logical framework analysis*	Managing Service Quality	The paper uses the LFA as an analytical tool to study the performance of healthcare service processes and as a planning and project management methodology to propose a quality management tool within healthcare.
9	(Dearden and Kowalski, 2003)	10	*Programme and Project Cycle Management (PPCM): Lessons from South and North*	Development in Practice	The paper positions the LFA based as part of a broader programme and project cycle management, critically reflecting on how lessons learnt from practice could improve its application.
10	(Armytage 2011)	8	*Evaluating aid: An adolescent domain of practice*	Evaluation	While focussing on evaluation of development aid, this paper positions the LFA as an integral element within OECD's focus of Managing for Development Results (results-based management) and critically analyse its pros and cons.
11	(Landoni and Corti, 2011)	8	*The Management of International Development Projects: Moving Toward a Standard Approach or Differentiation?*	Project Management Journal	This paper compares the project management standards adopted by international development agencies from Australia, Canada, Japan, US and the EU, examining the LFA as a core tool of project cycle management.
12	(Bornstein 2006)	8	*Systems of accountability, webs of deceit? Monitoring and evaluation in South African NGOs*	Development	The paper discusses the LFA as the foundations of monitoring, evaluation and reporting systems used by donors, examining the effects of such systems to South African NGOs.
13	(Grove and Zwi, 2008)	6	*Beyond the log frame: A new tool for examining health and peacebuilding initiatives*	Development in Practice	This article critically reflects on the logical framework matrix as applied to health and peacebuilding programs in conflicted settings.
14	(Curtis	6	*Finding energy in strategic project*	Public	The paper positions the LFA as a strategic

	2001)		*management: An essay in honour of Dean Fang*	Administration and Development	management instrument and elaborates on the risks and external factors column of the LF matrix.
15	(Hermano et al., 2013)	5	*How to manage international development (ID) projects successfully. Is the PMD Pro1 Guide going to the right direction?*	International Journal of Project Management	Based on identified critical success factors, this article compares the LFA methodology with another international development project management tool.
16	(Akroyd 1999)	5	*Logical framework approach to project planning, socio-economic analysis and to monitoring and evaluation services: a smallholder rice project*	Impact Assessment and Project Appraisal	The paper reviews the application of the logical framework approach to a rice production project in Gambia.
17	(Holma and Kontinen, 2011)	4	*Realistic evaluation as an avenue to learning for development NGOs*	Evaluation	Focussing on evaluation of development aid from an NGO perspective, this paper suggests an alternative to LFAs that focusses on better integrating values and learning mechanisms.
18	(Jacobs et al. 2010)	4	*Three Approaches to Monitoring: Feedback Systems, Participatory Monitoring and Evaluation and Logical Frameworks*	IDS Bulletin	The article compares three approaches towards monitoring development interventions, including the LFA.
19	(Curtis and Poon, 2009)	4	*Why a managerialist pursuit will not necessarily lead to achievement of MDGs*	Development in Practice	Based on three case studies on reform projects in Vietnam which hinge on LFA designs, this paper critically evaluate the assumptions of certainty in modern performance management.
20	(Wield 1999)	4	*Tools for project development within a public action framework*	Development in Practice	This paper assesses the LFA as a tool for managing public sector activities.

Table 3. Scoped sample of the most influential peer-reviewed articles on the theoretical foundations of Logical Framework Approaches.

Paper 2: Transition towards sustainable cement production in Tunisia: the limitations of donor interventions as promoters of niche development

Transition towards sustainable cement production in Tunisia: the limitations of donor interventions as promoters of niche development

Zyaad Boodoo[a], Ulrich Elmer Hansen[b],

[a]UNEP DTU Partnership, Technical University of Denmark (corresponding author)
[b]UNEP DTU Partnership, Technical University of Denmark

To be submitted to *Geoforum*

Abstract

With the increasing greenhouse gas emissions from developing countries, donor funding to promote low-carbon development have increased. To ensure an optimal use of resources, the role of donor interventions towards promoting a transition toward sustainability in the developing world must be adequately understood. However, this topic is still largely under-researched. This paper uses the Multi-Level Perspective to analyse the underlying factors influencing the development of four niches with the potential to improving the sustainability of the Tunisian cement industry from 1990 to 2015, focussing particularly on the role of external donor interventions. Despite decades of donor support, we find that the niches have only made limited progress, which is due to (i) a decrease in the price of global carbon credits; (ii) the emergence of an export market for olive pomace, (iii) opposition from the national electricity utility company; and (iv) prevailing instability in the waste management regime. The paper proposes a detailed understanding of the role and limitations of donors as a key landscape factor involved in niche development and stresses the need to reflect critically about the ambition levels and expectations of various donor programs adopted to implement the Paris agreement.

Keywords: Multi-level Perspective, Donors, Tunisia, Cement, Sustainability transition, Socio-technical niches.

Highlights:

- We study the transition to sustainable cement production in Tunisia over 1990-2015
- A socio-technical perspective is used to analyse the development of four niches
- Despite decades of donor support, niche development has only made limited progress
- Rapid price changes, opposition and conflicts among local actors were key causes
- A nuanced understanding of the role of donors as a landscape factor is proposed

1. Introduction

The increasing contribution of developing countries to global environmental problems, such as climate change, has enhanced the interest into understanding how the expected increase in greenhouse gas emissions (GHG) can be reoriented toward a more low-carbon development path (Elzen et al. 2013). Through the provision of knowledge, technology, capacity building and financial resources, foreign donor agencies potentially play an important role in promoting such a transition toward sustainability. While international development assistance has a long history dating back to post World War II, more recently, the increasing attention to the importance of mitigating climate change has led to a rapid increase in donor funding dedicated to low-carbon development. Indeed, climate financing provided by international donors specifically targeting developing countries have reached an unprecedented level of around USD 22.7 to 28.3 billion in 2014 (UNFCCC, 2016). The importance of ensuring an optimal use of the resources provided for this purpose has thus come to the fore recently (Eschalier et al. 2015; Jakob et al. 2015). In turn, this raises the need for an improved understanding of the role of donor interventions in promoting a transition toward sustainability in developing countries.

While the literature on sustainability transitions has taken an increasing interest in conducting empirical studies in developing countries, mainly in Asia and Africa (see e.g. Berkhout et al. 2010; Romijn et al. 2010), research in this field has only belatedly begun to address specifically the role of donors in promoting sustainability transitions. The few studies conducted so far have generated contradicting results concerning the ability of foreign donors to stimulate sustainability transitions, which range from an optimistic view (Power et al. 2016; Fridahl & Johansson 2016) to a less optimistic perspective (Arkesteijn et al. 2015; Amars et al. 2016; van Alphen et al. 2008; Tigabu et al. 2017; Hansen & Nygaard 2013; Marquardt et al. 2016). While the former mentioned studies could be interpreted as aligned with the positive self-image often promoted by donor agencies themselves, the latter studies could be seen as a continuation of a longer tradition of critical studies that are generally sceptical about the effectiveness of donor interventions (Long 2001; Mosse 2005).

This paper contributes to this emerging literature on the role donors as promoters of sustainability transitions in developing countries by analysing the transition toward sustainable cement production in Tunisia. The paper uses an analytical framework put forward within the literature on sustainability transitions, entitled the multi-level perspective (MLP), which comprises a combined socio-technical perspective conceptualising how the development and diffusion of technologies take place from interacting technological and social factors (Geels, 2002). The case of sustainable cement production in Tunisia is particularly interesting in light of its long history in the country, in which a number of small-scale initiatives have emerged over time with the potential to significantly improve the sustainability of cement production. Following the MLP, these small-scale initiatives are conceptualised as so-called 'socio-technical niches', which comprise the breeding place from where new and more sustainable ways of fulfilling societal functions, such as cement production, may develop to challenge the existing systems (Schot & Geels, 2008). These niches were heavily promoted over the past two decades by various resources and instruments provided through external donor interventions. While it can be reasonably expected that such support would produce tangible outcomes on the ground, the cement

industry in Tunisia has generally followed a business-as-usual trajectory, where increase in GHG emissions has followed the overall production output. Indeed, Klein et al. (2013) point at a 43% increase in absolute carbon emissions and a relative increase in per tonne of clinker or cement produced of around 30% during the period of 2003-2012 in Tunisia. Consequently, this stimulates interest into investigating the underlying reasons for these observations. To this end, we address the research question of how externally supported niches in the Tunisian cement industry developed and why they did not develop into viable ones, focusing in particular on analysing the main drivers and impeding factors underlying niche development.

The remainder of the paper is organised as follows. In Section 2, the analytical framework is described, which is followed in Section 3 by a presentation of the research methods adopted. Section 4 presents the main findings of the paper, which is organised into four narrative accounts of the development of the niches identified in this paper. These findings are then discussed in Section 5, while Section 6 presents the conclusions of the paper.

2. The multi-level perspective

The multi-level perspective (MLP) has been developed as a heuristic framework to analyse how transitions toward sustainability take place through a complex interplay between technological and social factors (Rip and Kemp, 1998; Geels, 2002). In contrast to standardised engineering-based assessments of the technical and economic feasibility of various technologies, the MLP posits that the development and diffusion of technologies requires a combined socio-technical perspective. This involves analysing how technical artefacts become embedded in society by various actors with a focus on user preferences, the adequacy of regulatory frameworks, cultural aspects and infrastructure requirements.

At the core of the MLP is the concept of socio-technical regimes, which are understood as relatively stable configurations of institutional structures, techniques and artefacts, as well as rules, practices and actor networks. Such socio-technical configurations provide the dominant manner in which various societal functions are fulfilled, such as energy supply, transport, communication and housing (Geels, 2002). Due to various stabilising mechanisms, regimes are characterised by path dependency, structural lock-in and resistance to change (Raven, 2006). Regimes, therefore, exhibit a high degree of inertia and stability, which effectively hinders alternative and more sustainable technologies from emerging and breaking through to create a transition at the regime level (Unruh, 2000).

According to the MLP, the development and diffusion of technologies, which provides a more sustainable way of fulfilling societal functions, takes place within so-called socio-technical niches (Rip & Kemp, 1998). Such niches are understood as the platforms or incubation rooms that allow for new socio-technical innovations and practices to emerge, and transfer of technology to take place (Markard and Truffer, 2008). A number of temporary measures, such as subsidies, direct investments and demonstration projects are typically needed to protect the development of new socio-technical configurations within niches. This is due to the experimental and uncertain nature of new technical concepts and social practices emerging within niches that may be unknown or untested in the local

context. The protective measures allow for experimentation activities within niches, which enable learning to proceed, expectations to increase, and new social actor networks to form and mature around new socio-technical configurations (Schot & Geels, 2008).

Socio-technical configurations developed at the niche level can, under certain conditions, reach a state where they can compete with and possibly take over the dominating socio-technical configurations at the regime level. The ability of niches to create a systemic transition requires a situation of relative instability at the regime level, which creates a window of opportunity for niche-level technologies to upscale. Instability can come about from destabilising pressure operating within regimes, but can also take place due to destabilising pressure from broader processes at the so-called landscape level. According to the MLP, landscapes comprise of a set of deep, slow-changing and exogenous structural trends that exert a unidirectional influence on regime and niche dynamics (Geels, 2002). Examples of landscape factors include: global consumption patterns, demographic trends, political ideologies, macro-economic patterns, oil prices, wars and emigration.

Figure 1 summarises how the MLP framework conceptualises transitions to occur from the alignment of niche-regime-landscape dynamics, as described above.

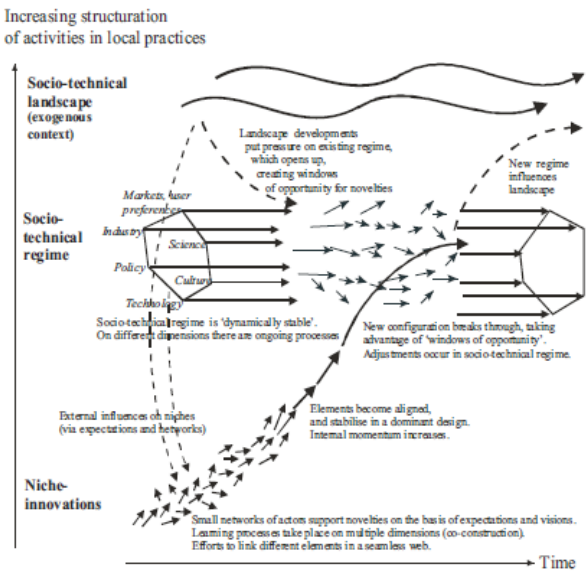

Figure 1: The MLP's visualisation of transitions (Geels, 2011)

3. Research methodology

3.1. Data collection

In line with the methodology suggested by Kamp and Vanheule (2015), the empirical material collected for this paper comprises three main sources: (1) Eighteen semi-structured, face-to-face interviews conducted with representatives of key cement industry actors and donor organisations actively involved with the cement sector in Tunisia, undertaken in two consecutive field studies in 2014 and 2015 (see Appendix A); (2) documentary material - such as published statistics, firm and consultancy reports, donor evaluation reports, material received from interviewees and pertinent publicly available information; and (3) direct observations made during a visit to a cement factory, and participation at three workshops in Tunisia relevant to the topics addressed in this paper[24]. This triangulation by data method contributed to ensuring validity of findings (Meijer et al., 2002).

The interviews lasted from 40 minutes to 3 hours, which enabled an in-depth understanding of the individual interviewee's reflections on the issues discussed during the interviews. If permission was granted by the interviewees, the interviews were digitally recorded, while insights gained from the remaining interviews were documented through extensive field notes. All interviews were conducted in French (the main foreign language spoken in Tunisia) and were subsequently translated and transcribed in English.

To operationalize the niche concept, interviewees were asked to elaborate on their involvement with or knowledge about specific local initiatives put into place with the potential to significantly reduce carbon emissions from cement production. The analysis focused on the period from 1990 to 2015, which corresponds with the period where data triangulation was possible. Drawing on prior information obtained from various documents, probing questions addressed sector-specific initiatives spanning from changes in management practices and new technical equipment implemented at the plant level to energy auditing schemes adopted throughout the sector. Interview questions addressed the main technologies and actors involved, as well as the regulatory aspects and the broader institutional conditions related to the development of the individual niches. Interviewees were also asked to describe the main driving and impeding factors underlying the development of these niches, respectively at the niche, regime and landscape level. It should be noted that this paper differs from mainstream MLP studies in two respects: (i) it conceptualises four different technological approaches adopted in one industry as niches, as opposed to understanding niches as one specific technology being promoted by various industrial niche actors, and (ii) the niches analysed in this paper have, for the most part, not materialised into tangible experiments as is typical of niche development studies (see e.g. Raven & Gregersen, 2007).

[24] "NAMA support to the Tunisian Solar Plan" workshop held on 04 April 2014 at Hotel Le Concorde in Tunis, "Development of carbon markets in the MENA region: Perspectives of new market mechanisms" held on 23-24 April 2015 at the Ramada Plaza Hotel in Gammarth, and "Technology Needs Assessment for adaptation and mitigation" held between 27-30 April 2015 at the Tunis International Centre of Environmental Technology (CITET) offices in Tunis.

The regime concept was operationalized during interviews by asking questions regarding the main organisations, physical infrastructures, formal rules and regulations, informal practices, the business culture, as well as the dominating actors and technologies related to cement production in Tunisia. Following the conventional approach in the MLP literature, the empirical boundary of the regime was operationalized to comply with national borders.

To operationalize the landscape concept, interview questions addressed various external factors influencing the national context, such as the foreign-driven privatisation of the domestic cement industry and macro-economic development patterns. These issues were obtained from documentary sources prior to conducting the interviews. As more information was gathered, the interview questions were refined so as to focus on identified niches, regime conditions and landscape impacts. Given the focus of this paper on the role of external donor interventions, particular attention was paid to analyse the nature and role of various donor programmes implemented over time to support niche development (Appendix B).

3.2. Analytical procedures

Relevant niche-regime-landscape dynamics were systematically analysed by combining the so-called 'qualitative content analysis' method as described in Gläse (2013) with the tabular coding approach suggested in Miles & Huberman (1994). Both of these approaches suggest analysing qualitative data by categorising the original data into narrower sub-categories and texts that can then be further analysed. This approach was applied to the empirical data collected for this paper by placing direct quotes and excerpts from interviews, documents and documented observations within three thematic categories as they were considered related to niche, regime and landscape-level dynamics. As shown in Table 1 below, the information obtained on the encouraging and impeding factors for the development of the individual niches were then placed within these three levels of analysis. This process enabled the critical factors to be distilled following meticulous and extensive interpretation of the excerpts and triangulation with pertinent documentation collected during fieldwork and publicly available data. To the extent possible, we also analysed the data for relevant niche development processes - dynamics of learning, expectations and actor network formation (Schot & Geels, 2008). Throughout the research process, the suggestions by Adcock and Collier (2001) were adopted to move iteratively back and forth between the analytical framework and the empirical data. This procedure involved changing and extending coding categories as they appeared in subsequent iterations during data collection and analysis.

Level of analysis	Encouraging factors	Impeding factors
Landscape	• Interview quotes • Specific document excerpts • Pertinent observations (documented in field notes)	• Interview quotes • Specific document excerpts • Pertinent observations (documented in field notes)
Regime	• Interview quotes • Specific document excerpts • Pertinent observations (documented in field notes)	• Interview quotes • Specific document excerpts • Pertinent observations (documented in field notes)
Niche	• Interview quotes • Specific document excerpts • Pertinent observations (documented in field notes)	• Interview quotes • Specific document excerpts • Pertinent observations (documented in field notes)

Table 1. Matrix used in the coding procedures applied to analyse the empirical data

These analytical procedures enabled the construction of a retrospective narrative of the sequence and unfolding of key events, processes and impacts over time related to the development of the individual niches. This narrative approach drew inspiration from the process tracing approach described in George & Bennett (2005).

4. Development of niches to improve the sustainability of cement production in Tunisia

Based on the above, four distinctive niches were identified, directed at significantly improving the sustainability of cement production in Tunisia and which benefited from donor support within the time period analysed: (1) an energy efficiency niche, (2) a wind energy niche, (3) a refuse derived fuel niche, and (4) an olive pomace residue niche[25]. In addition, two interrelated regimes influencing the development of the individual niches were identified: (1) an energy regime and (2) a waste management regime. In the following sub-sections, key findings are presented on the role of donors and the enabling and impeding factors, respectively at the niche, regime and landscape-level underlying the development of the four niches.

