



Linking the energy transition and economic development: A framework for analysis of energy transitions in the global South

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ABSTRACT

We are observing a significant increase in the deployment of large scale solar and wind technologies in the global south, and it is therefore a strategically and academically important focus of inquiry to understand context-specific spaces for locally-embedded actors to initiate energy transitions. This paper examines the linkages between the energy transition and economic development, and has attempted to do this by developing an approach that brought into focus the institutional micro-economics of four key dimensions of the economic development process, namely (a) the impact of the auction mechanism; (b) the key role MNCs play in the global value chain; (c) how developmentally-oriented states have attempted to harness the resulting investment flows by using LCRs; and (d) the local-level development impacts of utility-scale renewable energy power plants on local communities.

Drawing from the South African energy transition as a case we argue that the complex interaction between highly globalized value chain actors, path dependent local institutions and interests of incumbent local actors sheds new light on the dynamics of rapid institutional change during energy transitions in a global South context.

We use the South African case to develop a framework for analysing the energy transition in the global south that brings into relief the complex dynamics of change, learning and experimentation. Our focus is on the way rule-setting and the actions of actors within institutions (dis-)enables financial flows, institutional change and socio-technical adaptation in a fast-changing environment driven by responses to climate change and the challenge of rapid decarbonisation.

1. Introduction

The accelerated deployment of large scale solar and wind

technologies [1] in the global south has been achieved via the introduction of competitive auctions and similar procurement systems [2,3]. As a result, international energy companies have played a key role in the

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financing, construction and operation of utility-scale renewable energy projects [4]. The upshot is an energy transition pathway that is fundamentally different from earlier energy transition pathways experienced in Europe where cooperatives niches grew organically and upscaled over a longer period of time in countries such as Denmark and Germany [5]. This means, as argued by Hansen et al. [6] and Swilling [5], that the 'sustainability transition' frameworks that worked for the European context need to be adapted to fully understand the energy transitions emerging in the global South. Given that developmental challenges like inequality and poverty are key challenges in the global South, the relationship between the energy transition and economic development should become the core focus of analysis of energy transitions, in particular in regions where developmental challenges are policy priorities.

Our research has focussed on four key institutional and policy factors that directly shape the relationship between the energy transition and development in the South African context: (a) the consolidation of a global policy regime centered around the auction mechanism to secure and direct global and national-level investment flows into renewables, with varied context-specific impacts and related implications for national economies; (b) flowing from these new investment flows, the emergence of job-creating local content programmes within national economies aimed at benefitting from the global diffusion of renewable energy technologies; (c) given the key role Multi-National Corporations (MNCs) play in the global value chain, we focus on the role their subsidiaries play as instigators and diffusers of growth-enhancing innovations; and (d) the local-level development impacts of utility-scale renewable energy power plants on local communities.

The South African energy transition is used as a case to illustrate these four factors. Drawing from the South African case we argue that the complex interaction between highly globalized value chain actors (specifically the MNCs), path dependent local institutions and interests of incumbent local actors sheds new light on the dynamics of rapid institutional change in a particular global South context. In such a case, it may be assumed that the structural balance of power favours the global players and limits the space for local actors embedded within the various globalized value chains to instigate changes responsive to local conditions [7]. By focusing on learning within the wider dynamics of local institutional change catalysed by these global value chains, our research raises questions about this assumption. Drawing lessons from the South African context may assist other countries interested in exploring how the energy transition can be managed in a way that relates to the long-term developmental challenges that they face.

Given that renewables are growing at a faster rate in developing countries than in developed countries for the first time [1], understanding context-specific spaces for locally-embedded actors to initiate change is a strategically and academically important focus of inquiry. We explore the following research question: how do specific actors within the relatively new institutional eco-system that was created by South Africa's adoption of the competitive auction approach from the mid-2000s onwards for renewables procurement purposively respond to their conditions and act out their respective visions and strategic intentions?

Drawing on the institutional work literature, we use the South African case to develop a framework for analysis of a particular manifestation of the energy transition in a well-known global south context that brings into relief the complex dynamics of change, learning and experimentation. We conclude with suggestions for further policy-relevant research. We bring this important literature on institutional work that transcends the age-old structure-agency dualism into conversation with the 'political settlements' literature that has emerged from the weaknesses of developmental state theory to account for the continued centrality of the state in development processes. Our focus is on the way rule-setting and the actions of actors within institutions (dis-)enables financial flows, institutional change and socio-technical adaptation in a fast-changing environment driven by responses to climate change and

the challenge of rapid decarbonisation.