4.1. The development of an energy efficiency niche

The creation of an energy efficiency niche specific to the cement sector was particularly encouraged by a combination of landscape factors with changing conditions in the energy regime. The landscape factors mainly comprised of the impacts of Tunisia's adherence to the World Trade Organisation in 1994 and related support given by foreign donors to structural reform programmes aimed at liberalising the Tunisian economy (Saddem, 2001). The result of these externally-driven reforms was a wave of privatisation occurring between 1998 and 2005 in Tunisia, whereby five of the domestically-owned cement companies were sold to international groups (Moez, 2010). One of the implications of this privatisation process was that more efficient, state-of-the-art technologies and

[25] Indications of an additional niche for blended cement was also observed but was discarded due to a lack of sufficient and triangulated data enabling a deeper analysis of niche development processes.

management systems were brought into the local cement firms directly from their foreign owners. As an example, following the acquisition of a local cement factory by an Italian company, a comprehensive change in cement production technology was undertaken from a so-called wet-based to a dry-based process (Salas et al., 2015). This change in process technology evidently involved a significant reduction in the energy consumption of the cement factory. The transfer of cleaner technologies to the individual Tunisian cement companies quickly diffused to the local competitors due to obvious economic advantages. With specific reference to emission dust filters introduced by foreign owners, our interviews pointed at significant efficiency gains driving this local diffusion of foreign technologies (see Appendix C). A number of donor programs, including the French and German development agencies, the World Bank, the European Union and the United Nations Development Program (UNDP) (see Appendix B), also supported the emergence of this energy efficiency niche through grants and credit lines made accessible for cement companies via the environment and energy ministries (Interview 1 of Appendix C).

In parallel, a number of factors in the energy regime contributed to creating conducive conditions in support of the development of an energy efficiency niche. Firstly, the generally increasing energy demand in Tunisia since the 1980s put growing pressure on state budgets due to the subsidisation of energy prices. Secondly, from 1992, the rapid depletion of domestic fossil fuel reserves in Tunisia - mainly petroleum and natural gas - led to an energy deficit in 2000 (MoEE, 2013). During the 2000s, these regime-internal factors gave rise to a number of government-led initiatives aimed at reducing energy consumption in the country, especially in energy-intensive sectors such as cement production. These initiatives formed part of the energy policies adopted by the government in two consecutive periods, 2005-2007 and 2008-2011, which focused on enhancing national energy security by i) improving energy efficiency, and ii) diversifying energy sources (Lehr et al., 2012). A key initiative involved the creation of new agencies dedicated to energy management and environmental regulations, in particular the national agency for energy conservation in Tunisia (ANME). These agencies prompted cement firms to engage in mandatory energy auditing, environmental licencing and a revamping of technologies and practices (MoELP, 2001; Lehr et al., 2012; MoESD, 2007). This was backed by co-financing of up to 70% of investments related to the cost of equipment, training, energy auditing, and demonstration projects. Donor organisations, such as the World Bank, the European Union and UNDP, were heavily involved in the development of these initiatives through the provision of technical and financial support to local actors (MoESD 2007; World Bank 2016) (Appendix B). To exemplify the (significant) scale of these initiatives to promote energy efficiency in the cement industry, the contracts signed between ANME and individual cement companies since 2004 amount to a total of around 60 million Euros, which was mainly financed through grants and credit lines provided by the World Bank (Appendix B).

At the niche level, a cement producer association was founded in Tunisia in 2002, which adopted a joint commitment (in the form of a charter) to reduce the environmental impact of the industry, with a primary focus on measures to enhance energy efficiency (CNPC, 2007). Interviews indicated that this coordinated commitment represented a strengthening of the social networks and the engagement of niche actors in raising expectations for the development of an energy efficiency niche. These social networks were further expanded to include cooperative relationships between cement industry companies

and key government agencies - for example, through the establishment of a dedicated task force on energy efficiency (ANME and UNDP, 2010). Various donor programmes implemented to improve energy efficiency in the cement industry played a key role in encouraging these niche development processes (World Bank, 2012; GIZ, 2013) (Appendix B).

All of the encouraging factors described above enabled a niche to gradually emerge and gain momentum, particularly during the early 2000s. Concrete manifestations of niche development include the implementation of the following energy efficiency technologies across most cement factories in Tunisia: (i) improvement of filtration systems, (ii) introduction of higher efficiency bagging and despatching systems, (ii) use of new cement raw meal grinding equipment and coolers, and (iv) renovation of production lines (Cimpor, 2009; MoAE, 2011; Cimpor, 2010). Interviews 1, 2, 6 and 11 confirmed that the Tunisian cement companies actively pursued investments in such energy efficiency measures.

However, in spite of these encouraging factors promoting niche development, the continued rising energy demand - increasing at around 6% per year - during the 1990s and 2000s put increasing pressure on state budgets (Rekik et al., 2014). This forced the Tunisian Government to reduce spending on energy subsidies from around 2004, which resulted in a significant, temporary increase in electricity costs for industrial and private consumers, especially during the 2005-2008 period. The Tunisian cement companies were, therefore, forced to swiftly shift to more cost efficient sources of fuel. The domestic cement industry responded immediately by engaging collectively in lobbying for approval of the use of imported petroleum coke (pet coke), which was considered a financially viable, albeit less sustainable option compared to natural gas[26]. Pet coke also provided a relatively unproblematic shift in fuel supply to ensure continued production. With its dual mandate of promoting the manufacturing sector and managing energy resources in Tunisia, the ministry of energy and industry was highly receptive to the lobbying efforts undertaken by the cement industry in favour of using pet coke. With the endorsement of the finance ministry, which considered the use of pet coke as a means of decreasing energy costs, this powerful coalition of ministries consequently reacted by requesting other regime actors, such as the environment ministry, to abstain from vetoing such a shift. Interviews suggested that the use of pet coke was politically acceptable, mainly as a means to preserve the use of domestic sources of natural gas, and as a compromise to prevent the use of coal (see Appendix C). From around 2004/2005 cement companies gradually shifted from a mix of heavy fuel oil and natural gas to using pet coke-fuelled cement kilns at their factories (MoAE, 2011). Subsequently, this became the preferred source of fuel used throughout the cement industry and currently, seven of the eight factories operating in Tunisia use pet coke as the main source of fuel in their kilns. One factory is still using natural gas, which is explained by its proximity to the Algerian border and the appertaining possibility of purchasing natural gas from Algeria (Klein et al., 2013). As shown in Figure 2, the shift to pet coke had a major impact on the total carbon emissions from the cement sector.

[26] Our interviews indicate that the cost of pet coke at that time was comparable to the subsidised price of electricity prior to the reduction in subsidies.

In the end, this shift in fuel sources effectively supressed the energy efficiency gains obtained prior to the introduction of pet coke. The energy efficiency niche, thereby, lost significant momentum gained previously.

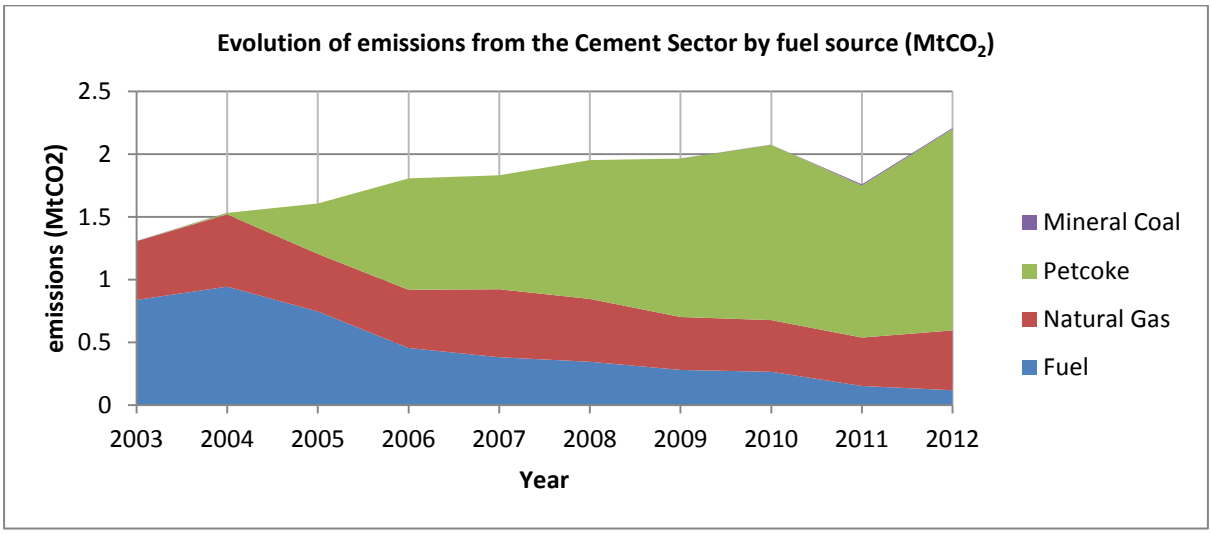

Figure 2: Emissions from the cement sector by fuel source. Adapted from Klein et al. (2013).

4.2. The development of a wind energy niche

At the landscape level, the development of a wind energy niche in the Tunisian cement sector was strongly related to donor activities undertaken by UNDP and GIZ (Appendix B), while cement industry actors were particularly interested in the possibility of obtaining project co-financing from the sale of carbon credits under the Kyoto Protocol's Clean Development Mechanism (CDM). After signing the Kyoto Protocol in 2002, and with the support of various donors, a so-called Designated National Authority (DNA) was established in 2004 in Tunisia, which was responsible for national approval of CDM projects. Subsequently, a CDM task force and strategy was created in 2005, and the approval procedures related to the implementation of CDM projects in Tunisia became formalised by law in 2008 (Kratou, 2012). Simultaneously, a number of donor organisations actively promoted the development of wind projects in Tunisia, including German and Spanish development agencies and the United Nations Development Programme (UNDP & ANME 2012; Lehr et al. 2012; UNDP 2015). The promotional activities involved the preparation of a national wind atlas and a number of feasibility studies prepared for private project developers, including a 45 MW UNDP-supported wind farm by Gabes cement factory (UNDP 2015).

At the regime level, the construction of wind power plants in Tunisia was envisioned in the energy policies covering the period 2008-2011, as part of the objective to diversify energy sources, which included a focus on renewable energy (Lehr et al., 2012). Indeed, the government set a target of 60 MW added installed capacity of wind power in 2011 to be constructed by energy-intensive industries, including cement production. This target was part of the objective to increase the share of renewable energy in primary energy consumption to 4% by 2011. Specific incentives for investors included co-financing of 70% of feasibility study costs and a decrease in tax rates on equipment investments (GIZ, 2011).

At the niche level, the above factors contributed to creating significant interest from most cement companies in Tunisia towards investing in wind power projects. Interviews indicate that this investment interest was also spurred by a need for cement companies to become i) more independent with respect to electricity sources, and ii) less vulnerable to increases in electricity prices. Cement companies considered both of these motivations as necessary preconditions to sustain continued and stable production of cement at their factories (see Appendix C). In addition, some cement companies pursued the development of wind power projects based on an expected economic return by becoming energy producers. The tangible manifestations of this investment interest is reflected in the initial agreements signed between ANME and six individual cement companies for the development of CDM wind projects[27] (GIZ, 2011). Following the CDM project cycle, three of these projects reached the stage of initial project descriptions in 2009 (ANME, 2009). As a result, expectations for the development of a wind energy niche in the cement sector were raised in the 2007-2009 period.

However, from around 2008 onwards, a rapid and substantial reduction in the price of carbon credits occurred, following the global economic recession, which resulted in an overall reduction in production and energy use, and hence in the global demand for carbon credits. Indeed, from 2008 to 2009, the price of carbon credits fell from around 35 USD to 10 USD, and continued to decline to 0.17 USD in 2014 (Kossoy et al., 2015). This meant that the expected revenue from the sale of carbon credits were substantially lower than expected, which contributed significantly to reducing the investment interest of cement companies in CDM wind projects.

More importantly, at the regime level, the role and vested interests of the national utility company for electricity and gas, entitled STEG, comprised an insuperable factor preventing further development of CDM wind projects from the Tunisian cement sector. STEG has had a monopoly on electricity generation, transmission and distribution in Tunisia since 1962, and has enjoyed strong political legitimacy for its activities (Alcor et al., 2014). The electricity regime in Tunisia is highly stabilised through the dominating and powerful role of STEG and its electricity union in maintaining the status quo. According to Rocher and Verdeil (2013), STEG has actively and quite effectively resisted the incorporation of independent power producers (IPP) and privatisation, more generally, in the energy generation system. STEG has, for example, continuously prevented the establishment of a clear regulatory framework for IPPs (UNDP 2015; Klein et al. 2013). The opposition against private investors in electricity generation meant that STEG actively resisted the development of wind projects by cement companies. As a corollary, cement companies were not allowed by STEG to engage specialised wind energy companies to operate their wind parks, which was necessary due to the lack of experience of cement companies. Instead, to meet the renewable energy targets set out by the government in 2008, STEG created a subsidiary called STEG-ER in 2010 with the mandate to upscale renewable energy projects in Tunisia. STEG had increased its wind energy production capacity from 10 MW in 2000 to 55 MW in 2009 and 175 MW in 2012 (MoELPSD, 2014; Rekik et al., 2014). This

[27] Those comprise of the following firms: "Les Ciments D'Oum El Kelil", "Les Ciments de Bizerte", "Les Ciments de Jbel Oust", "La Societe Tuniso-Andalouse de Ciment Blanc", "Les Ciments de Gabes" and "Les Ciments D'Emfidha".

illustrates the role of STEG in maintaining its monopoly position as the main electricity provider, and of wind power projects in Tunisia.

Interviews suggest that since wind power projects were already considered a risky business venture for most cement companies (see Appendix C), none of the planned wind projects, for which initial feasibility studies had been prepared, reached financial closure and progressed to the construction stage. Confronted with the diminishing price of carbon credits and the opposition from STEG, cement companies refrained from pursuing further project development. In the end, this meant that the wind energy niche never materialised into the construction of tangible plants and remained at the planning stage for cement companies.

4.3. The development of a refuse derived fuel niche

At the landscape level, the German Development Agency (GIZ) provided technical and financial assistance to the establishment of a planning group in 2006 in Tunisia, which comprised of key representatives of the cement industry and the ministries of environment, energy and industry. The purpose of the group was to identify different options to improve the sustainability of cement production in Tunisia (MoAE, 2011). One of the preferred options identified by this group as technically and economically feasible involved the use of refuse derived fuel (RDF), which is a well-known and widely used alternative fuel source in the global cement industry (Mokrzycki et al., 2003; Benhelal et al., 2013). Subsequently, the planning group actively, and in a coordinated manner, lobbied for the acceptance of RDF use in cement kilns in relevant government agencies related to waste management. This actor network comprised a strong coalition promoting the development of the RDF niche, not only via lobbying efforts, but also through joint publications, such as practical guidelines for the use of RDF in the cement sector (CNPC, 2007; MoAE, 2011). In addition, the planning group organised a visit in 2009 to cement factories in Germany and Belgium showcasing practical examples of RDF use. Interviews indicated that this visit contributed significantly to convincing the participating Tunisian actors about the feasibility of using RDF as a source of fuel in their factories (see Appendix C).

In parallel, at the regime level, the annual increase in waste generation in Tunisia from approximately 1.5 Mt in 2000 to 2.5 Mt in 2015 put increasing pressure on the government to identify new waste management strategies (SWEEP-Net, 2010). The energy policies adopted in 2008 also contained a target to add 40 MW installed capacity of electricity generation facilities using household waste by 2011 - albeit without specific measures to achieve this target.

In combination, the above activities contributed to raising expectations for the development of the RDF niche in Tunisia, particularly during the 2008-2010 period. This rise in expectations is reflected in the approval granted by the Ministry of Environment for the use of imported tyres for combustion in cement factories and the acceptance granted to one cement company to import RDF on a temporary testing basis (ANGed, n.d.). Meanwhile, a number of cement companies started exploring the possibility of using RDF in their factories by conducting feasibility studies and initial project planning (MoAE, 2011; World Cement, 2008). Within this impetus for RDF niche development, one cement company

reportedly requested exclusivity rights for the exploitation of wastes generated within the Basin of Tunis, and other cement companies followed suit with similar requests. According to the interviews, cement companies were motivated mainly by the foreseen economic advantages in using RDF, compared to the (increasing) price of pet coke during this period. This led to a search for alternative, more cost-efficient sources of fuel.

In spite of the encouraging factors described above, further development of the RDF niche was hindered mainly due to the composition and functioning of the waste management regime in Tunisia. Since RDF consists of combustible components of municipal solid waste (MSW), its usage in cement kilns would require a change in the dominating practice by waste management authorities to landfilling of MSW. Indeed, since 1999, landfilling of MSW has been the preferred waste management strategy, which means that 70% of the total MSW generated in 2012 in Tunisia was landfilled (GIZ, 2014). The management of the nine landfills in Tunisia is coordinated by the so-called waste management agency (ANGED), through relationships between local authorities and private entities - through concessions (GIZ, 2014). However, interviews suggest that conflicts of interest and disagreements have prevailed among these actors, mainly relating to a lack of clarity concerning their respective roles and responsibilities, budgetary allocations and ownership of waste (Appendix C). The waste management regime in Tunisia has, therefore, been characterised by a persistent lack of overarching strategic coordination and coherence. Since the sorting of MSW is required prior to the use of RDF in cement kilns, disagreements quickly emerged about who should bear the costs and responsibility for waste collection, sorting and distribution. Furthermore, the existing controversies and instability in the waste management regime spilled over to create an insurmountable obstacle for the usage of RDF in the cement industry. According to the interviews, cement companies pursuing the use of RDF found themselves up against a lack of strategic orientation from decision making authorities, which made it impossible for them to set up contractual agreements and reach financial closure[28]. Moreover, the Ministry of Environment in Tunisia issued a decree in 2010, which enforced very strict emission norms for combustion of RDF, based on concerns about their potential health risks[29] (Chouaouta & Ben Azouz, 2013). Interviews with cement companies suggest that compliance with these norms would make the use of RDF less viable due to additional investments needed in emission control equipment.

In combination, the above meant that from around 2010 cement companies simply lost interest in using RDF at their factories, with the result that the use of RDF never materialised in Tunisia.

4.4. The development of an olive pomace niche

At the landscape level, and similar to the wind energy niche, the development of an olive pomace niche was encouraged by the possibility of obtaining project co-financing from the sale of carbon credits under the CDM. This was also accompanied by donor support for the development of CDM projects in Tunisia (see section 4.2). More importantly, however, at the regime level, the energy policies adopted in 2008 set a target for the installation of

[28] This lack of strategic coordination was further exacerbated in the aftermath of the Tunisian revolution in 2011, which caused renewed uncertainty about roles and responsibilities across government agencies.
[29] These emission norms were evidently beyond the levels used in Europe for the combustion of RDF.

electricity generation facilities using olive residues with a total capacity of 40 MW, to be achieved in 2011 (Lehr et al., 2012). However, it would appear that the achievement of this target was not followed by supportive instruments provided by the government.

For a prolonged period of time, until around 2011, the prevailing and conventional waste management practice in the Tunisian olive industry was to discharge olive pomace. Olive producers generally considered olive pomace residues as an unproductive waste to be disposed, except for minor use as fertiliser or animal feed (Karray, 2012; Jackson et al., 2015). Tunisia has ranked amongst the six largest world producers of olive oil, producing approximately 650,000 tonnes of olive pomace annually from the total 1 750 oil mills (UNFCCC, 2011; Jackson et al., 2015). Prior to 2011, olive pomace was readily available in large quantities and at low costs, estimated at around 8 Euros/tonne in 2010 - when purchased directly at mills - and occasionally even free of charge (UNFCCC, 2011). Since olive pomace has a high calorific value, it is highly suitable to be used as fuel for combustion in cement kilns (Pattara et al., 2010).