The remainder of the paper is structured as follows. In Section 2, the research methodology is presented while Section 3 describes the policy, financial and rule-setting context. Section 4 describes the emergence of the competitive auction and the impacts on local contexts, and Section 5 describes the consequent rise of the MNCs in the value chain, and the implications for innovation and localization. Section 6 deals with the implications of local content requirements for the industrialisation potential of the energy transition, and Section 7 addresses the challenges mainly black women development officers face trying to bridge the gap between energy developers and communities within which their projects are located. Section 8 consolidates the findings into a conclusion that reflects on potential policy implications.

2. Research methodology

This paper is based on original empirical research by a joint team of Danish and South African researchers who collaborated over the period 2018–2020. Partly funded by the Ministry of Foreign Affairs in Denmark, the aim of the project was to analyse the global dynamics of renewable energy procurement via auction mechanisms by assessing the inner workings of South Africa's Renewable Energy Independent Power Producers Procurement Programme (RE4P), with special reference to the procurement arrangements, institutional configurations and roles in particular of the Multi-National Corporations (MNCs) who have become the key players at a global and national level. The team produced 8 papers⁴ and shared the findings with key decision-makers and stakeholders during the course of the research project. The inter-disciplinary nature of this research project was made possible by the fact that the team comprised experienced researchers from a range of disciplinary backgrounds, including economics, development studies, social sciences, governance studies, engineering, institutional development, sustainability science and community development. This paper draws on these primary research papers in order to build up a synthesis. Led by Mark Swilling and Ivan Nygaard, this synthesis paper integrated the core material from the eight papers using a conceptual synthesis drawn from the institutional work and political settlements literature. This was deemed appropriate because it became necessary to highlight a common theme that emerged from the papers that addressed a wide range of topics. This common theme related to the role key change agents play in influencing the way a given policy and regulatory framework is

⁴ Davy, E., Hansen, U.E., Nygaard, I. (2021). Dual embeddedness? Innovation capabilities, multinational subsidiaries, and solar power development in South Africa. *Energy Research and Social Science*, 78, [102145]Funder, M., Wlokas, H., Jhetam, T., Olsen, K.H. (2021) Corporate community engagement professionals in the renewable energy industry: Dilemmas and agency at the frontline of South Africa's energy transition. *Energy Research and Social Science*, 81, [102249]Hansen, U.E., Nygaard, I., Morris, M., & Robbins, G. (2020). The effects of local content requirements in auction schemes for renewable energy in developing countries: a literature review. *Renewable and Sustainable Energy Reviews*, 127, [109843]. Hansen, U.E., Nygaard, I., Morris, M., Robbins, G., (2021) Servicification of manufacturing in global value chains: upgrading of local suppliers of embedded services in the South African market for wind turbines. *The Journal of Development Studies*, DOI:<https://doi.org/10.1080/002220388.2021.2017892>Kitzing, L., Khan, B.S., Nygaard, I.; Kruger, W. (in review) Worth the wait: How South Africa's renewable energy auctions perform compared to Europe's leading countries. Kruger, W., Kitzing, L., Nygaard, I., (2021) Counteracting market concentration in renewable energy auctions: lessons learned from South Africa, *Energy Policy*, 148, Part B [111995]Larsen, T.H., Hansen, U.E. (2020). Sustainable industrialisation in Africa: the localization of wind-turbine component production in South Africa. *Innovation and Development*. <https://doi.org/10.1080/2157930X.2020.1720937>Morris, M., Robbins, G., Hansen, U., & Nygaard, I. (2021). The wind energy global value chain localisation and industrial policy failure in South Africa. *Journal of International Business Policy*, 1–22. <https://doi.org/10.1057/s42214-021-00123-8>

interpreted and implemented.