In combination, the above conditions raised expectations for the use of olive pomace in the cement industry, which enabled an olive pomace niche to flourish, particularly during the 2008-2011 period. During this period, a number of cement companies undertook technical experimentation at their factories with a view towards co-firing olive pomace directly in their kilns - in combination with pet coke. One cement company developed the use of olive pomace into a CDM project, which was registered in 2013 - co-firing started in 2012 but the CDM project never materialised into the final stage to issue carbon credits. According to interviews, a key motivation for cement companies to start utilising olive pomace was the relative cost-efficiency compared to pet coke, which was increasing during this period - estimated at around 102 USD/tonne in 2010 (UNFCCC, 2011; UNFCCC, 2013). Evidently, the sheer abundance, availability and relatively low cost of olive pomace provided cement companies with a suitable alternative (see Appendix C).

However, at the landscape level, an export market for olive pomace developed swiftly after 2012 to service an increasing demand from Europe (mainly Italy) and the Middle Eastern and North African region (Jackson et al., 2015; Olivecoal, n.d.). This export market increased the price of olive pomace rapidly and significantly to reach a range of 45-95 Euros/tonne in 2015 - direct purchase at mills (Algomtl, n.d.). This price increase changed the understanding in the olive industry of olive pomace as a waste disposal problem to a profitable resource. In turn, the sale of olive pomace to overseas buyers significantly reduced the volume of olive pomace available for cement companies in Tunisia. According to interviews, cement companies found it increasingly difficult to purchase olive pomace and obtain long-term biomass fuel supply contracts. In combination with the price increase, most cement companies subsequently refrained from pursuing further use of olive pomace, which led to a rapid demise of the olive pomace niche after 2012.

5. Discussion

From the empirical results presented above, it is clear that the four niches analysed in this paper experienced a limited period of momentum. In the end, however, the niches were halted before reaching a stage where they could create a significant, transformational

impact on improving the sustainability of cement production in Tunisia. Indeed, for the most part, the niches did not even manifest in tangible niche-level experiments on the ground. What is equally evident is that the development of these niches is difficult to reduce merely to a question of the techno-economic feasibility of the technical concepts and practices explored and developed within the cement sector. Rather, the four niches analysed in this paper were encouraged and prevented by a complex interplay between technical, economic, political and social factors. Table 2 provides a summary of the main encouraging and impeding factors identified.

Most of the technologies developed and diffused within the four niches were considered technically and economically feasible by the cement companies, at least at a certain point in time, which also partly explains their active role in pursuing initial project planning, direct investments and lobbying efforts. It is evident from the above, that the windows of opportunity encouraging the development of the four niches have, in particular, been driven by support from various donor programmes implemented over time in Tunisia (Table 3).

Niche	Level	Enabling factors	Impeding factors
Energy Efficiency niche	Landscape	➢ External-driven liberalisation reforms (1998-2005): foreign ownership of cement companies led to transfer of cleaner energy efficient technologies ➢ Donor programmes/projects (from GEF, World Bank, GIZ, AFD and UNDP) provided technical and financial support to energy efficiency initiatives in cement sector.	
	Regime	➢ Government initiatives to promote energy efficiency in energy-intensive sectors (including cement production) during the early 2000s, such as mandatory energy auditing	➢ Increase in electricity prices for industrial and private consumers, especially in the period 2005-2008 (due to reduction of state subsidies for fuel oil and natural gas)
	Niche	➢ Creation of a cement producer association in 2002, which comprised a new actor network that advocated for more state regulation incentivising sustainable cement production ➢ Individual cement companies pursued investments in energy efficiency measures mainly due to economic feasibility, especially in the period 2004/5	➢ From 2004/5 cement companies lobbied actively for the use of (imported) pet coke, which was considered an economically viable option compared to natural gas ➢ Based on political acceptance, the cement companies shifted from a mix of heavy fuel oil and natural gas to using pet coke-fuelled cement kilns at their factories from around 2005
Wind energy niche	Landscape	➢ From around 2005, the possibility of obtaining co-financing from the sale of carbon credits in CDM wind projects in Tunisia ➢ Donor support (from GIZ and UNDP) for CDM wind projects in the cement industry	➢ From 2008 onwards, significant reduction in the price of carbon credits
	Regime	➢ Establishment of national DNA in 2004 and CDM task force in 2005 ➢ Energy policies in 2008 set a target of 60 MW added installed capacity of wind power in 2011 to be constructed by energy-intensive industries, including cement production	➢ Stabilised electricity regime: STEG and its union opposing private IPPs, including CDM wind projects by cement companies
	Niche	➢ Cement companies actively pursuing CDM wind project investments, through feasibility studies and project applications to regulatory bodies in the period 2007-2009 (niche momentum) ➢ Motivations for cement companies to pursue wind project investments include an increase in electricity independence	➢ Post-2008: Cement companies stopped pursuing further wind project investments mainly due to i) the loss of economic incentive from sale of carbon credits, and ii) active resistance and lack of support from STEG

		and exploration of new business opportunities	
Refuse derived fuel niche	Landscape	➢ Donor support (from GIZ) involved in creation of a planning group in 2006 to nurture niche promotion	
	Regime	➢ The generally increasing waste generation in Tunisia motivated the government to identify and promote new waste management strategies ➢ Energy policies in 2008 set a target to add 40 MW installed capacity of electricity generation facilities using household waste by 2011	➢ Unstable waste management regime: conflicts and disagreements about roles and responsibilities, budgets and ownership of waste ➢ Compliance with strict emission norms for combustion of refuse derived fuel reduce the financial viability significantly
	Niche	➢ Planning group (actor network) pushing for the acceptance of refuse derived fuel use in cement kilns ➢ Visit to Europe in 2009 (via financial support of GIZ) demonstrating the viability of RDF mobilised significant interest from cement companies	➢ Post 2010: the investment interest of cement companies in using refuse derived fuel was significantly reduced
Olive pomace niche	Landscape	➢ From around 2005, the possibility of obtaining co-financing from the sale of carbon credits in CDM wind projects in Tunisia	➢ From around 2012 an export market for olive pomace emerged rapidly
	Regime	➢ Energy policies in 2008 set a target for the installation of electricity generation facilities using olive residues with a total capacity of 40 MW to be achieved in 2011	
	Niche	➢ Tangible results at the plant level from experimentation undertaken at factories in using olive pomace in cement kilns ➢ A number of cement companies started trials by using olive pomace directly in kilns	➢ Reduction of domestic supply of olive pomace and difficulties in obtaining long-term fuel supply contracts ➢ Price increase reduced the economic viability of olive pomace

Table 2: Encouraging and impeding factors for niche development across MLP levels

No.	Niche	Donor support mechanisms to the Tunisian cement sector across niches examined
1	**Energy Efficiency**	➢ Structural reform programs leading to privatisation of 5 cement companies ➢ Provision of technical and financial assistance (through grants and credit lines) to support (i) factory upgrading, (ii) investment in environmental protection equipment, (iii) engagement in renewable energy development, (iv) energy auditing, (v) training and (vi) demonstration projects ➢ Direct support to niche development processes via strengthening of social networks (such as through a dedicated task force on energy efficiency linking cement industry companies with key government agencies)
2	**Wind Energy**	➢ Support to Government for the creation of (i) new institutions (such as the Clean Development Mechanism Designated National Authority), (ii) new coordination mechanisms (such as a CDM Task Force), and (iii) new legal frameworks (DNA regulations) ➢ Technical and financial assistance for the preparation of (i) a national wind atlas, (ii) feasibility studies for cement industries interested in developing wind farms, and (iii) CDM wind energy projects
3	**Refuse Derive Fuel**	➢ Technical and financial assistance to strengthen social networks via (i) the establishment of a planning group, (ii) lobbying for RDF acceptance across Government agencies, (iii) facilitating an overseas visit in Europe, and (iv) supporting joint publications/practical guidelines for RDF usage.
4	**Olive Pomace**	➢ Support to Government for the creation of (i) new institutions (such as the Clean Development Mechanism Designated National Authority), (ii) new coordination mechanisms (such as a CDM Task Force), and (iii) new legal frameworks (DNA regulations)

Table 3: Donor support mechanisms to the Tunisian cement sector

While these donor interventions are considered an influential factor operating at the landscape level, it appears that they influence niche development in a more direct manner than is typically assumed in the MLP framework. According to Geels (2005), landscape factors are conceptualised as influencing niche development in a diffuse and indirect manner - by stabilising/destabilising regimes - compared to the influence from the regimes on niches, which is stronger and more direct. In the case of the cement sector in Tunisia, however, donor interventions are seen to directly influence dynamics at the regime and niche levels. Donor interventions provided various kinds of advice, consultancy and capacity building activities to regime actors to promote changes in the existing political and regulatory set-up in order to encourage niche development. In sustainability transitions more broadly such capacity building efforts are often related to the adoption of incentive schemes or regulation based on the transfer of experience from regulatory frameworks adopted in the donor home countries (Marquardt et al., 2016). Donor support promoting changes within existing regimes can also take the form of support for the creation of new institutions within government agencies, such as in the case of the establishment of a national agency to manage CDM projects in Tunisia. In some cases, donors also act as niche advocators through direct negotiation and lobbying at the regime level to mobilise political interest and legitimacy for niche development.

At the niche level, donor interventions can, in a similar manner, influence key niche-level processes directly, for example through promotional activities aimed at raising expectations of niche actors and/or by providing direct funding and technical assistance for demonstration plants and other types of niche-level experiments. In Tunisia, this was discernible in the case of a number of donor programmes, which directly incentivised cement companies to pursue feasibility studies and plant investments through the provision of co-financing for specific projects, such as in the case of the wind energy niche (Appendix B). The flipside of such promotional efforts is the risk of luring local actors into risky investments and activities that may lead to financial and other loses. Donor interventions may also facilitate learning and actor network formation within niches by creating knowledge sharing platforms and supporting the creation of cooperative arrangements, such as industry associations and lobbying groups. In the cement industry, such arrangements were supported by various donors in order to promote wind power and RDF development.

Critics of the MLP framework have stressed that the landscape concept is elusive and ill-defined, and is often used as a residual category in empirical research to describe the broad context or background for regimes and niches (Genus and Coles, 2008; Geels, 2011). This means that the landscape level often does not comprise an independent focus of most MLP-based studies. The Tunisia case, however, suggests that donor interventions can function as an important landscape factor that can channel key resources, such as technology, knowledge and finance into the local context, which may directly influence niche development processes (Wieczorek et al., 2015). This finding points at a need to place more explicit emphasis on the landscape-level as an interesting topic to explore in its own right (Morone et al., 2016). This paper takes a step in that direction by providing a more nuanced understanding of the role of one landscape factor particularly relevant in the developing world (Marquardt et al., 2016).

In spite of the numerous donor programmes implemented over time to support the development of the four niches analysed in this paper, niche development has only made limited progress. As summarised in Table 2, we identified a number of inhibiting factors that effectively contributed to prevent niche development. These include: (i) the decrease in the price of carbon credits, (ii) the rise of an export market for olive pomace, (iii) the active opposition of the national utility company, and (iv) the prevailing instability in the waste management regime. These empirical observations give rise to broader reflections about the complexity of donor programs in promoting low carbon development in the cement sector and, more generally, sustainability transitions in developing countries.

One interpretation is the obvious fact that donors do not operate in a vacuum. As shown in Olsen (2006), donor interventions typically enter into a local context with a variety of on-going processes of conflicts, struggles and negotiations, which influence the extent to which the interventions ultimately realise their expected objectives. This was evidently the case with regard to the unstable waste management regime identified in this paper, characterised by longstanding conflicts and tensions among various actors, which were difficult for the external donors to resolve or overcome in any straightforward manner. Moreover, as stressed in Hansen & Nygaard (2013), donors are constrained by their lack of formal decision making authority and typical weak position as external actors in the national political system. This is especially the case in the energy sector, which often has high national priority and attention. This means that the extent to which the policy advice provided by donors is taken up politically, and leads to regime changes, depends greatly on whether the recommendations resonate with the interest of key regime actors. In this case, opposition from the national utility company may be interpreted as a reflection of an apparent misalignment between the interests of donors and a key regime actor on the topic of IPP inclusion in the energy generation system. This suggests that the ability of donor agencies to stimulate niche development through the provision of policy recommendations is very difficult in cases where there is a weak interest from key regime actors.

Furthermore, the decrease in the price of carbon credits and the emergence of an export market for olive pomace could be understood as a reflection of broader structural conditions that are beyond the immediate operational sphere or control of donor agencies. This circumstance could thus be interpreted to illustrate the limitations of donor programmes that are typically designed and managed as rationally planned interventions with predictable objectives and outputs. In this case, rather than following a clear and linear means-end process, processes of change for sustainability transitions are highly complex and require a donor management approach that is reflexive and responsive to unforeseen factors. While this can be crucial for niche development, it can be difficult for donors to encompass in a rational, linear and control-oriented approach to manage interventions (Long 2001).

Finally, in many cases, the donor interventions implemented successively by various actors in a given sector typically proceed in an uncoordinated manner over time and is often characterised by competition rather than collaboration (Marquardt et al. 2016). This means that the individual interventions often are isolated instances, which is not undertaken within an overarching, long-term strategy comprising a battery of coordinated interventions (Tigabu et al. 2017). This prevailing lack of coordination between donors - and the

associated issues of duplication and sub-optimal resource utilisation - certainly also seems to have prevailed in the cement sector in Tunisia, which contributed to the limited effectiveness in terms of niche development. These observations resonate with recent findings from evaluation reports on donor effectiveness in Tunisia (see Appendix D).

The above discussion forms part of a recent stream of empirical research that has put forward a more sceptical view on the ability of donor interventions to promote niche development in developing countries (Kundu et al. 2016; Ahlborg & Sjöstedt 2015; Gabriel et al. 2016). These studies have emphasised that external donors are fundamentally constrained by aiming at steering societal change from the outside. Such critical observations stand in contrast to the overwhelming body of positive (self)appraisals of various donor programmes in the grey literature and the prevailing discourse in the donor community. Thus, as argued in Hansen & Nygaard (2013), there seems to be a scope for additional research in transition studies, which explores the effectiveness of development aid to stimulate niche development.

6. Conclusions and policy implications

This paper began by highlighting the generally limited research undertaken within the sustainability transition literature specifically analysing the role of foreign donors. This stands in contrast to the need for an improved understanding of the ability and limitations of donors as promoters of sustainability transition in the developing world in light of the increasing climate funding provided by donors to promote low carbon development. In order to contribute to address this knowledge gap, we made use of the MLP framework to analyse the development of four niches with the potential to significantly improve the sustainability of cement production in Tunisia during the 1990-2015 period. Through the provision of capacity building, technical and financial resources, decades of targeted donor support have tried to stimulate niche development by inducing changes at the regime level and stimulating niche-level processes. In spite of these efforts, the development of the four niches has only made limited progress.

Through an in-depth analysis of the key events and processes influencing niche development over time, we were able to identify four main factors important for hindering niche development. The first is related to the rapid and substantial reduction in the price of carbon credits, which contributed to reducing the investment interest of cement companies to pursue project investments. The second involves the rapid and significant rise in the price of olive pomace due to an increasing demand from overseas buyers. The increase in price and demand for olive pomace reduced the economic viability of its use in cement kilns, making it difficult for cement companies to obtain long-term fuel supply contracts. Thirdly, the active opposition from the national utility company against the inclusion of IPPs, which resulted in prolonged project approval processes, meant that cement companies did not proceed with the development of previously planned projects. Finally, the prevailing instability in the waste management regime characterised by long-standing conflicts among the involved actors and agencies made it impossible for cement companies to establish arrangements for the collection and distribution of RDF to be used as fuel in cement kilns.

The paper shows that in a developing country context, donors are critical actors that can provide key resources to stimulate sustainability transitions. However, the paper also suggests that donor agencies, as external actors, are constrained by a number of context-specific factors, which are not easily resolved given the short time-frame, the limited decision making authority and the often uncoordinated nature of successive interventions. Recently, a number of bilateral and multilateral donor-funded initiatives have been adopted as a follow up to implement the Paris agreement, such as support for developing countries to prepare and implement so-called intended nationally determined contributions (INDCs). Considering the limited effectiveness of donors in promoting niche development stressed in this paper and in related research, such as Marquardt et al. (2016) and Tigabu et al. (2017), this raises a need for development practitioners and donor agencies to reflect critically about the ambition level and expectations of such initiatives. As shown in this paper, resolving fundamental issues of state monopoly in the energy sector and overcoming long-standing conflicts in the waste sector, within a relatively short period, clearly highlights the importance of reconsidering the approach to donor-supported sustainability transitions and aligning it with the prevailing ambition level. Additional research is needed to address the role of donor interventions - as a particularly interesting landscape factor in the developing world - across various industry and country-specific circumstances.