3. Rethinking developmental states and institutional change

Two remarkable features about the post-2000 global economy have yet to be adequately connected in academic literature. The first is the accelerated growth and global expansion of the renewable energy sector since the turn of the millennium, but in particular since 2004 [1,8]. The second is the re-emergence of state-led market-compatible development during the post-2000 era [9]. Mazzucato goes some way towards connecting these trends when she argues that state-led development during the early phases of the innovation cycle was a critical precondition for accelerating the energy transition [8,10]. Developmental state theory makes similar arguments, but with respect to accelerated industrialisation in developing countries. ‘Relatively autonomous’ and ‘developmentally oriented’ states are depicted as drivers of industrial policies that enabled accelerated modernization [11–19]. It is against this convergence of accelerated investments in renewables and persistent ‘developmental statism’ that we need to understand the rise of state-managed auction mechanisms across all world regions to orchestrate the procurement of privately owned renewable energy infrastructures funded by a wide mix of private and public investment institutions.

However, as argued by the contributors to the new ‘political settlements’ literature on state-led development, the analytical frameworks offered by developmental state theory and Mazzucato may be useful for a ‘structural’ understanding of state-led development, but they say very little about what kinds of agency practices result in specific developmental outcomes [9,20]. In other words, no matter the structure, key actors within particular institutions can get organized to create ‘pockets of efficiency’ that get things done [16]. What matters is not simply the degree of structural ‘embedded autonomy’ as argued by Evans [11] or the ‘developmental commitment’ of the political and managerial elite [21], or the extent of intervention in R&D and risk reduction [22], but also the more granular dynamics that give rise to these ‘pockets of efficiency’ no matter how ‘strong’ or ‘weak’ the state-in-general might be [8,16,20]. This “strategic-relational approach” to governance [5,23] opens up a conceptual space for a better understanding of agency and institutional change. It shifts the focus from general structures of power to specific relationships between individuals embedded within institutional processes. This matters, because outcomes may have more to do with choices made by these actors than general structures of power or even institutional design. For this we need to turn to the new literature on ‘institutional work’ that brings into focus how actors within institutional settings choose to act (within specific constraints) in ways that significantly influence the final outcomes and which cannot be explained purely by reference to institutional enablers and constraints [25].

The rapid uptake of renewable energy (RE) since the turn of the century is often understood in teleological terms as a manifestation of ‘path dependency’: the process of positive feedback loops (e.g. carbon constraints, falling prices, coal closure, climate emergency) that reproduce the structural conditions that deepen existing institutional pathways [24]. However, as an alternative we are interested in agency within relational contexts, that is the active ‘institutional work’ that occurs to create ‘pockets of excellence’ that allow things to happen. Institutional work is defined by Lawrence and Suddaby [25] as “the purposive actions of individuals and organisations aimed at creating, maintaining and disrupting institutions”. By foregrounding the ‘work’ that is exercised in institutional change, the concept helps to understand how ideas and intentions take on particular forms in diverse contexts. It searches for explanations focusing on the intermediation of actors between technology and institutions [26].

In short, in the analysis that follows, we are interested in the way the state sets up rules and institutional arrangements that shape the way public and private investments flow into renewable energy technologies in ways that drive the energy transition in certain directions. During this

process of institutionalisation – which is particularly fluid when new institutions are being designed and built as in the case of South Africa during the early years of the renewables build programme - agents have some relatively constrained but nevertheless significant strategic room for discretion as to how to act in a way that shapes the dynamics of institutional change and development. This more granular approach provides an understanding of those rules and practices that may need to change to further incentivise more socially just and environmentally sustainable outcomes. Such outcomes cannot be predicted in advance based on the assumption that structural conditions guarantee intended outcomes. Instead, what also shapes outcomes is the institutional work by specific actors to realise those outcomes in practice in accordance with their own values, interests and idiosyncrasies. Understanding how they act within these complex institutional environments contributes to an understanding of the potential policies, regulations and capability building interventions that may be useful in reinforcing those practices deemed to be positive by the stakeholders involved.

The institutional work literature addresses what Battilana and D’Aunno refer to as the “paradox of embedded agency” [27,32]: the assumption that what individuals can do is institutionally constrained, and yet institutional change assumes individuals can make change happen. Overcoming this paradox is necessary for understanding agency that is arguably less constrained in a still unconsolidated yet highly regulated emerging institutional environment (as in the South African case) where individual choices and actions can really make a difference. The institutional configurations catalysed by the introduction of auctions created such an environment, including high levels of uncertainty about the ultimate outcomes.

In this context the institutional agenda was – in Lawrence and Suddaby’s terms - about ‘creating’ institutions, and less about ‘maintaining’ or ‘disrupting’ them [28]. But when creating institutions, the ‘intentionality’ of agents is what matters: they can recall “schemas of action” ([29]:975) from the past to improve and modify the present (‘schematization’); through “translation, bricolage and reacting to shocks” (Battilana & D’Aunno, p.48) they can (re-)contextualise the lived experience of the present to maintain things as they are (‘contextualisation’); or they can “hypothesize” futures by “inventing, creating, advocating and establishing” ([27]:48) new institutional configurations that respond to major new opportunities (‘hypothesization’, or what we prefer to call ‘imagineering’). If ‘creating institutions’ is the dominant type of institutional work during a founding phase of a new institutional environment (which is the focus of this paper), then of the three forms of intentionality (schematization, contextualisation, imagineering) and following Oomen et al., it is the ‘imagineering’ of institutional futures that results in “socially performative” outcomes that is of primary concern here [30] – this is, in other words, what ‘contextualisation’ looks like in practice.

What follows, therefore, is an account of the complex and often contradictory process of future-oriented *imagineering* involved in *creating* new institutions in the South African context. This follows the formal adoption (and modification) of the globally constructed auction narrative [31] by a state that purported to be ‘developmental’ in directing private capital into potentially developmental and decarbonising investments [32].

4. Rise and centrality of the auction mechanism and consequences⁵

A RE feed-in tariff (REFIT) was initially conceived of as an economic instrument designed to incentivise the uptake of an emergent RE industry which is not yet economically competitive with conventional

⁵ This section draws on Kruger, W., Kitzing, L., Nygaard, I., (2021) Countering market concentration in renewable energy auctions: lessons learned from South Africa, Energy Policy, 148, Part B [111995]

energy generation, but which is desirable for other reasons, such as environmental imperatives [33]. REFITs guarantee a fixed price paid to RE generators for a specified time period. The evolution from REFITs to auctions was part of a wider market transformation process that resulted in smaller actors and cooperatives getting pushed out and the preferencing of major market players with access to large sources of finance, capital, and resources [34,35]. REFITs were becoming too rigid and costly in light of price reductions, increasing demand and the globalization of RE companies [31]. Furthermore, there is evidence that once the energy transition shifts from niche innovations to the need for large-scale procurement it is necessary to depend on quantity control mechanisms (like auctions) rather than price instruments (such as feed-in tariffs) [36]. In the wake of the elimination of feed-in tariffs from about 2008 onwards, competitive auction programmes emerged triumphant as the policy mechanism of choice at the global level. By 2020 it had been adopted by 116 countries [37]. According to Grashof [31], this remarkable policy shift was the outcome of skilful institutional work by a globally networked group of experts during the period 2008 and 2015, who were 'imagineering' the auction as a specific institutional configuration. This group of experts included a researcher network (Brazilian Consultancy PSR, University of Cape Town, Ecofys, Fraunhofer Institute, DTU in Denmark, and the Spanish economist Pablo del Rio), who evaluated the performance of auctions and developed best practices for the adoption of auction mechanisms, as well as the World Bank, IRENA, European Commission (DG Competition), REN21 and BNEF, who worked with auction adoptions on a regional and global scale [31]. The World Bank published the first comprehensive analysis of the auction mechanism in 2011, followed by a series of successful workshops. This included setting up the Scaling Solar platform within Africa to advocate for the auction mechanism over the REFIT option. The International Renewable Energy Agency (IRENA) published a 200 page guide to auction mechanisms in 2015 [31]. By 2016, auctions were accepted as 'best practice' globally. Grashof [31] explains the success by referring to the institutional work of the same network of experts working together and producing consistent findings. In the language of Oomen et al. [30], they effectively built a globally applicable 'imaginary'. A similar dynamic has been described for earlier support policies for renewable energy, for example for the adoption of the REFIT programme in Uganda (see e.g. Bhamidipati, Haselip and Elmer Hansen [38]).

The popularity of the auction is due to two factors. The first is that this modality is well aligned with state procurement in many developing nations [3]. Secondly, the supply of financial aid and technical expertise, driven primarily by the development finance institution (DFI) agendas and lending requirements, has been instrumental in establishing RE sectors in many developing countries [39,40].

Auctions, which ensure competition, transparency and the compliance of the recipients of donor aid, have coincided with significant supportive cost reductions for several RE technologies across various jurisdictions [2,41–44].