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Appendix A

Interview	Role(s)	Category	Date(s)
Interview 1	Factory Manager & Engineer-in-Charge of Environment	Cement Factory 1	05 May 2015
Interview 2	Factory Director	Cement Factory 2	24 April 2015
Interview 3	General Manager	Consulting firm 1	28 April 2015
Interview 4	Director	Environment Ministry - waste management	18 May 2015
Interview 5	Senior Executive and Expert	Energy Ministry and Donor 1	15 April 2015
Interview 6	Executive Director	Trade Union	19 May 2015
Interview 7	Officer-in-Charge	Environment Ministry - environment technologies	30 April 2015
Interview 8	Analyst	Donor 2	27 May 2015
Interview 9	Head	Energy Utility Authority	07 May 2015
Interview 10	Deputy Director	Environment Ministry	13 May 2015
Interview 11	Director	Environment Ministry	21 May 2015
Interview 12	Senior Executive	Energy Management Agency	27 May 2015
Interview 13	Director	Energy Management Agency	08 April 2014
Interview 14	Director	Consulting firm 2	02 April 2014
Interview 15	Consultant	Consultant for Donor 1	04 April 2014
Interview 16	Head of Project	Donor 1	10 April 2014
Interview 17	Director	Environment Ministry	11 April 2014
Interview 18	Senior Executive	Energy Management Agency	07 April 2014

Appendix B: Donor programmes of relevance to the cement sector

Project Title	Main Donor	Time Period Covered	Focus Area	Budget
Energy Efficiency Programme/Industrial Sector	Global Environment Facility (GEF)/World Bank	2004-2011	Overcoming barriers to the development of a sustainable market for energy efficiency products.	8.5 million USD
Support to the implementation of the UNFCCC	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)	2006-2014	Capacity building on climate change in Tunisia.	9 million Euros
Environment Protection Programme	GIZ	2003-2013	Better integration of environmental concerns in the industry and society.	16 million Euros
Capacity Development for greenhouse gas inventories and MRV in Tunisia	GIZ	2012-on-going	Greenhouse gas inventory development and establishment of Monitoring, Reporting and Verification systems.	2.2 million Euros
Deployment of energy efficiency applications on industrial sites in Tunisia	GIZ	2012- on-going	Mitigation of greenhouse gas emissions from the Tunisian industrial sector through the improvement of energy efficiency in industries.	2.5 million Euros
"Programme d'Appui à la Ligne de Maitrise de l'Energie"	Agence Française de Développement (AFD)	2009 – on-going	Improving energy efficiency of Tunisian industries and diffusion of renewable energies.	40 million Euros credit line
"Quatrième programme de mise à niveau des entreprises (PME)"	AFD	2005 - 2013	Structural reforms of the Tunisian economy, with focus on upgrading industrial facilities.	30 million Euros
"Projet renforcement des capacités des task-forces (Industries Grosses Consommatrices d'Energie & Cogénération)"	United Nations Development Programme (UNDP)	2005-2009	Capacity building in Tunisia on Energy Efficiency, focussing on energy intensive industries.	0.8 million USD
"Renforcement des capacités nationales en matière de sensibilisation, et d'information,	UNDP	2003-2005	Capacity building in Tunisia to satisfy international environmental agreements.	0.15 million USD

d'éducation et de formation dans le domaine du changement climatique"				
"Projet de rendement énergétique dans le secteur industriel de la Tunisie"	World Bank	2009-2014	Energy efficiency in the Tunisian industry and cogeneration projects, with technical assistance to project proponents and key actors.	55 million USD credit line
"Programme Environnement Energie"	European Union	2009-2014	Assistance to Tunisia towards promoting sustainable development policies and environmental protection, with focus on energy.	33 million Euros
"Renforcement des Capacités de la gestion durable des Zones industrielles" - "Industrial Depollution Fund (FODEP) Phase III"	GIZ / Kreditanstalt für Wiederaufbau (KfW)	2008-2014	To help Tunisian companies gain better access to financing for environmental protection investments with the purpose of reducing their harmful pollutants and/or their use of resources (loan channelled through the Industrial De-pollution fund).	14 million Euros loan
Private Sector-Led Development of On-grid Wind Power in Tunisia	GEF/UNDP	2009 - 2012	Promotion of on-grid wind power in Tunisia through the introduction of the necessary regulatory and institutional frameworks, to create favourable conditions for private sector investors in the renewable energy sector, and assisting the government of Tunisia in launching a programme of private wind concessions totalling 100 MW.	2 million USD

Appendix C: Illustrative interview quotes

This appendix presents a selection of key illustrative direct quotes/interview excerpts underlying the findings presented in the four sub-sections on niche development in Section 4.

Section	Direct quotes	Interviewee/Source
4.1. The development of an energy efficiency niche	*"The problem of the company was related to energy consumption and the company moved from a wet to a dry process. Consumption of energy decreased by half after this change. This gain of 50% on energy represents a gain in profit on the price of cement and a tripling of production. Before we used to make 800-900 tonnes of cement, now we produce three times more, around 2 500 tonnes."*	***Interview 1, 5 May 2015***
	" (Cement factory 2) belongs to (International group 2), which puts a lot of importance on safety and environment issues, (International group 2) can be considered as a model in Europe on that topic…bought a lot of filters, especially process filters and some other smaller filters for transport installations, when the Portuguese group bought the industry."	***Interview 2, 24 April 2015***
	"… (Cement Factory 1) started with hybrid filters and dust collectors and obtained an output of 10 micrograms per cubic meters. Since that initiative from (Cement Factory 1), all other plants followed and did the same. There was an interest from all the cement industries, lower emissions of dust meant better efficiency, so every cement industry invested in those filters. It was a financially viable investment."	***Interview 6, 19 May 2015***
	"In 2007, we signed a sustainable development charter, which was voluntary and which covered renewables and a decrease in energy use. At the level of this union, we only consider converging interests within the industry. We hold meetings and talk, a maximum of 3 times per month. However, we aim for at least 8 to 14 of those meetings per year..."	***Interview 6, 19 May 2015***
	*"The environment ministry and ANME initiated those energy efficiency measures. Since 1990, they started with those revamping programmes and energy audits. We are not forced to do those measures. Energy audits are required by law. With the decrease in demand of Algerian gas, we had those measures, with the law on energy audits. The energy audit requirement date back to 2004. We have benefited from the Fonds d'aide (*de-pollution fund*) managed by environment ministry to undertake revamping measures. Now it is changed to Fonds de Transition Energetique (*Energy Transition Fund*). We benefited 600 000 Tunisian Dinars of direct aid for purchase and installation of electro-filters because we were polluting a lot. The total costs were more than 2 million euros and the funds helped in this endeavour."*	***Interview 1, 5 May 2015***
	"…We have already started to think in terms of energy efficiency due to the energy policies of Tunisia."	***Interview 3, 28 April 2015***
	"Following the privatisation of those (cement) *industries, of course, they adopted a viability logic; an economic and financial logic that pushed them to examine all possible sources of fuel to increase their profits. I believe this is legitimate, but it has to stay within respect for emission limits, it is what we look for, and it is what defines our relationship on that aspect … Of course, there were inter-ministerial pressures because the ministry responsible for the cement sector; that is the Industry Ministry, adhered to their cause and requested that the environment ministry do not make reservations on this request. However, we were not agreeable on the use of coal. The main issue with use of coal concerns mercury emissions, which is why we were not agreeable. Concerning pet coke, we did not put any specific reservations, though there were issues regarding the ports that would be required to receive this pet coke which is 100% imported."*	***Interview 11, 21 May 2015***

Section	Direct quotes	Interviewee/Source
4.2. The development of a wind energy niche	*"Cement firms are nonetheless interested by this activity (wind energy production) since it would allow them to become more independent with respect to electricity production sourced from STEG and anticipate onto foreseeable increases of electricity prices from STEG" (translated from French).*	Direct quote **(Klein et al. 2013) pg 65**
	"*We consider the CDM as being no longer relevant, following the crash of the carbon markets in 2011/2012…This is the current situation, we no longer seek to develop CDM projects, we do not hide that there is no interest in that…At one time, there was a cement industry that was very interested in a CDM project. It entailed a wind energy project with a view to provide the industry with electricity. It was not subsequently registered and did not generate credits. CDM does not bring investments but rather cash flows that could improve the financial viability of a project, depending on the carbon market…*"	***Interview 11, 21 May 2015***
	"There were initiatives regarding the use of wind energy but the laws did not move at the same speed, because of the monopoly of STEG."	***Interview 6, 19 May 2015***
	"*Firstly, the conditions for the implementation of the law are complex. For example, if I am a cement producer. The law require that you invest and operate yourself. If I am a cement producer, I know how to make cement, I don't know how to make use of wind energy. I won't take this risk. On the other hand, I am ready to purchase electricity over a period of 10, 15, 20 years from a specialist that can develop wind energy. That is not possible according to law, because it falls within the monopoly of the electricity company and we cannot do it. STEG does not want to cede.*"	***Interview 3, 28 April 2015***
	"…For the state and STEG, there is another philosophy. We do not really want our customers to become companies that produce electricity…We want to keep the monopoly of electricity production at STEG, but at the same time allow economic actors to firstly produce electricity for their own needs, yes, that's no problem, it suits us, but not really to compete with STEG in the production and sale of electricity, that is not tolerated yet. Maybe with the new regulatory framework that might be possible. It is not the case yet. In Tunisia we do not allow companies to produce and sell electricity, distribution stays within the monopoly of STEG."	***Interview 9, 7 May 2015***
	"*…the government pushed for renewable technologies, which STEG was wary of and whose implementation it has slowed.*"	Direct quote **(Rocher & Verdeil 2013), p1**
	"The STEG trade unions made a lot of efforts, even going to the Court of Constitutional Rights to show that some paragraphs of this law were unconstitutional."	***Interview 9, 7 May 2015***

Section	Direct quotes	Interviewee/Source
4.3. The development of a refuse derived fuel niche	"*GIZ organised a study tour for the benefit of the cement industry, the cement trade union and concerned administrations - including me since I am a member of this network, held in Belgium and Germany and we witnessed how they operated. We saw cement industries that operate nearly up to 80% of substituted energy sources, not exclusively from RDF which comprise of 20%, but a portfolio of sources, including dangerous wastes, wood, solvents, paints. The visit did have a big impact on me.*"	***Interview 4, 18 May 2015***
	" *…we started with the network. Its principal objective was to connect state actors with cement producers, especially from the private sector, to discuss on environment issues, and also to help cement industries to overcome issues in their sector. Energy represents around 40% of their costs and the industries want to improve their energy use.*"	***Interview 7, 30 April 2015***
	"*…in Tunisia, we have a big problem. We have an institutional conflict... That is, ANGED manages but in reality, we do not have the right to manage* (wastes)*. We are mandated to do the design, we look for funds, we guide, we execute programmes, but it is up to communes to manage. However, the communes are not executing their tasks... All that concerns management of household wastes is not clear … This conflict of interests, that is, ANGED is doing something it is not really mandated to do. Exploitation is not really ours, it is supposed to be communes...*"	***Interview 4, 18 May 2015***
	"It is all the management of wastes in Tunisia that will have to change, to be able to provide cement industries with RDF. For the time being, it is not very clear… because wastes are owned by whom, is it ANGED? Is it also the local government who are tied to the interior ministry? There is a need for a first sorting, at which level, who will be responsible?"	***Interview 12, 27 May 2015***
	"*If you take alternative fuels, you need to knock on three doors: the ministry of environment, industry and interior. Waste fuels include ministry of interior through municipalities across Tunisia. Contacting municipalities, you can have appointments, but when you talk about using wastes, you will be redirected to ministry of environment, if you talk about waste collection it is the ministry of interior. In Tunisia, you don't have an organisation that oversees everything.*"	***Interview 2, 24 April 2015***
	"We requested the permission to import RDF, until we can get Tunisian RDF and it did not work. We cannot do everything, such as waste collection and treatment also. We asked participation of the state in terms of costs together with cement industry in terms of waste collection. The state refused and did not want to engage in the project. There is discontinuity, no decision maker wanting to engage. I can understand these last four years in view of the political instability, but there is no one willing to take decisions."	***Interview 2, 24 April 2015***
	"*…we cannot use RDF in our industry, regulators think it is a dangerous waste and have put stringent emission levels. But it is not, and has never been a dangerous waste. Moreover, with too stringent emission levels, even if cement industry complies to those, we cannot maintain such equipment so as to abide by those regulations. It is too costly to invest in filters that could maintain such levels. We are supposed to invest in filters that abide by 20 mg while in Europe, factories abide by 30 mg. Responsible people in environment ministries recognise they made a mistake but it is very difficult for them to go back.*"	***Interview 2, 24 April 2015***

Section	Direct quotes	Interviewee/Source
4.4. The development of an olive pomace niche	*"But we are working a lot to use alternative fuels … We have made studies with used tyres and olive pomace. However, for pomace, there is too little quantity for us, we need more. Pomace is being exported to Italy. The problem with pomace is not with burning it but to crush it. We need another type of mill to crush it. We have studied the use of pomace, and it is the quantity existing is too small. Other than quantity, the problem with pomace is also the price; it is at least 1.5 times pet coke. If we don't get at least 20% returns on the price of pet coke, why engage in something like that?"*	***Interview 2, 24 April 2015***
	"… we have managed to keep some credible providers of olive pomace, who manage to provide us with it. We pay for it, but we pay it at a lower price than pet coke. Olive pomace is more financially viable than pet coke. They are bought on the local market and we do not have a lot of storage exigencies as compared to pet coke storage, where we have to buy through cargo and the environmental issues we need to consider in storing pet coke. We used 20 000 tonnes of olive pomace last year, representing between 10-15% of all our calorific energy use… it is not a difficult product to use. It is an easy product to get from Tunisia, to use, there is no crushing needed, it goes directly to the kiln, it is a good waste, a very good waste, a noble waste…At first, we made a trial, I don't know where the idea came from. In our trial, we crushed it with pet coke. Then we discovered that we did not need to crush it. Olive pomace was not totally free but nearly free…"	***Interview 1, 5 May 2015***

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Appendix D

This appendix presents illustrative quotes from evaluation reports focussing on donor programs in Tunisia highlighted in Section 5

Quote	Source
"The mid-term evaluation had identified a new risk related to the fear among the various stakeholders to discuss and work through their differences in positions and points of view in a systematic way. The evaluation had then recommended the setting up of a PSC (Project Steering Committee) that would provide political leadership … to address institutional differences so that the negative events associated with this risk would be avoided. However, there is no evidence that this recommendation was implemented, and the differences continue to prevail thereby hindering the institutional transformations that are needed for catalyzing private sector investments in renewable energies"	**(UNDP 2015), pg 10**
"This evaluation has shown that there were serious design flaws in the results framework (and the project document) that also capture the over ambitious or unrealistic investment targets and the corresponding direct GHG emission reductions that the GEF-financed project was expected to deliver"	**(UNDP 2015), pg 15**
"There is evidence that the project has not been able to adapt to the main challenge it faced, that is resistance from STEG for politically supporting private generation of on-grid electricity from wind power. "	**(UNDP 2015), pg 16**
" the project supported the Gabes Cement Company to carry out auto-production. … However, several technical and regulatory issues concerning the interpretation and application of Decree No. 2773 have hampered the commissioning of the wind farm. …Under the law, only STEG is allowed to sell electricity."	**(UNDP 2015), pg 30**
"…given the situation of power sector monopoly by STEG, it was unrealistic to assume that any reforms to accommodate IPP wind power suppliers and the commissioning of 60MW of wind power plants could take place within the 3-year project duration."	**(UNDP 2015), pg 54**
"Disbursement delays occurring from …. Direct competition from another subsidized credit line partially dedicated to EE (Energy Efficiency) projects provided by another donor (AFD) supported by a European Union grant "	**(World Bank 2016), pg 14**
"Notwithstanding the billions in loans and assistance Tunisia has received, patterns of overpromising and under delivering harm trust between citizens and their leaders, as well as between the government and international donors"	**(Muasher et al. 2016), pg 8**
"Politicians' and international funders' promises have crashed into the constraints of an under resourced parliament, a convoluted bureaucracy, and international donors' lack of coordination "	**(Muasher et al. 2016), pg 9**
"Donors often continue to support less-coordinated initiatives in parallel with budget support "	**(Caputo et al. 2011), pg 2**

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Paper 3: Assessing Transformational Change Potential: The case of the Tunisian Cement Nationally Appropriate Mitigation Action (NAMA)

Assessing Transformational Change Potential: The case of the Tunisian Cement Nationally Appropriate Mitigation Action (NAMA)

Zyaad Boodoo[a], Karen Holm Olsen[b]

[a]UNEP DTU Partnership, Technical University of Denmark (corresponding author)
[b]UNEP DTU Partnership, Technical University of Denmark

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Academic Abstract

To effectively address the root causes of carbon lock-in across developing countries, Nationally Appropriate Mitigation Actions (NAMAs) with transformational change characteristics are being supported by donors and finance mechanisms as a means to achieve ambitious Nationally Determined Contributions (NDCs). However, there is still a scarcity of empirical studies on how transformational change policies and actions are designed and supported in practice. This paper addresses such a gap in knowledge by combining theoretical insights from the Multi-Level Perspective and Transitions Management literature to examine a donor-supported cement sector NAMA in Tunisia developed during 2012-13. A narrative is constructed to analyse the adequacy of the NAMA design to promote structural shifts towards low carbon development in the cement sector. Data collection is based on semi-structured interviews and documentation gathered during field work in Tunisia 2014-15. The study finds that the NAMA design is not likely to lead to transformational change of the cement sector, since underlying factors accounting for lock-in are not properly tackled. Although the NAMA has enabled new and promising sectoral partnerships across the cement sector, the analysis suggests that the NAMA's transformational potential is currently limited by a number of factors not being adequately addressed. Measures are proposed to reorient the NAMA towards promoting system innovation, building on further research and experimentation with the policy entrepreneurial role of donors.

Key Policy Insights

- Underlying factors such as the absence of local finance institutions and the lack of reflexivity features in project design restrict the potential of the Tunisian cement NAMA to spur transformation to low carbon development.
- To tackle underlying causes of carbon lock-in and re-orient policies and actions for transformational design, the promotion of feedback loops and self-contemplation needs to be based on a long-term vision, experimentation, social learning and information gathered during implementation.
- Donors need to re-think their existing modalities to better support unpredictable and highly political changes for sustainability transitions in developing countries.

Keywords: Mitigation actions, low-carbon, transition management, transformational change, carbon lock-in, cement sector

1.0 Introduction

Nationally Appropriate Mitigation Actions (NAMAs) were launched by the 2007 Bali Action Plan (UNFCCC, 2007) to enhance the contribution of developing countries to global climate change mitigation under the 1992 UNFCCC. They are now increasingly branded as vehicles to implement Nationally Determined Contributions (NDCs) (Bosquet et al., 2016). NDCs are the basis of international commitments agreed upon during the 2015 Conference of Parties to the UNFCCC (COP 21) in Paris for up-scaled greenhouse gas (GHG) emissions reduction measures by all countries (UNFCCC secretariat 2016). From its launch at the end of 2013 to August 2017, the UNFCCC NAMA registry recorded 166 submissions from developing country parties (UNFCCC Secretariat 2017). Concurrently, expectations from the climate community regarding the role of NAMAs in stimulating low carbon development in developing countries have risen. Indeed, NAMAs are being regarded by many donors as vectors of transformational change (or paradigm shifts) (NAMA Facility, 2014; NEFCO, 2016) to achieve systemic change for low carbon and sustainable development. However, NAMA implementation is still in its infancy, with few empirical cases available for academic scrutiny. Consequently, this generates interest in the investigation of what exactly such transformational objectives for NAMAs mean in practice.

Despite the relative youth of the NAMA mechanism and the limited real-world implementation, a growing number of scholars have engaged in NAMA-related research. Grey literature covering conceptualisations, operationalisation and practical challenges of NAMAs is extensive (Olsen et al., 2015; Sharma & Desgain, 2013; ICAT, 2017), out of which some emerging publications have tackled the role of NAMAs for transformational change (OECC, 2015; Mersmann et al., 2014; Westphal & Thwaites, 2016; Olsen & Fenhann, 2015; Olsen & Fenhann, 2016). However, there are fewer peer-reviewed publications analysing the NAMA/Transformational Change linkages. Most academic contributions have focussed on NAMA-like mechanisms (Garibaldi et al., 2013; Delgado et al., 2014), traced their historical origins (Gupta, 2010; Coetzee & Winkler, 2013), or dwelled on ancillary topics and proposed design parameters relevant to NAMAs (Cheng, 2010; Linnér & Pahuja, 2012; Li, 2011). While a comparative literature on NAMAs is emerging (Tyler et al. 2013; Fridahl et al. 2015; Upadhyaya 2017), the few in-depth empirical contributions on NAMAs so far have a strong regional focus on Asia (Chunark et al., 2015; Jaeger et al., 2015) and, to a lesser extent, South America (La Rovere et al., 2013; Zevallos et al., 2014).

With the exception of Winkler & Dubash (2015), Amars et al. (2016) and Fridahl & Johansson (2016), academic literature dealing with the role of NAMAs in shifts towards transformational, low carbon development are practically non-existent. This gap in knowledge is addressed in this paper by drawing theoretical insights from relevant sub-fields of sustainable transitions theories (Markard et al., 2012) to analyse the Tunisian Cement NAMA initiative. Within this field of scholarly work, the focus is on future-oriented attempts at restructuring established ways of fulfilling societal functions, termed as regime conditions. To analyse the influence of the NAMA on existing regimes, the concept of multi-regime interactions is applied within the Multi-Level Perspective school of thought combined with assessment of the design for regime transformations described within Transition Management (TM) literature. The Cement NAMA is conceptualised as a kind of

planned intervention (Long & Ploeg 1989; Olsen 2006) for transformational change, designed and implemented by the Government of Tunisia with donor support from the German Government. How the transformational change objectives of NAMAs can be understood is investigated by tackling the following main research question:

> *How, and to what extent, does the Tunisian Cement NAMA promote transformational change to low carbon development in Tunisia?*

To answer the research question, the results of another study (Boodoo & Hansen, forthcoming), focussing on the limitations of donor interventions towards promoting niche development across the Tunisian cement sector over 1990-2015, are used to map out the regime architecture prior to the planned intervention. Based on insights from the study, an analytical framework is designed by adopting TM as an idealised model to investigate how the design of the Tunisian Cement NAMA, analysed as a planned intervention consisting of a complex set of evolving social practices and struggles (Long & Ploeg, 1989), is tuned towards encouraging transformational shifts to low carbon and sustainable regimes. By bringing insights from the sociotechnical transitions literature to enrich the NAMA community, this approach contributes to the emerging scientific literature that explores what designing for transformational change (or paradigm shift) means in practice. Though the NAMA developers have not followed a TM approach, the NAMA was submitted to the NAMA Facility with the explicit aim to support transformational change. By analysing the NAMA design against an idealised model for TM, this paper provides a conceptual and an empirical contribution to the NAMA community, while pointing towards areas of further research within TM. The analysis reveals that at its current level of development, the NAMA is not likely to lead to structural shifts in regimes.

2.0 Theoretical and Analytical Framework and Methodology

2.1 Introduction to the Multilevel Perspective and Transition Management

The Transition Management (TM) and the Multilevel Perspective (MLP) are two schools of thought among sustainable transition theories. While the MLP provides for historical and contemporary accounts of transitions (Smith et al., 2010), TM extends its analytical reach by suggesting managerial approaches to guiding structural transformation processes (Loorbach & Raak, 2006). Both strands of research provide a descriptive ordering framework for change at various scales, and suggest that transitions happen when interactions at various levels come together (Smith et al., 2010; Grin, 2010).

The MLP analytically delineates between three key concepts: regimes, niches and landscapes. While the definition of regimes varies across different research foci (Geels, 2011), they are typically represented as stable sociotechnical configurations that depict the established way of doing things, which, in turn, hinder the development of innovative ways to fulfil societal functions termed niches. Niches represent protected spaces where unstable but more sustainable practices may be nurtured to challenge existing ones, while the landscape comprise of a set of deep, slow-changing and exogenous structural trends that exert a unidirectional influence on regime and niche dynamics (Geels, 2002). The MLP posits

that transitions occur when regimes are destabilised under the influence of pressures from niches and landscape factors.

On the other hand, TM postulates that sustainability transitions -- that is the destabilisation of regimes -- can be partly steered through a series of governance activities termed strategic, tactical and operational, which are cyclically linked on a time dimension across reflexive governance activities (Loorbach, 2010). While long-term visions of cultural and societal change are envisaged at the strategic governance (macro) level, activities devised at the tactical (meso) level focus on translating such visions into pathways through the formulation of scenarios and agendas required for action. At the operational (micro) level, actors are mobilised and projects and experiments are implemented. Finally, at the reflexive level, monitoring and evaluation components are devised and used to adjust or re-orient actions and strategies adopted across the other levels.

Within TM, steering of niche development is entrusted to a so-called transition arena (TA) (Rotmans & Loorbach, 2009), the activities of which cut across the four governance levels. In essence, a TA is a combination of an institutional arrangement (Voß & Bornemann, 2011) comprised of an open and dynamic network of carefully chosen change agents tied around a common objective, and a method through which different perspectives, expectations and agendas are confronted, discussed and aligned (van de Kerkhof & Wieczorek, 2005). Comprised of members of various segments of society, a TA enables a shift in ideologies and belief systems by allowing participants to operate outside normal policy circles (Frantzeskaki et al., 2012). Loorbach (2010) situates the establishment of the arena at the strategic governance activity level, wherein actors involved undertake a mapping of the current flaws of a system, formulate images of areas that need change, establish sustainability criteria and envisage futures over at least a 25-year time horizon. At the tactical governance level, activities undertaken within a TA involve the inclusion of new entrants who possess more relevant knowledge of the planned transition implications. At this level, visions are translated into scenarios, and roadmaps are devised. Short-term activities are devised at the operational governance level, where actors can either choose to recreate system structures or restructure them (Frantzeskaki et al., 2012). Lastly, at a reflexive level, monitoring and evaluation elements are conceived by TA actors to better inform strategic reorientation across all elements of the intervention.

The key analytical levels used by the MLP and TM frameworks have a direct link; with niches, regimes and landscapes under the MLP corresponding to micro-, meso- and macro-levels, respectively, across TM. To conceptualise the issues at stake in the empirical case, analytical levels are combined across both frameworks.

2.2 Analytical framework

This paper empirically assesses the means and extent to which a planned intervention, conceptualized as a transition arena created by the Cement NAMA, promotes transformational change towards a low carbon development path. Analytically, such a focus entails exploring how a shift in regimes is designed and planned in the context of the carbon lock-in of existing regimes in the Tunisian cement sector. To obtain an initial mapping of the

regime architecture within this case, pertinent insights regarding multi-regime dynamics are used from the MLP literature (Raven & Verbong, 2009; Konrad et al., 2008; Raven, 2007), and a broad definition of regimes at play is pragmatically adopted through the different societal functions pursued and their scope spanning across a national scale. Since the NAMA has not yet reached implementation stage, data is not available to support a historical MLP assessment of the extent of its transformative influence. However, a TM perspective enables an analysis of the NAMA design for transformational change by comparing the structural components and targeted actions embedded within the NAMA with TM's idealised model.

The donor supported Cement NAMA is conceived as a landscape-level intervention (see section 3.2) along the lines of Grin (2010), and is further visualised as creating a transition arena, through which the development of promising low carbon niches are anchored -- pictured in Figure 1. Prior to the implementation of the Cement NAMA, the niches portrayed are located within an energy production and a waste management regime without significant interactions with the cement sector. However, those regimes are prompted to interact closely through activities planned in the Cement NAMA intervention.

TM is a specific form of multi-level governance, whereby state and non-state actors 'co-produce and coordinate policies in an iterative and evolutionary manner on different policy levels' (Kemp et al., 2007, p 82). Within this set-up, state actors have a key role to play through promotion, mediation, brokering, creating the right conditions and engaging in steering activities (Loorbach and Rotmans, 2010). Assuming the political feasibility of TM constituents, TM is adopted as an ideal transitions-promoting model for planned interventions. To answer the research question, the paper begins with the concept of a transition arena to conceptualise the network of actors having participated in the formulation of the Cement NAMA. The characteristics, and the activities carried out within a transition arena (summarised in Table 1), are used as analytical concepts to scrutinise the Cement NAMA.

TM governance activity level		Targeted MLP level	Time horizon	Target	Focus activity
Strategic	Establishment of a transition arena	Landscape (Macro)	> than 25 years	Society and Culture	Long-term envisioning of cultural and societal change
	Problem structuring				
	Envisioning of futures				
Tactical	Coalition building	Regime (Meso)	5 - 15 years	Structures	Translates visions into pathways
	Development of images and transition agendas				
	Development of transition scenarios				
Operational	Mobilisation of actors	Niche (Micro)	0 - 5 years	Practices	Execution of projects and experiments
	Execution of activities				
Reflexive	Monitoring of the process	All	All	All	Monitoring of the process and adjusting all elements above
	Evaluation and re-orientation				

Table 1: TM's Analytical dimensions (adapted from Frantzeskaki et al., 2012; Loorbach, 2010)

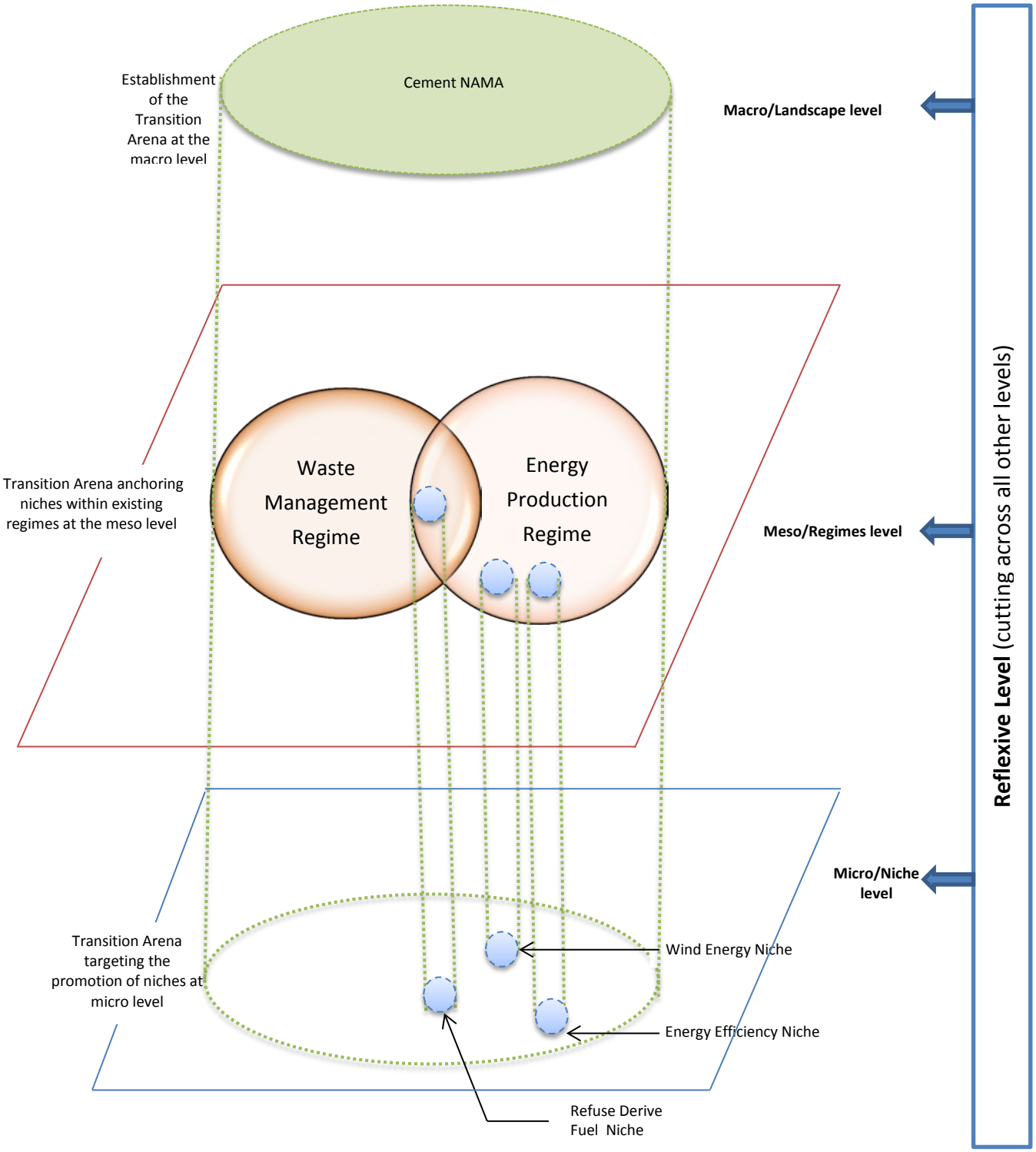

Figure 1: Conceptual framework of the Cement NAMA's influence on niches and regimes
(adapted from Sutherland et al., 2015; Slingerland, 2014)

2.3 Methods

Primary data collection was undertaken through 20 semi-structured interviews (Appendix 1) conducted during two field visits to Tunisia between 2014 and 2015, and includes pertinent publicly available documents and reports handed in by interviewees. Nine interviewees were identified as transition arena actors, including two cement factory managers, one cement trade unionist, one donor organisation, one representative from the national electric utility company and four senior officials from the energy and environment ministries.

Secondary data used for the construction of a narrative about the role of the NAMA to transform the cement sector in Tunisia was a cement NAMA study undertaken between 2012 and 2013 (Klein et al., 2013a; Klein et al., 2013b; Klein et al., 2013c), and a related NAMA proposal submitted to the NAMA Facility. Triangulation was ensured via interview data and field-based observations. Along the lines of methodologies used by Bos et al. (2015), the analytical concepts in Table 1 were used to operationalise the different elements comprising TM's governance activity levels (see Appendix 2 for more detailed data collection and analytical procedures).

The results are presented in the next section through a two-pronged narrative. First, relevant insights are applied from the literature to understand how carbon-locked regimes exist in the Tunisian cement sector. Second, the empirical evidence of the NAMA design is compared with the levels of activities in the ideal TM model to evaluate the potential of the intervention to lead to transformational change. Three out of four categories of mitigation measures recommended by the NAMA were addressed, thereby omitting the promotion of blended cements from the analysis. This is deemed acceptable in view of the low fraction it represents in terms of both targeted emissions reduction (15.4%) and required investments (0.2%). Furthermore, since implementation of the NAMA has not yet materialised due to its early stage, the level of operational activities within TM dealing with the actual execution of projects was disregarded. The results from this exercise are presented in the next section.

3.0 The Tunisian Cement Sector and the Influence of the Cement NAMA

3.1 Carbon locked-in regime structures in the Tunisian cement sector

Cement production is typically a highly resource-intensive and polluting industry prone to carbon lock-in (ECA, 2015; Xu et al., 2016). The cement sector in Tunisia is no exception. Comprised of nine factory units spread over its territory (case details are at Appendix 2), the sector contributes to around 13% of Tunisia's total emissions of GHGs (MoELPSD, 2014). Sector-specific data indicate increasing trends in emissions; from 4.5 MtCO2-eq in 2003 to 6.4 MtCO2-eq in 2012 (Klein et al., 2013b). Those values suggest that the Tunisian cement sector is following an increasingly carbon intensive pathway. Nevertheless, a closer look at the sector reveals a number of low carbon development initiatives (niches) that have been attempted over time. However, those niches have had little influence on the overall emissions performance of the cement sector. Indeed, average sector-specific emissions increased from 0.723 tCO2/tonne cement produced in 2003 to reach 0.803 tCO2/tonne cement produced in 2010 (Klein et al., 2013b). This contrasts with trends observed at the

worldwide level -- global average intensity values decreased from around 0.68 tCO2/tonne cement produced in 2003 to 0.63 tCO2/tonne cement produced in 2010 (WBCSD, 2012). These figures suggest that the cement sector is carbon locked-in.

The sociotechnical configurations that account for this lock-in are explored in Boodoo & Hansen (forthcoming), wherein the MLP is used to identify the critical factors, at niche, regime and landscape levels, which influenced the development of mitigation initiatives undertaken across the cement sector between 1990 and 2015. Two regimes hindering niche development were observed: an Energy regime and a Waste Management regime. Across those regimes, three key and distinct barriers were identified, as summarised below (see Boodoo and Hansen (forthcoming) for a full analysis).

First, the stability of the Energy regime is mainly determined by the interests of STEG, the national electric utility company, whose long-standing resistance towards Independent Power Producers (IPPs) has increased the investment risks for cement companies wishing to implement wind energy parks. Second, with respect to energy efficiency in the production of cement, this Energy regime has stabilised around the use of petroleum coke (petcoke) as a cheaper option than previously utilised heavy fuel oil and gas-fired cement kilns. Firms were pushed towards adopting petcoke following the drying up of national fossil fuel reserves and a subsequent reduction in energy subsidies. This shift in fuel type effectively curbed previously achieved energy efficiency gains. Third, the Waste Management regime in Tunisia is entrenched in landfilling practices. Such a focus has blocked the promotion of Refuse Derived Fuel (RDF) as an alternative energy source in cement firms. Existing conflicts in roles, responsibilities and budgets among actors involved in the management of waste in Tunisia have obscured the opportunities for firms to engage in RDF, especially since prior agreements on collecting, sorting and cost sharing would be required to ensure its viability.

3.2 Background to the Cement NAMA

Before engaging in a detailed analysis of the NAMA design for transformational change of the Tunisian cement sector, the origins of the Tunisian initiative to decrease GHG emissions from its cement industry is briefly introduced. Within the context of a nine-year (2006-2014) country support programme provided by the German government on the implementation of the UNFCCC (GIZ, 2013), a national climate change strategy for Tunisia was formulated (MoE & GIZ, 2012). One of its policy recommendations pertained to reaping the financial benefits from windows of opportunities at the international level, via an early engagement in emerging mechanisms under the UNFCCC. Against this background, a NAMA for the Tunisian cement sector was initiated in 2012 and further developed through technical and financial assistance from the German Development Cooperation Agency (GIZ).

Further to a scoping study undertaken in 2012, a technical working group was set up in 2013 to undertake an in-depth exploration of viable mitigation options across the sector (Troudi et al., 2013). Coordination of this group's activities was entrusted to the state-run energy management agency, ANME. While GIZ (2013b) points to the Tunisian Cement NAMA as an ANME-driven initiative, the interview data suggests that the NAMA was primarily the result of donor intervention, with GIZ playing a crucial role in initiating and developing it. Interviewees from both the public and private sectors suggest that the NAMA originated

from a lack of political will in Tunisia to fund international climate mitigation measures due to limited financial and human means, and a dependency on bilateral and multilateral cooperation to support mitigation efforts.

This technical working group identified four main measures that could be applied to the cement sector: (i) the promotion of energy efficiency, (ii) the setting up of wind parks, (iii) the use of RDF, and (iv) the adoption of blended cements. Based on the MLP and TM perspectives illustrated in Figure 1, these mitigation measures are understood as niches and the Cement NAMA intervention as a landscape factor.