Some have argued that there is a substantial 'price' being paid for this auction-based reduction in renewable energy support costs. Auctions are criticised for seemingly leading to market concentration and dominance by a few big players – with large, often international industry incumbents reportedly being able to out-bid smaller, newer and/or local bidders [42,45,46]. This can be especially concerning for jurisdictions where renewable energy deployment has traditionally been driven by small, community-based projects (e.g. Germany, Denmark). It has also been argued that the dominance of large, international players in auctions may depress the development of a nascent domestic renewable energy sector in developing economies. Market dominance is furthermore a concern for the efficiency of auctions in general, since an increasingly smaller number of large actors may lead to less competition during consecutive bidding processes, resulting in higher prices in the long-run [42,47].

The South African case was used to test these arguments [48]. South Africa is a well-known early mover, with the Development Bank of

Southern Africa (DBSA) providing an R80 million facility to fund the setting up of the REI4P and the IPPO. The IPPO had procured more than 6.3 GW of renewable capacity, representing 112 projects, in seven auction rounds between 2011 and 2015 [49]. Two programmes were analysed, namely the Renewable Energy Independent Power Producers Procurement Programme (REI4P) and the Small Projects IPP Procurement Programme (SP-I4P). Although both programmes were analysed in detail in the research project, due to space constraints only results from the REI4P are reported here.

With funding and strategic guidance provided by a DFI, the DBSA, the rule-setting for the REI4P resulted in a complex single-stage, pay-as-bid, sealed-bid reverse auction with dedicated technology bands for solar photovoltaics (PV), onshore wind, concentrating solar power (CSP), small hydro, biomass and landfill gas. As one international interviewee put it, the REI4P is "the most onerous bidding programme in the world". Bids were managed by the IPPO, a government agency. Bidders competed for 20-year power purchase agreements signed by Eskom, the government-owned utility, backed by a sovereign guarantee. Bids were scored 70% on price, and 30% on socio-economic and economic development (SED and ED) criteria. Four bid windows between 2011 and 2015 were executed for the REI4P, with the fourth (BW 4a) extended into a de facto fifth bid window (BW 4b). The other two were for the SP-I4P.

Analysis shows that the number of competing bids in the REI4P programme increased from 53 in BW 1 to 77 in BW 4 (a&b). The average price dropped from R1.14 c/kWh to 72 c/kWh. At the same time, more bids were awarded to a smaller and smaller pool over the bid windows, mostly to large multi-nationals like ENEL and Mainstream. However, using the Herfindahl-Hirschman Index (HHI) [cited in 48], analysis shows that while there has been a high level of market concentration in the later rounds of the auction programmes, it does not necessarily conform to a pattern that would inevitably lead to consolidation and dominance by a small group of powerful international companies. Furthermore, market concentration has to an extent coincided with market dominance by international firms across the bid windows. However, over this period, South African companies have also at the same time gradually increased their share of the winning bids.

In short, greater market concentration has occurred, but not to the point that this results in reduced competition. The evidence that supports this claim is, of course, very rapid price reductions in line with international trends. However, overall, there has been market consolidation with only the bigger firms left standing. This is mainly due to policy uncertainty after 2015 caused by government delays creating costs that smaller firms could not handle. On the positive side, the South African renewable energy industry has expanded significantly over time and an increasing number of South African project developers, investors, lenders, advisors and service providers are engaged in the REI4P [48,50].

This can be attributed in part to South Africa's Independent Power Producers Office (IPPO) that managed the implementation of the REI4P and has often been praised for its efficiency and effectiveness in implementing the complex set of rules that resulted in the large-scale investment flows into renewables. By institutionalising the IPPO as an adjunct to the DBSA and not a formal part of a Government Department, together with a legal framework that allowed the IPPO to collect a bidding fee from each bidder, created a remarkably effective unit with the requisite operational space to manage the bidding process in a corruption-free strategically sophisticated manner. Being managed by the DBSA in accordance with policies set by an inter-departmental Steering Committee, but embedded within the Department of Energy while aligning decisions with National Treasury, made it possible for the IPPO to be responsive, agile and administratively innovative. Without this positioning, the IPPO would not have been so effective. The IPPO is a successful case of public sector institutional work that resulted in what must be South Africa's most successful institution building project in the infrastructure sector. This was confirmed by our study of the

competitiveness of the process enabled by the REI4P resulting in price reductions, and high realization rates [51].⁶ It was also acknowledged by the National Planning Commission, located within the Presidency [52].