3.3 Analysis of the Tunisian Cement NAMA's design

3.3.1 The establishment of a transition arena

The mitigation measures targeted by the technical working group anchor the planned niches within existing regimes (Section 3.1). In light of the cement firms' use of energy to power cement kilns, and their intention to become producers of electricity through wind energy development, the energy efficiency and wind energy niches operate within the Energy Regime. Meanwhile, the potential use of RDF as an alternative energy source entails new ways to process and manage waste from landfill to power cement kilns. Hence, the RDF niche anchors at the overlap of the Waste and Energy regimes. The networks established through the formulation of the Cement NAMA create linkages between those regimes, whose traditional ways of operating have been contributing to locking the cement sector into a high carbon pathway. By anchoring targeted niches within, or at the intersection of, regime boundaries, the working group provides a platform to target regimes synergistically, as depicted in Figure 1. By including the varying interests of a previously loosely connected heterogeneous group of concerned actors for discussions around a common objective, i.e. greening the cement sector, this technical working group demonstrates characteristics of a transition arena. The interview data indicates that such an inclusive way of tackling mitigation of emissions at the sector level was new to the local context.

The establishment of the Tunisian cement sector transition arena thereby embraces two essential characteristics at the strategic level described by the TM model: strong government involvement and inclusion of a wide range of concerned actors grouped around a common aim.

3.3.2 The capture of the NAMA transition agenda by industry incumbents

In designing the NAMA, a shared understanding of the underlying carbon lock-in status of the Tunisian cement sector and its mitigation potential was developed both (i) at the strategic governance activity level during the scoping study in 2012, and (ii) at the tactical level within the activities undertaken through the transition arena towards formulating transition images and agendas. In the first instance, through bilateral meetings and a questionnaire sent to cement firms, a team of international and local consultancies used energy and production data to construct a GHG emission baseline of the sector. This baseline subsequently provided transition arena actors with a quantified basis through which they could structure their thinking and undertake a preliminary assessment of the

emissions reduction possibilities of the sector, based on a projection of data for the period 2013 to 2020.

However, the methodological approach adopted deviates from open-ended agenda features claimed by TM as being conducive to fostering radically new ways of viewing problems and solutions. This approach was essentially based on a techno-economic feasibility analysis of generic cement production mitigation measures that could be applied to the Tunisian context. It consisted of an initial identification of a list of 35 mitigation measures inspired from technical specifications published by the European Cement Research Academy (ECRA & CSI, 2009). Firms were subsequently surveyed on their predisposition to engage in those measures, the results of which brought the list down to 26 options. A subsequent computation of the cost implications of those options, followed by a screening for measures that cost less than 20 euros per tonne of CO_2 avoided resulted in a final shortlist of 13 actions. The interviews suggest that such a strategy was deemed essential by the coordinating agency as a means to keep the NAMA appealing to industry players.

The fact that transition agenda discussions were based on pre-decided conditions (only win-win solutions) deemed acceptable by cement firms, however, meant that the coordination approach of the NAMA was hinged on a deliberate capture of the transition agenda by industry incumbents. This capture entails restricted ability for participating firms to reflect in an unbiased way on their existing practices, cultures and structures that contribute to carbon lock-in. This lack of reflexivity to break away from the stickiness of path dependency, i.e. the business-as-usual way of doing things, particularly manifests throughout the energy efficiency niche. Indeed, interviews with cement companies indicate an apparent bias to direct mitigation efforts towards the wind and RDF niches, arguing that the energy efficiency niche is not sufficiently viable -- technically or financially. However, these arguments contrast with sectoral level estimates undertaken within the technical working group, wherein (i) the payback for recommended energy efficiency measures have been evaluated as being relatively short (less than three years), and (ii) the emission reduction potential for energy efficiency measures are still expected to contribute to a significant 21% of the NAMA's total mitigation potential (Klein et al., 2013a; Klein et al., 2013b).

3.3.3 From tactical coalition building efforts to planned actor mobilisation - the absence of key actors

The promotion of coalitions between and across government and industry actors was an integral element of the procedural approach adopted in the formulation of the Cement NAMA; that is, in the final selection of 13 mitigation actions, and during the subsequent design of an implementation plan covering the 2014-2020 timeline. At the industry level, the extensive individual and grouped consultations carried out to create a sectoral baseline were accompanied by a subsequent strategy of formulating voluntary, non-punitive measures applicable to cement firms. At the government level, a similar strategy was endorsed to ensure the buy-in of transition arena actors from governmental agencies whose mandates were impacted by measures recommended within the NAMA. By putting off formal policy decision-making and industry commitments, the transition arena actors were able to formulate an array of recommendations that were deemed essential to developing those niches.

Those coalition building efforts (accomplished between 2012 and 2013) were carried forward to planned actor mobilisation components at the operational level, thereby creating conditions aimed at further encouraging the building of partnerships in the subsequent implementation of the NAMA. This manifests through recommendations put forward within the NAMA action plan pertaining to (i) an institutionalisation of the transition arena via an implementation committee responsible for the management, coordination and execution of recommendations formulated within the NAMA, comprising existing transition arena actors and additional finance ones -- such as donors and concerned financial agencies; (ii) planned public-private sector negotiations; (iii) consultations regarding the review of regulatory frameworks; and (iv) communications at national and international levels to rally further support. Interviews suggest that the combined coalition building and actor mobilising components of the NAMA have enabled (i) state actors to obtain a better understanding of the issues at stake with greening the cement sector; (ii) improved relationships, linkages, and collaborations between firms and government agencies; (iii) securing funding from the EU Commission to finance a NAMA readiness programme, as of 2015.

While the inclusion of new entrants to deepen the insights of transition arena actors involved in a planned transition is recognised as a necessary feature in TM, the absence of finance actors in discussions within the technical working group --with the exception of GIZ acting as a provider of technical and financial assistance for NAMA design-- meant that coalition building efforts undertaken by the end of 2013 were incomplete. Instead, the involvement of financial institutions has been included in the NAMA's 7-year action plan, as part of a voluntary agreement to be devised within the first 18 months of implementation. The main objective of this agreement is to operationalise a performance-based public-private financial mechanism with the ultimate aim of triggering 969.13 million euros of investments (representing 99% of NAMA investment requirements to be sourced from both donor organisations and the private sector) in the technological hardware required.

Hence, the basis on which the NAMA action plan had been framed by the end of 2013 had not yet incorporated means to operationalise the vast majority of funding requirements needed. Nonetheless, ANME and GIZ submitted a technical cooperation project proposal to the NAMA Facility in 2013, largely inspired by the Cement NAMA recommendations, for a 6.65 million euros grant -- along with co-financing of 1.3 million euros from local cement firms and 1.1 million euros from state energy funds. The proposal was not approved on the basis that the NAMA Facility only funds direct implementation rather than NAMA readiness. This failed bid to secure financing illustrates the limitations of the Cement NAMA at the time the proposal was tabled to the NAMA Facility.

3.3.4 Reflexive design deficit

In line with pertinent guidance from decisions of the UNFCCC Conference of the Parties (COP) on elements to be included within NAMAs (UNFCCC, 2007; UNFCCC, 2009), Measurement, Reporting and Verification (MRV) mechanisms have been proposed within the Tunisian Cement NAMA. By investigating MRV components as the empirical expression of TM's reflexive design elements, it is observed that the Cement NAMA's MRV mechanism

is essentially oriented towards the realisation of pre-defined emissions reduction targets for each niche detailed in the NAMA action plan. Such a narrow conceptualisation of the impacts of a planned intervention misses the importance of built-in learning for transformational change and contrasts with the adaptive exploration of development paths of TM. While experimentation is envisaged through an RDF pilot project within the operational governance activity level, feedback loops to reorient development of the energy efficiency and wind energy niches, based on lessons learnt during implementation, are absent. Therefore, the promotion of social learning, i.e. through a continuous process of learning-by-doing, only partly shines across the NAMA's design. This lack of consideration for social learning shows that, in the framing of the NAMA, the TA only partially factored in mutual dependencies between its planned implementation process and expected outcomes. The misalignment between the NAMA and TM's envisaged timelines illustrates this difference. TM claims that it is only by forecasting and back-casting scenarios of sustainable futures, as they unfold, over at least a 25-year timeline that transitions can be steered in such a way as to challenge dominant regime structures. However, the Cement NAMA is limited to only a 7-year period without dynamic scenario building exercises to inform transition arena actors on lessons learnt within and across niche development efforts.

4.0 Discussions

4.1 To what extent key regime barriers are addressed in the NAMA

By comparing the factors accounting for the Tunisian cement sector's high carbon pathway (identified in 3.1) with the intervention areas detailed across the NAMA's design (described in 3.3), it is seen that key regime level barriers have been identified within the NAMA. Proposals tabled to tackle them are: planned consultations, sensitisation programs, pilot plants and the creation of independent institutions (see Appendix 3). However, since the crux of implementation relies on financing and commitments from different involved parties, the absence of financial actors in the transition arena and the postponement of hard decisions are major limitations of the NAMA in effectively incurring changes in regimes. Hence, regime-level barriers are not yet adequately addressed.

Furthermore, the lack of commitments from the different parties involved suggests that the timelines proposed to implement NAMA recommendations have neglected potential countervailing strategies from regime actors. For example, planning the revision of regulatory barriers to wind energy development across 2014-2016 presumes that historical interests from STEG and its electricity union in maintaining the status quo --and resisting IPPs-- will be overcome within a two-year period, despite no such formal agreement being reached during the formulation of the NAMA.

In summary, the analysis shows that the NAMA primarily scratches the surface of regime level barriers without adequately addressing their underlying reasons. This is further illustrated by the absence of implementation in 2014, where no progress towards fulfilling the NAMA action plan took place, until around mid-2015, when the EU Commission agreed to finance further development of the NAMA through a readiness plan.

4.2 How well does the Cement NAMA incorporate a transition design following the TM model

The empirical results show that the Cement NAMA espouses some of the analytical concepts of TM at the different governance levels examined (Appendix 4). This is illustrated through activities such as: establishing a transition arena, problem structuring and envisioning possible futures at the strategic level; a strong focus on coalition building at the tactical level; planning the mobilisation of actors at the operational level; and integrating some evaluation elements at the reflexive level. These activities have benefited actors aiming at greening the cement sector by providing them with a transparent, synergistic and scientifically structured approach to envisaging mitigation of the sector's GHG emissions. Such an approach led to the creation of new partnerships between firms and state actors. Through these activities, the Cement NAMA's design supports transitions to sustainable cement production. However, elements of the coordination approach and design deviate from crucial TM principles behind managing a transition process.

The NAMA design's bias towards a deliberate appropriation of the transition agenda by industry incumbents, and a focus on selecting win-win options as a pragmatic way of engaging previously unconnected actors are problematic. Having pre-defined solutions instead of being open to innovation effectively hinders actors' ability to reflect on the underlying reasons for path dependency (Rotmans & Loorbach, 2009; Loorbach 2010). Even if concerned actors had demonstrated out-of-the-box thinking during transition arena deliberations, the Cement NAMA's methodological approach shuts the door for an open-ended, yet structured, exploration of possible futures. Therefore, part of the NAMA's design runs against the fundamental rationalities of TM -- geared towards avoiding lock-in into sub-optimal measures.

The Cement NAMA's scarce consideration for (i) long-term envisioning of cultural and societal change, (ii) experimentation, and (iii) feedback mechanisms contrasts with TM's perspective on transitions as being cyclical, dynamic and exploratory in nature (Rotmans et al., 2001; Kemp et al., 2007). These elements oppose Burch et al.'s (2014) argument for climate policy responses aiming to foster long-term development path transformations to consider long time horizons, systems thinking, adaptive management, and integrated decision making. Such limitations further suggest that complexity, uncertainty, and reflexivity elements were only partially considered across the NAMA's design. Instead, a control-oriented approach seems to transpire across the Tunisian Cement NAMA, along the lines of logical framework thinking that prevails across causal models of planned intervention in development cooperation (Boodoo, Mersmann & Olsen, forthcoming). Such a lack of integration of social learning elements, suggests that, to date, the NAMA is at best likely to favour system improvement measures (incremental adjustments) as opposed to a combination with system innovation measures -- experiments done to change dominant designs (Kern & Smith, 2008).

The absence of financiers in transition arena discussions suggests that perspectives from crucial actors on how to operationalise transition pathways have been overlooked, to date. Rather, the viewpoints of investors, bankers and long-term commitments by donors, along with a number of hard decisions, have been deferred for implementation at a later stage.

Therefore, the NAMA's action plan has been built around the premise that conflictual issues will be sorted out within pre-determined time frames. Given the active role of regime actors towards resisting fundamental change (Geels, 2014), this presumption may be unfounded. Furthermore, McDowall (2012) points to the limited credibility and utility of roadmaps where participation and buy-in of key actors are ignored. In turn, this caveat also implies that the NAMA action plan, in its current form, hinges on rather thin assumptions of facilitation and, therefore, is not likely to disrupt incumbent regimes within the timelines envisaged.

By studying the Tunisian Cement NAMA from a TM perspective, this paper brings forward issues that have had little academic coverage. While application of TM in developing country contexts is notoriously limited (Poustie et al., 2016), scientific studies on the policy entrepreneurial role of donors is even more scarce, with the notable exception of Meijerink & Huitema (2010) and Marquardt et al. (2016). The role of donors as external drivers of sustainability transitions contrast with developed country applications of TM, where the drivers of change are primarily domestic. Consequently, developing country contexts highlight challenges not envisaged within TM literature. This article illustrates such challenges via the absence of prior coordinated approaches in bringing structural reforms across the Tunisian cement sector. Within this background, avoiding the potential exit of key participants was perceived as a crucial element in initiating collaborations and keeping actors engaged. Such concerns translated into the NAMA design through a deliberate strategy of eluding confrontation of viewpoints -- contrasting with the required characteristics of a transition arena (Loorbach, 2010). While scholars have previously called for more methodological guidance on the politics of TM (Voß & Bornemann, 2011), the particular political circumstances of donor-driven transitions illustrated in this paper suggest avenues for further focussed academic enquiry.

5.0 Conclusions and Policy Recommendations

While the concept of transformational change is widely used within the global agenda for sustainable transitions through the adoption of the UN's Sustainable Development Goals, its recent uptake across the NAMA and NDC community indicates an enhanced sense of urgency towards upscaling climate change mitigation measures in developing countries. Given the dearth of academic literature pertaining to the role of NAMAs in incurring transformational shifts towards low carbon development, empirical evidence of such broad ambitions, particularly in developing countries, remain poorly understood. This article addresses the gap in knowledge by exploring the transformational change potential of the Tunisian Cement NAMA using relevant insights from theories of sustainable transitions.

The analysis undertaken in this article suggests that the NAMA's design, in its current form and at its present level of development, mainly aims at rearranging regime structures such as laws, regulations and markets to enable the future implementation of viable low carbon measures, when barriers are removed. The empirical findings further point out that, despite a number of promising outcomes in terms of creating partnerships amongst relevant actors, the design of the NAMA is not likely to lead to transformational change of the sector, since it does not adequately tackle the root causes of carbon lock-in. A close investigation of the

NAMA's methodological and coordination approach unveils limitations in the credibility of its action plan, as well as a design that restricts system innovation in the cement sector.

Based on how the TM model proposes to govern sustainability transitions, policy recommendations are suggested that could potentially improve the Tunisian NAMA's design for transformational impacts. First, to increase the NAMA's ability to attract funding for implementation, its action plan could be reformulated to include the crucial views of local finance actors. This argument coincides with similar calls from donors aiming to facilitate the implementation of NDCs of parties to the UNFCCC (NEFCO, 2016). Second, in order to avoid the pitfalls of transition agenda capture highlighted in this article, cement industry actors could be prompted to undertake self-contemplation by re-assessing mitigation measures currently identified in the NAMA. Finally, the MRV mechanism defined across the NAMA could be redesigned to integrate feedback loops to inform and enable the NAMA's proposed implementation committee in re-orienting niche development, based on information gathered during implementation.

Despite the fact that 40 developing countries have explicitly mentioned NAMAs as their means to achieving NDCs within the ambit of the Paris Agreement (Bosquet et al., 2016), the text of this historical global climate deal avoids any verbatim reference to NAMAs. A general phasing out of the acronym can, thus, be reasonably expected to occur over time. This was apparent in the case study, where the Cement NAMA was referred to as a "hybrid mitigation mechanism", which could be adapted to a New Market Mechanism format, depending on the outcomes of climate negotiations. Regardless of which acronym prevails, the policies and actions, which constitute the foundations of NAMAs as a mitigation mechanism, remain essential components of any emergent low carbon development mechanism. Therefore, within future efforts to design NDCs for transformational change, climate practitioners such as donors, climate funding entities, and national planners need to be wary of, and avoid, the caveats in policy design illustrated in this article.

The findings of this article demonstrate that the TM model is a useful framework for assessment of transformational climate policies and actions. However, using the model to that end requires that key change agents such as governments and donors understand its conceptual and theoretical bases in order to promote ambitious NDCs through the design and implementation of transformational policies and actions. This implies envisaging change as being unpredictable in nature due to mutually dependent social and technical elements. Planning for sustainability transition in developing countries supported by donors requires (1) an exploratory approach, (2) a series of incremental steps spanning over the long-term, and (3) the integration of reflexive thinking. Such features are currently not internalised within the design of key climate funds aiming for transformational impacts (Boodoo et al., forthcoming). The findings are supported by (Mersmann & Reich, 2016; Wieczorek 2017)'s suggestion that donors need to re-think their existing modalities to foster transformational low carbon development.

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Appendix 1

Interview	Role(s)	Category	Date(s)
Interview 1	Senior Executive	Energy Management Agency	27 May 2015
Interview 2	Factory Manager & Engineer-in-charge of Environment	Cement Factory 1	5 May 2015
Interview 3	Factory Director	Cement Factory 2	24 April 2015
Interview 4	Director	Agriculture Ministry	12 May 2015
Interview 5	General Manager	Consulting firm 1	28 April 2015
Interview 6	Director	Environment Ministry - waste management	18 May 2015
Interview 7	Senior Executive and Expert	Energy Ministry and Donor 1	15 April 2015
Interview 8	Executive Director	Trade Union	19 May 2015
Interview 9	Officer-in-Charge	Environment Ministry - environment technologies	30 April 2015
Interview 10	Deputy Director	Environment Ministry	13 May 2015
Interview 11	Analyst	Donor 2	27 May 2015
Interview 12	Director	Environment Ministry	21 May 2015
Interview 13	Head	Energy Utility Authority	7 May 2015
Interview 14	Director	Environment Ministry - waste water management	28 April 2015
Interview 15	Director	Energy Management Agency	8 April 2014
Interview 16	Director	Consulting firm 2	2 April 2014
Interview 17	Consultant	Consultant for Donor organisation 1	4 April 2014
Interview 18	Head of Project	Donor 1	10 April 2014
Interview 19	Director	Environment Ministry	11 April 2014
Interview 20	Senior Executive	Energy Management Agency	7 April 2014

Appendix 2

Data collection, Analytical procedures and Case Study rationale

Data Collection

The interviews lasted from 40 minutes to 3 hours and were digitally recorded when permission was granted, while the remaining were documented through field notes. To enable interviewees to express themselves more fluently, interviews were conducted in French and then translated and transcribed in English.

In line with Adcock & Collier (2001), probing and follow-up questions guided the interviews, which were adapted to the interviewee's degree of involvement in the arena. Questions were designed to, among other things, investigate the history behind the Cement NAMA, the workings of the transition arena, the motives of different actors involved, the approaches adopted, the features, scope, target areas, set-up and influences of the NAMA.

Analytical procedures

The analytical concepts in Table 1 were used to operationalise the different elements comprising TM's governance activity levels. For example, to analyse coalition building efforts at the tactical level, interviewees were asked for the basis on which an agreement was reached between actors. Relevant extracts of interview data thus condensed, as well secondary data from the aforementioned NAMA study and proposal, were then fed into a matrix delineating the analytical concepts of Table 1. This procedure was meticulously repeated across all the relevant governance activity levels of TM to enable data triangulation, as well as the interpretation of results.

Case Study rationale

Case study focus	Justification
Tunisia	Despite a decade having passed since the framing of NAMAs (at the 13th session of the Conference of Parties to the UNFCCC) in 2007, NAMA implementation across developing countries is still at its infancy. Within this context, and given the limited coverage of African case studies at research design stage, a continent wide scoping was undertaken to identify the most advanced African state involved in NAMA formulation. As a result of this scoping exercise undertaken in 2013/2014, Tunisia emerged as the most progressive African nation on the topic, with its explicitly stated aim at being amongst the early movers in NAMA design (MoE & GIZ 2012) as from 2012.
Cement NAMA	Amongst six NAMA initiatives under consideration in Tunisia (covering buildings, solar, transport, wastewater, forestry and the cement sector), the Cement NAMA, which covers mitigation measures across the Tunisian cement sector, came out as the most advanced. Given that this stage of development implied a more advanced level of thinking behind NAMA design, the cement NAMA emerged as an appropriate basis for further analysis.

Transformational change of the Tunisian cement sector	This paper uses pertinent schools of thought within socio-technical transition theories to analyse the means and extent by which the Tunisian Cement NAMA promotes transformational change to low carbon development across the cement sector. Given this socio-technical analytical perspective, the Tunisian cement sector possesses a number of pertinent characteristics that supports its choice as a case study; - it provides the study with an object of analysis that is wide enough (sector level) to be framed as a socio-technical system, and specific enough to manage reasonable data collection through a number of distinctly identifiable key actors (see Table below for more details). - the cement sector is a traditionally carbon intensive industry which has a long history in the country, dating back to 1930's. Over time, it has witnessed major changes such as a wave of privatisation and a depletion of fossil fuel at national level. Data collection enabled triangulation over a 25-period timeline spanning from 1990 to 2015, which corresponds to a long term perspective coherent with transition studies. - it is a rapidly growing energy (representing 11 % of national energy consumption) and carbon-intensive sector despite many low carbon development efforts from donors, governments and industrial actors.

Key Actors and Structures

Key actors which exert the most influence towards enabling or constraining the development of low carbon niches across the cement sector comprises of the following;

Key actors	**Details**
Cement industry actors	9 cement factory units belonging to 8 different groups, out of which • 5 are privatised, • 2 are state-owned and • one is partly state- and partly private-owned.
Cement producer union	The union represent the interest of the cement sector. Its key activities include industry-specific interactions whereby factory managers meet a maximum of 3 times a month to discuss on technical issues
Donor agencies	Donors interact with cement industry actors and governmental bodies via ad-hoc targeted support programs
The Ministry of Energy, Industry and Mines (MoEIM)	The MoEIM spearheads strategic and policy orientation focussing on its energy and industry portfolios in Tunisia. It furthermore oversees agencies that link up with cement industry actors. Those agencies comprise of; • the Agency for the Promotion of Industry and Innovation, which runs a country-wide industrial upgrading program (including the cement industry) following liberalisation of

	the economy, • the National Agency for Energy Efficiency, which interact with cement industry actors through programs that support energy management measures, and • the National Electric Utility Company, which act as provider and distributor of energy to cement industry actors.
The Ministry of Environment and Sustainable Development (MoESD)	The MoESD oversees three agencies which interact with cement industry actors; • the National Agency for Environment Protection, which oversees environmental strategy and policy orientation in Tunisia, • the Waste Management Agency, which oversees waste management strategies and policies in Tunisia (which is particularly relevant for the promotion of Refuse Derive Fuel alternative in cement kilns), and • the Tunis International Centre for Environmental Technologies, which monitors the environmental performance of cement industries based on promulgated environmental regulations.
The Ministry of Interior (MoI)	Local authorities responsible for waste collection operate under the MoI. Though local authorities do not interact directly with cement industry actors, they are crucial regime actors relevant for the promotion of Refuse Derive Fuel (RDF) alternative in cement kilns (since RDF requires the combustible components of Municipal Solid Waste).

Appendix 3

Summary table comparing key regime barriers for high-carbon lock-in with NAMA intervention areas addressing those barriers:

Niche	**Key regime level barrier**	**How the NAMA intervention areas specifically address those barriers**
Wind energy	Resistance from STEG	o STEG has been included as a concerned actor in the TA and is also part of the future institutionalised TA o Consultations have been planned with respect to reviewing wind energy related legislations o Proposal to create an independent regulatory body to oversee energy production in Tunisia
Energy Efficiency	Shifting to petcoke	o Tackled by pursuing 10 new promising energy efficiency measures (comprised of the most technical interventions in the NAMA) o A voluntary agreement will define the terms and conditions for firm specific interventions, backed by results to be obtained from audits conducted by independent international experts o This regime barrier is also tackled by engaging in niches that diminish the need to use petcoke (Wind energy and RDF niches)
RDF niche	Conflicts on roles, responsibilities and budgets amongst waste operators	o Discussions/consultations are included within the NAMA action plan dedicated to clarifying those conflicts o A pilot plant using RDF is also scheduled o Sensitisation amongst waste operators is also recommended during the RDF niche development

Appendix 4

Governance Activity Level	Cement NAMA design alignment with TM model	Cement NAMA design deviation from TM model
Strategic	• Establishes a TA by: - Bringing the varying interests of a wide heterogeneous group of concerned actors for discussions around the same table, with government holding a strong role • Structures the problem at hand and envisages futures by - Identifying niches that can be developed in the cement sector (based on energy and GHG data collected from firms and possible mitigation options) - Anchoring niches within regimes, with the NAMA intervention acting as a landscape factor that enables a synergistic targeting of niches and regimes - Mapping flaws that hinder niche development	• Caveats in problem structuring methodology: - The NAMA design is biased towards a deliberate capture of the transition agenda by industry incumbents, resulting in limited self-reflection on existing practices that contribute to path dependency
Tactical	• Build coalitions through: - Adopting an inclusive and transparent process based on individual and grouped consultations - Formulating voluntary, non-punitive niche development measures • Formulates transition images, agendas and scenarios: - Based on energy and GHG data collected from firms and inspiration sought from technical publications on mitigation measures applicable to the cement sector	• Concrete targets and objectives: - Have been identified but no formal commitments were reached • Transition pathways devised but: - No dynamic scenario building envisaged through back-casting and forecasting
Operational	• Planned mobilisation of actors: - Is a key element in the planned activities of the NAMA, through the institutionalisation of the TA, planned consultations and sensitisation activities at national and international level • Planned execution of activities: - Materialised through a plan of action from 2014 - 2020	• Experimentation needs: - Are not explicitly mentioned in the case of wind and energy efficiency niches
Reflexive	• Monitoring of the process: - Envisaged by the NAMA through MRV requirements	• Limitations in evaluation and re-orientation: The Cement NAMA - Only partially integrate societal complexity and uncertainty elements, especially regarding its anticipated impacts - Does not sufficiently consider social learning - Does not integrate back-casting and forecasting elements across its action plan

		• Timelines: - Long-term (more than 25 years) envisioning of cultural and societal change not taken into account in the NAMA - The 7-year timeline envisaged in the NAMA is not cyclically tied to a more long-term perspective

Dansk Resumé

Overvældende beviser og videnskabelig konsensus om virkningerne af menneskeskabte klimaændringer har ført til forbedrede klimastrategier over tid, ledet af udviklede lande der repræsenterer de største forurenere med drivhusgasser historisk. For nylig har den hurtige økonomiske vækst i udviklingslande ført til skyhøje udledninger af drivhusgasser. Som et resultat er tiltag til omstilling henimod lave CO2-vækst og bæredygtig udvikling i alle verdens lande nu centrale elementer i verdensmålene for klima og udvikling som aftalt i to historiske aftaler i 2015, Paris Aftalen om klimaændringer og 2030 Agendaen om bæredygtig udvikling. For at imødegå den globale udfordring om bæredygtig omstilling har udviklede lande bekræftet, jf. Paris Aftalen 2015 indgået ved den 21. Partskonference for De Forenede Nationers Rammekonvention om Klimaændringer, i fællesskab at mobilisere 100 milliarder USD om året i 2020 til at støtte klimatiltag i udviklingslande. Inden for denne aftale betragtes bilaterale udviklingsbureauer og multilaterale finansielle institutioner som nøgleaktører, hvorigennem midlerne vil blive givet. Det viser, at det internationale samfund tillægger donorer en vigtig betydning for at støtte udviklingslandene i at omstille henimod en mere bæredygtig fremtid.

På denne baggrund er hovedformålet med Ph.d.-afhandlingen at bidrage til den fremspirende litteratur om donorers betydning for fremme af bæredygtig omstilling ved at undersøge, hvordan omstillings-begreber og donor praksis påvirker en transition til lav CO2-vækst i udviklingslandene. Dette overordnede forskningsemne behandles på to måder i afhandlingen: 1) gennem en teoretisk gennemgang af tilgange til projektledelse praktiseret blandt donorer; 2) og ved at anvende case-studie-metoder til at undersøge virkningerne af donorinterventioner på omstilling til lav CO2-vækst i den Tunesiske cementsektor. Det teoretiske og begrebsmæssige grundlag for de tre artikler, der udgør denne afhandling, trækker på 'Transition Management'-litteraturen for at forstå, hvordan overgangen til lav CO2-vækst kan styres og på 'Multi-Level'-perspektivet for at forstå de faktorer, der påvirker udviklingen af nicher i den Tunesiske cement sektor. Analyser er baseret på kvalitative data primært fra semistrukturerede interviews, direkte deltagelse og observationer indsamlet gennem feltarbejde i Tunesien 2014-15.

Afhandlingen konkluderer, at donorer bidrager til at stimulere en omstilling til lav CO2-vækst i udviklingslande ved at tage fat på de problemer, der begrænser tiltag mod en omstilling i modtagerlandene såsom mangel på lokal ekspertise, koordineret indsats og tilgængelig finansiering. Donorer adresserer disse begrænsninger ved at støtte udviklingsprocesser for nicher, tilskynde til ændringer i regime niveauet gennem støtte til politiske og lovgivningsmæssige reformer, eller mere generelt via donorfinansieringsmodeller, som danner grundlag for rationel tænkning og projektstrukturering. Derudover finder denne forskning evidens for, at de nuværende donormodaliteter lider under manglende forståelse af egenskaber ved bæredygtig omstilling såsom opgør med indgroet praksis og afhængighed. Faktorer der særligt begrænser donorers forsøg på at støtte lav CO2-vækst i udviklingslandene er: fravær af vigtige forandringsagenter, manglende formel legitimitet af donorers beslutningstagning angående formulering af omstillings-initiativer, udviklingsbistandens kortsigtede karakter, manglende koordinering mellem donorer, den begrænsede opmærksomhed i forbindelse

med lokale politiske processer samt manglende refleksivitet og forestillingen om fremsyn og kontrol gennem donorinterventioner.

I betragtning af at alle lande i Paris-aftalen nu bevæger sig til en implementeringsfase af stadigt mere ambitiøse klimapolitikker og -aktioner, der er fastsat i nationalt bestemte bidrag, giver resultaterne af denne afhandling nyttig viden, der kan bidrage til at forbedre donorernes effekt ved at undgå faldgruberne fremhævet.

ANNEXES

Annex 1

Translating analytical concepts into interview guide questions

Background concepts	**Systematized Concept (explicit definition by scholars)**	**Indicators: Relevant general probing questions**	**Potential follow-up Questions (to allow focussing back to the background concept)**
Regimes	Intangible and underlying deep structures (such as engineering beliefs, heuristics, rules of thumb, routines, standardized ways of doing things, policy paradigms, visions, promises, social expectations and norms). 'regime' is an interpretive analytical concept that invites the analyst to investigate what lies underneath the activities of actors who reproduce system elements. (Geels 2011)	Can you tell me the story of the Cement Sector as you experience it? Can you recall when and how you/your organisation is/has been driving/confronted with energy use/carbon emissions? What happened next?	What are the established patterns of policy making? What rules/laws govern the sector? Do any of those impacts on energy and greenhouse gas emissions? What are the responsibilities of the policy maker and the industry with regards to those rules? What major changes have characterised the sector's energy use and greenhouse gas performance? Which measures have been taken by actors (industry or government) towards those goals? Which barriers have been present in trying to change the sector? Did privatisation increase environmental performance of the industry? Why?
Landscapes	The sociotechnical landscape is the wider context, which influences niche and regime dynamics (Rip and Kemp, 1998). The landscape level, highlights not only the technical and material backdrop that sustains society, but also includes demographical trends, political ideologies, societal values, and macro-economic patterns. This varied set of factors can be combined within a single 'landscape' category, because they form an external context that actors at niche and regime levels cannot influence in the short run.		Which factors impact the sector but on which you do not have any control on? Why do you consider those factors as impacting the Cement Sector? e.g. oil prices, geopolitical relationships, treaties, dictatorships to transition to democracy, cultural values, major environmental problems. liberalisation, globalisation, international standards, global value chains functioning.
Niches	Niches are 'protected spaces' such as R&D laboratories, subsidised demonstration projects, or small market niches where users have special demands and are willing to support emerging innovations. Niche actors (such as entrepreneurs, start-ups, spinoffs) work on radical innovations that deviate from existing regimes. Niche-actors hope that their promising novelties are eventually used in the regime or even replace it (Geels 2011)		Were there voluntary measures to reduce energy consumption and greenhouse gas emissions? What motivated those voluntary measures? Have measures taken been successful? Why do you think those have not been fruitful? Are those activities protected from normal market and other pressures that would otherwise not make them viable? Have they been successful over time? If yes, what factors contributed to their success? If no, what barriers hinder their wider adoption? Have those niches been nurtured (processes of learning, networking and expectation formation)? Have niches been empowered (making niches competitive such that protection status be removed within amended selection environments)? Which niche level experiments have been implemented? Where, How?
Landscape-regime-niche dynamics	-	How would you describe the features/factors that influence your efforts to decrease energy use and emissions of greenhouse gases?	Can you tell me the story of the Cement NAMA as you experienced it? Can you recall when you first started to talk about a Cement NAMA? What happened next? What problems do you expect from the implementation of the Cement NAMA? How will the Cement NAMA overcome existing barriers (weaken existing regime / institutionalised ways of doing things)? Does the Cement NAMA provide space for experimentation? How is the Cement NAMA different from existing policy making processes?

Annex 2

Sample interview question guidelines

INFORMANT
Name: _____
Profession: _____
Institution: _____
Contact details: _____
Date and Location: _____

STEP 1: Explain purpose of interview, duration, why the actor is important for this interview, seek his/her agreement to use a digital tape recorder.

MLP analysis of the sector

1. **Concept of "Landscape and regime" factors**

   Could you describe, in your own words, the story of the cement sector as you know it, especially with regards to major changes that characterised its energy and greenhouse gas emission performance historically/over time?

   Additional questions
   - Which policies, laws and other types of government or other types of interventions impact on the sector's energy use and greenhouse gas emissions?
   - What are your responsibilities and how did your organisation engage with regards to those government interventions?
   - What other factors influence the cement sector's performance?
   - On the same note, what factors influence your performance but on which your organisation or government do not have any direct control upon?

2. **Concept of "Niches"**

   Do you remember when and how your organisation has been involved in initiatives (voluntary or mandatory) that reduce your use of energy and your emissions of greenhouse gases?

   Additional questions
   - Why did you engage in those and what happened next?
   - According to you, what factors facilitated your efforts?
   - What aspects hindered your progress?
   - Did you collaborate in research activities, sharing of information and lessons learnt with other actors in the sector?

3. **Paper 3 on NAMAs**

   (a) Cement NAMA - concept of activities at the "strategic level"

   When did you first start talking about the Cement NAMA and what happened subsequently?

   Additional questions
   - **Concept of "Interests", "sustainable transition" and "regime change" (from sustainable transitions literature)**

- What are your interests and expectations in participating to the Cement NAMA? How did they evolve and how do they compare to other actors?
- What are your views on the sectoral transformation challenge of the Cement NAMA?
- How is the approach of the Cement NAMA different from other initiatives targeting energy and greenhouse gas emissions in the sector? Do you think it can make a difference and why?
- How much resources and efforts are your organisation ready to dedicate to the Cement NAMA proposals?
- What conditions will encourage more involvement and ambition in reducing your energy use and greenhouse gas emissions?

- **Concept of "tactical activites" and "mobilisation of actors"**
  - Which coalitions emerged during the process?
  - How do these collective commitments emerge together?
  - What characteristics do those groups share? e.g. constraints, opportunities and resources shared by those groups
  - What do they hope to achieve in engaging together?
  - On which topics were you not agreeable to proposals suggested therein and why?

(b) Operational and reflexive levels

- What approach have you adopted in the formulation of your NAMA? How will the NAMA be governed?
- How would you describe the transformation challenge of the NAMAs you are involved in?
- How does it relate to other NAMAs in Tunisia?
- Do you envisage integration of an exploratory approach and more reflexivity in searching for solutions to decrease energy use and greenhouse gas emissions and why?

4. Concluding questions

- Do you have anything else you would like to tell me concerning the cement sector, the cement NAMA or other NAMAs you have been involved in that we have not discussed?
- Do you have anything you would like to ask me?