In summary, finding a way to reinforce the position of local firms in a new industry has to date been a policy priority for the South African Government. However, like many other global South countries, this is also a policy priority where there are developmentally oriented national governments who are keen to reap the developmental dividends of the energy transition. However, equally important will be accelerating the pace and extent of the development process, which often means relying on the substantial capacity of MNCs. The South African experience, in holding the balance by mandating a specialist government unit (the IPP Office) to manage the auction process is, therefore, instructive. This ‘pocket of excellence’ within a sea of institutional weakness managed a complex rule-setting process that maintained competitiveness and a very high realization rate. More importantly, while market dynamics are often blamed, our analysis shows that it is mainly policy uncertainty and unpredictability that has knocked out the smaller players. Despite the institutional work by the emergent renewables industry in SA to sustain policy certainty, wider political dynamics related to a preference for the ‘nuclear option’ within the wider context of ‘state capture’ [53] over-determined market dynamics resulting in the consolidation of a relatively concentrated industry.

5. Role of MNCs in the global South and implications for innovation

As argued in the previous section, the shift from REFITs to auctions on a global scale coupled to the globalization of RE companies as prices dropped and REFITs became counter-productive, cleared the way for MNCs to become the major global market players. As intended by those who did the institutional work for the DFIs to establish the auction mechanism globally, MNCs have effectively taken over from local co-operatives and social enterprises as the major market actors in the frontrunner countries [5]. However, unlike Germany and Denmark where renewables emerged from the social logic of the cooperative movement, these ‘latecomers’ in the global South got inserted into a pre-established global policy regime with auctions at the centre. Therefore, following Hansen et al. [6], this means accepting that the transition pathway applicable to Europe where the energy transition began is different to the pathway unfolding in the global South. The key difference being the role played by MNCs within a state-led rules-based implementation environment. The South African case, as already argued, is an ideal case in point.

There are three emergent trends that will be discussed in this section that once again illustrate how key actors were able to ‘imagineer’ and create innovative institutional configurations within a fairly fluid (albeit highly regulated) emerging institutional context:

- the first is when the MNC becomes fully localised via a process that will be referred to as ‘dual embeddedness’;
- the second is when Original Equipment Manufacturers (OEMs) prefer what will be referred to as ‘follower sourcing’ rather than contracting locally constituted manufacturing firms;
- the third is when OEMs set up subsidiaries that employ local staff and that capture a number of O&M contracts in partnership with the IPPs.

The prominent role played by MNCs can easily reinforce the structuralist impression that the future is about the dominance of large MNCs

who impose their own pre-baked technology solutions onto the host country, with limited learning and capability building [for a good example of this see [54]]. What this image ignores is that global diffusion is not a one-way street, especially during the early phases of the innovation cycle when learning curves are exceptionally steep and states are (following Mazzucato) particularly interventionist. As in previous phases of global infrastructure diffusion during colonial times, the centre learns from the periphery because of the embeddedness of MNCs in the host country (see [55]). But the periphery, in turn, can choose to do the kind of creative institutional work that enables it to take advantage of these learnings and in the process catalyse local industrialisation. Without making this choice and building capabilities to make it happen, the advantages flow only one way. This has significant implications for our understanding of innovation and industrialisation.

5.1. Dual embeddedness⁷

Over the past thirty years, a stream of research has sought to explain the various stages of advancement of firms in developing and emerging economies, referred to as ‘latecomer firms’, on the basis of how such firms are able to acquire and develop innovation capabilities. A key finding to emerge from this literature is that the ability of latecomer firms to progress from being innovation followers to innovation leaders depends critically on the conscious, purposeful and costly efforts to make this transition a reality – in short, the institutional work to ‘imagineer’ and then create locally embedded institutions [56].

Several authors have sought to explain the innovative performance of MNC subsidiaries as an outcome of the degree of their external embeddedness in host-country networks (e.g., Almeida and Phene [57]; Andersson, Forsgren and Holm [58]), allowing subsidiaries to gain access to locally specific knowledge [60]. Others have examined the influence of internal embeddedness of the MNC subsidiaries within the global MNC’s intra-corporate networks of innovative performance [62–65].