NOTE:

Questions mentioned in Part 3(b) will be asked only to the actors I manage to get hold of who are spearheading NAMA development but are not involved in the Cement NAMA - so as to get a better view of the NAMA community in Tunisia as a whole

Annex 3

Operationalising MLP's concepts by placing interview data across a matrix of categories

Analytical category			Interview 1	Interview 2	Interview 3	Interview 4	Interview 5
Main	*Sub*	*Examples*	pg no				
Landscape level (factors influencing regimes and niches unidirectionally)	Globalisation	liberal policy, privatisation	1: "the gove	1. "Bought a	1. "Also, the sector has b		2. "Those fo
	Political Ideologies	Revolution, new forms of protest and voicing out	6. "It must b	3. "There is c	7. "But it mig	3. "In Tunisia we had a tr	
	Geopolitics	Libya, Algeria, EU financial crisis	2. "Libya wa	2. "For us, the exportation is directed to Algeria ar			
	Macro-economic development patterns	waste generation, demography	2. "..1980's. Since then, consumption and demand (for cement)				
	Shift in Energy balance	Energy importer, Peak in petrol prices	1 "Before, th	1. "as from 2	3. "There is also a point, it is the price		
	CDM landscape	No DoE availabe, prices low,	3. "..there is no clarity lef		7. "Yes, the CAT project is the only or		
	Donor programs	Participation in projects	5. "There are many programs with GIZ, as part of a cooperation				
	Exchange rates	Impact on exports					
Niches level (Protected space/Measures/initiatives/studies taken within the sector)	Energy efficiency niche	Influence on emissions from chemical processes, in-house fossil fuel combusion and electricity combusion	1 "In 2000, they restructured the industry ... the company move				
	Wind Generation Niche	Influence on emissions from chemical processes, in-house fossil fuel combusion and electricity combusion	2-3 "We had presented a		2. "There we	9. "The third alternative	
	Pomace Oil Niche	Influences emissions from in-house fuel combusion	3. "It is base	3. "But we are working a lot to use alternative fue			
	Refuse Derived Fuel Niche	Influence on emissions from in-house fossil fuel combusion and maybe displace electricity combusion	4. "and ther	1. "Started talking on alte		1. "The history of the us	
	Blended cement use niche	Influences on emissions from chemical processes by displacing the mix of clinker	6. "the study	1. "Blended cements are		9. "the quality of cemen	

Operationalising TM concepts from interview data by placing interview data across a matrix of categories

TM governance activity level		Interview 1	Interview 2	Interview 3	Interview 4	Interview 5	Interview 6	Interview 7
Strategic	establishment of a transition arena	The indus	It is the GIZ that coordinated			It is where	I consider	It is not a p
	problem structuring	For the cement NAI		This NAMA is much more scientific. The se				I believe t
	envisioning of futures	In fact, one of the n		The first thing is that we need a clear v				They see t
Tactical	coalition building	Yes, yes, we don't h		Secondly, the ceme		To tie all c	Moving to	Implemer
	development of images and transition agendas	For the cement NAI		Our interests are al		To my opi	We have b	When we
	development of transition scenarios	Yes, for example for co-processing; the				It is the truly the rip		Through th
Operatio nal	mobilisation of actors	Last question on this matter, how accor				I think the processes involved i		
	execution of activities		All that meant that in the end, it was agre				Are there waste mar	
Reflexive	monitoring of the process					The NAMA brings some rigour,		
	evaluation and re-orientation							...it is diffi

Operationalising TM concepts by placing secondary data (Tunisian NAMA documents) across categories

TM governance activity level		Report on Summary of portfolio options		Report 1 on evaluation of mitigation potential from the cement sector and determination of reference scenario												
Strategic	establishment of a transition arena			Compositi	Strong role endorsed by government through ANME leading and coordinating the arena's work, with support from GIZ (p11)											
	problem structuring	methodolo	firms's sus	methodo	Mapping c	mapping	mapping c	mapping c	mapping c	mapping	for RDF ni	by analysi	mapping c	by analysi	mapping c	questionn
	envisioning of futures	different sustainabilit		(how a re	sustainabi	for ee nicl	for blende	assume a	summary of estimated cost estimates of envisaged futures across a Marginal Abate							
Tactical	coalition building			Nurtured	Cement se	through consultations during site visits to cement firms and the use of questionnaires to gauge mitigation potenti										
	development of images and transition agendas	table with f	summary	through ic	breakdow	by mappir	developm	investmer	by devising scenarios of emissions avoided p77							
	development of transition scenarios	to construct a model f		baseline s	model use	or RDF use	emissions	developed transition scenarios per ton cement produced p78								
Operational	mobilisation of actors															
	execution of activities															
Reflexive	monitoring of the process			MRV systems for clinker composition are already in place and monitored every 2 hours in cement firms (p13)												
	evaluation and re-orientation															

Annex 4

Tabulation of frequency of events occurring across interview data based on analytical categories

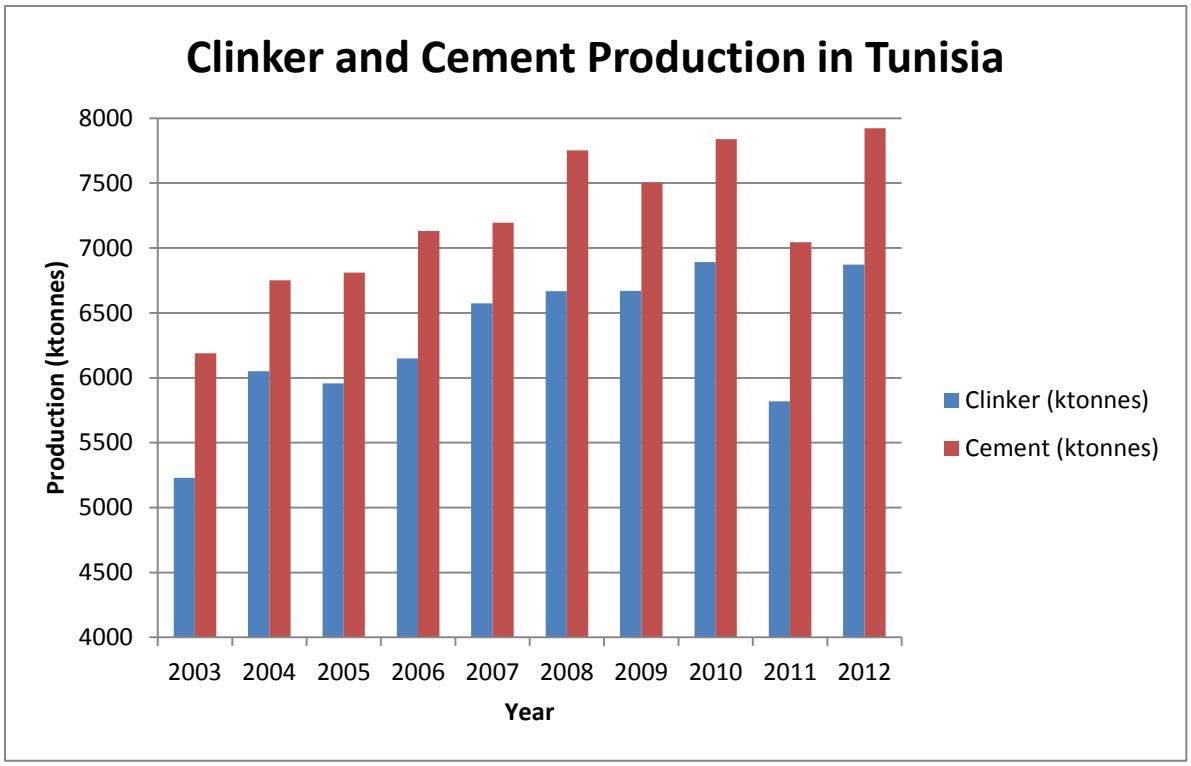
Analytical category			Interview number											
Main	*Sub*	*Examples*	1	2	3	4	5	6	7	8	9	10	11	12
Landscape level (factors influencing regimes and niches unidirectionally)	Globalisation	liberal policy, privatisation												
	Political Ideologies	Revolution, new forms of protest and voicing out												
	Geopolitics	Libya, Algeria, EU financial crisis												
	Macro-economic development patterns	waste generation, demography												
	Shift in Energy balance	Energy importer, Peak in petrol prices												
	CDM landscape	No DoE availabe, prices low,												
	Donor programs	Participation in projects												
	Exchange rates	Impact on exports												

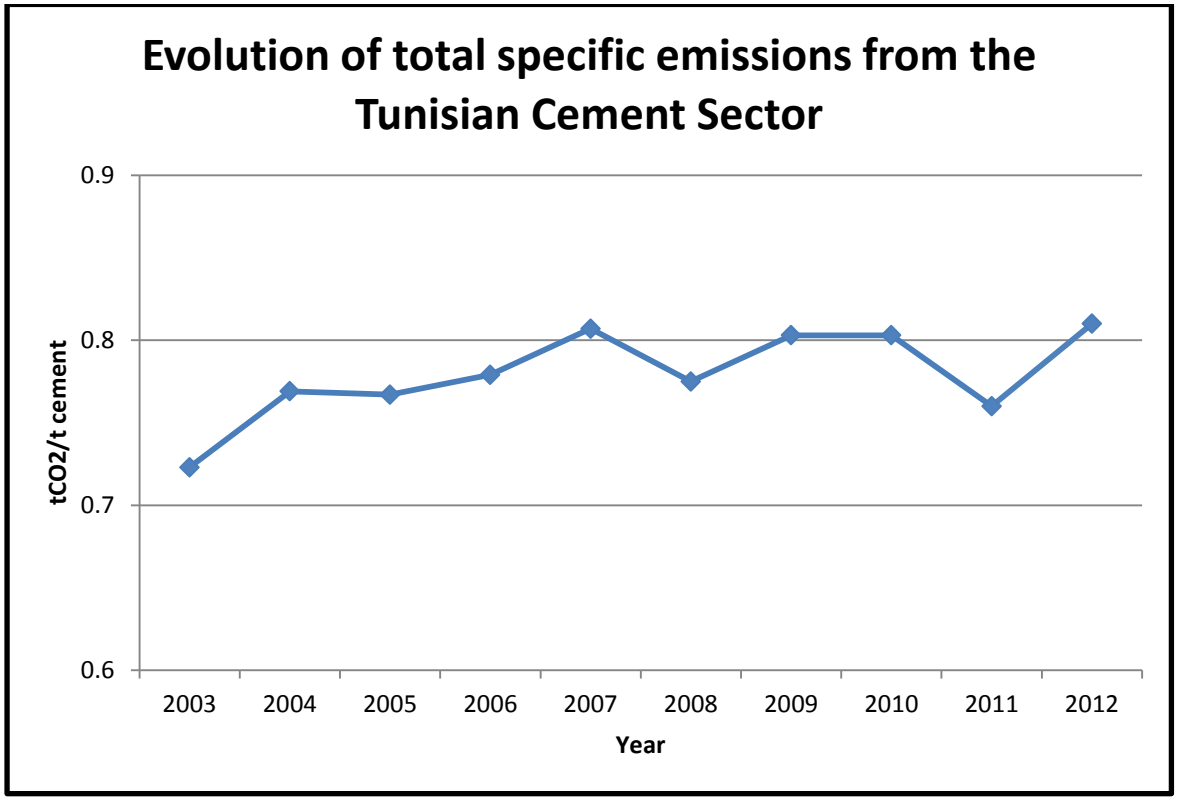
Analytical category			Interview number											
Main	*Sub*	*Examples*	1	2	3	4	5	6	7	8	9	10	11	12
Niches level (Protected space/Measures/initiatives/studies taken within the sector)	Energy efficiency niche	Influence on emissions from chemical processes, in-house fossil fuel combusion and electricity combusion												
	Wind Generation Niche	Influence on emissions from chemical processes, in-house fossil fuel combusion and electricity combusion												
	Pomace Oil Niche	Influences emissions from in-house fuel combusion												
	Refuse Derived Fuel Niche	Influence on emissions from in-house fossil fuel combusion and maybe displace electricity combusion												
	Blended cement use niche	Influences on emissions from chemical processes by displacing the mix of clinker												

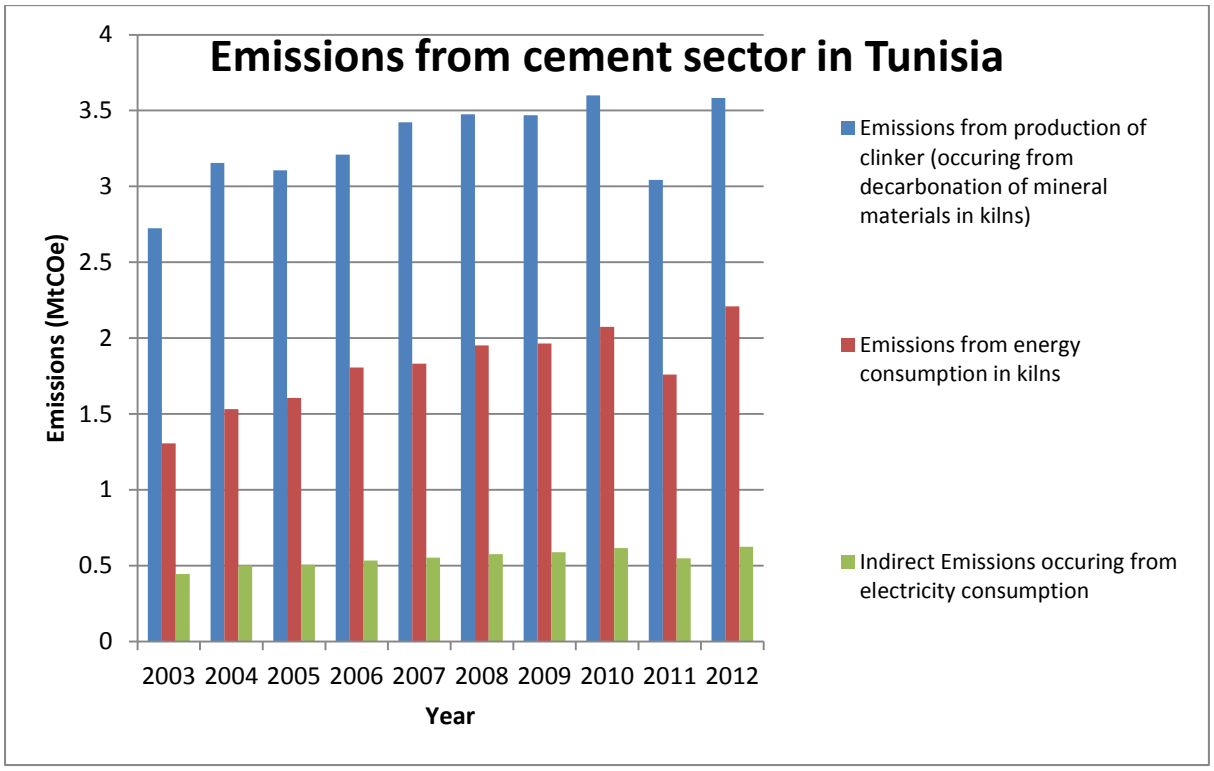
Analytical category			Interview number											
Main	*Sub*	*Examples*	1	2	3	4	5	6	7	8	9	10	11	12
Regime level (stabilising or destabilising mechanisms that influences how emissions from the cement sector are generated)	keeping state control on some industries	stabilising mechanism	■		■									
	Low emission limits in Tunisia	stabilising mechanism	■											
	profit-making motive/maximising returns	stabilising mechanism and destabilising (for positive IRR initiatives)	■	■	■								■	
	increasing capacity	stabilising mechanism	■					■					■	
	initial state subsidies for energy	stabilising mechanism	■								■		■	
	Policies to invest in energy measures	destabilising mechanism	■		■						■			
	Required to do energy audits	destabilising mechanism	■	■				■			■			■
	Financing for EE measures	destabilising mechanism	■							■				■
	Signing of SD charter	destabilising mechanism	■					■	■				■	
	Lobbying for promulgation of new laws	destabilising mechanism	■										■	■
	STEG resistance to liberalise electricity production	stabilising mechanism	■		■	■	■	■		■	■	■	■	■
	High level sensitisation	destabilising mechanism					■							
	Policy to reduce consumption of natural gas by shifting to petcoke	Stabilising mechanism	■		■	■		■			■		■	■
	Participation in congresses and seminars	destabilising mechanism	■				■	■						
	Certification to ISO standards	destabilising mechanism	■						■					
	participation in projects	destabilising mechanism	■	■	■			■	■	■				■
	Dependency on donor programs to undertake reforms	stabilising mechanism	■										■	
	Lure for knowhow, technology and transfer of tech	destabilising mechanism	■				■							
	Collaboration in sharing info and experiences	destabilising mechanism	■	■	■			■						

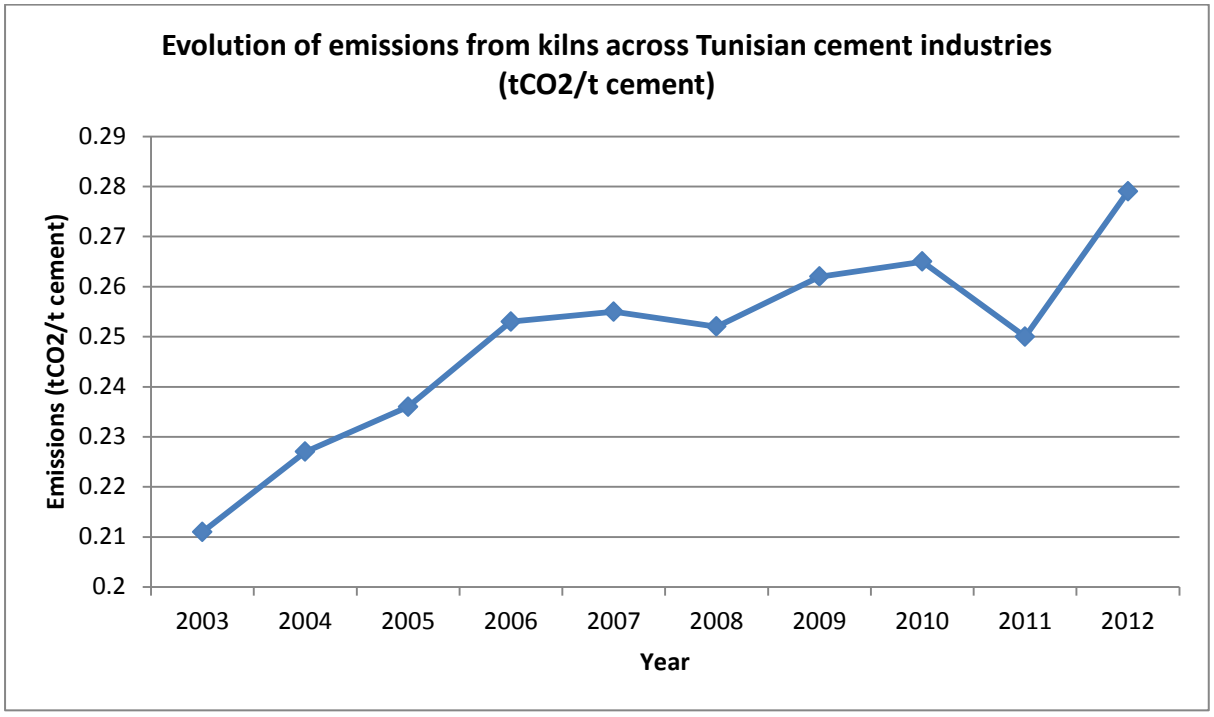
Annex 5

Examples of data displays created to support narratives in this study






Emissions from cement sector in Tunisia
Emissions (MtCOe)
4
3.5
3
2.5
2
1.5
1
0.5
0
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012
Year
Emissions from production of clinker (occuring from decarbonation of mineral materials in kilns)
Emissions from energy consumption in kilns
Indirect Emissions occuring from electricity consumption


Evolution of emissions from kilns across Tunisian cement industries (tCO2/t cement)
Emissions (tCO2/t cement)
0.29
0.28
0.27
0.26
0.25
0.24
0.23
0.22
0.21
0.2
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012
Year

Annex 6

Chronological display of events of interest occurring across the case study