However, as Figueiredo [66] points out, there is an absence of research simultaneously exploring the effects of embeddedness in both local and intra-corporate networks, referred to as *dual embeddedness*, on the innovative performance of MNC subsidiaries. Nevertheless, a few examples of such research have recently emerged [67–72] which show that two out of the three main forms of institutional work are present, i. e. creating and maintaining institutions, with both highly dependent not on structure or policy, but the choices and relational abilities of the key individuals involved in building these personal linkages.

To explore the way dual embeddedness of MNC subsidiaries can shape innovation capabilities within the renewables sector, we conducted a qualitative case study of a company owned by a Scandinavian MNC that integrates two roles that are usually kept separate: it acts as an IPP developer, and as an engineering procurement and construction (EPC) firm [4]. Prior to setting up its South African subsidiary, the MNC was a relatively small company with a portfolio of non-SA utility-scale PV plants with an installed capacity of only 20 MW. Its first South African project was 75 MW, and by 2019 it was one of the leading solar PV IPPs in South Africa and it was building plants in many African countries (Rwanda, Egypt, Mozambique, etc). The researchers who conducted the case study found that over a short period of five years, the company had drastically improved operational efficiencies by doing more with less staff in response to declining prices. Furthermore, key corporate staff (including the CEO) and core technical functions to support the MNC’s global operations were transferred from Europe into the South African office, which in turn was staffed increasingly by South Africans. This

⁶ A realization rate refers to the quantum of projects approved versus the quantum implemented. A 100% realization rate means all approved projects were in the end implemented.

⁷ This section draws on Davy, E., Hansen, U.E., Nygaard, I. (2021). Dual embeddedness? Innovation capabilities, multinational subsidiaries, and solar power development in South Africa. *Energy Research and Social Science*, 78, [102145]

effectively meant that the technical support team for operations in Argentina, Brazil, Egypt, Mozambique, Ukraine and Malaysia was a South Africa-based team comprised (by 2019) almost entirely of South Africans. And finally, the company created the funds for a Research Chair at a South African University staffed by a South African expert to manage joint R&D work for the company's South African and global operations.

In short, the subsidiary of a European MNC operating in the South African renewables sector did the ambitious institutional work that resulted in the complete re-imagining of the traditional role of a MNC in an auction-based state-market environment, resulting in the end in the creation of a significant South Africa-based knowledge (University-linked) and technical capability. This is what enabled it to achieve an advanced level of innovation capabilities over a short period of nine years (2010–2019) due to the institutional work involved in creating *dual embeddedness*. The rapid achievement of advanced innovation capabilities contrasts with most studies in the capabilities literature, which point to capability development in latecomer firms as evolving slowly over a prolonged period of twenty to forty years [73]. The learning that took place within the subsidiary (which was eventually run by a team comprised entirely of South Africans) was driven by the institutional work with the parent company, collaboration with a University, and the hard lessons learnt by 'just doing it'.

5.2. Follower sourcing⁸

As MNCs have become increasingly significant players in the globalized RE value chain, so this has shaped the strategies of the large OEMs. Like their counterparts in the automotive global value chain (GVC) [74], first tier suppliers of towers, blades and nacelles to the turbine manufacturers prefer to establish subsidiary plants in the local economy rather than importing such critical components [78]. Known as 'follower sourcing', this practice involves a significant form of localisation, albeit of foreign owned firms. A key advantage is that many locally owned suppliers end up providing services and products that feed into this high-end part of the value chain. The institutional work that shapes the articulations of MNCs and local firms depends on the way local industrial policy interacts with lead firm strategies and local supply firms [50].

The primary international OEMs (e.g. General Electric, Nordex Acciona, Vestas, Siemens and Goldwind) play a key role in determining the many performance features and standards for those supplying them with manufactured components [50,75,76]. However, the picture is more complex than this: recent trends in the global wind energy sector reveal how the procurers of energy set supply conditions for the OEMs because of government policy, procurement regulations of utilities or via regulators. Furthermore, the pressures of falling energy prices has forced the OEMs to consolidate in order to have the institutional capacity to accelerate innovation (e.g. the production of much higher output capacity turbines) [36]. These forces have enabled OEMs to use their buying power to influence the geographic distribution of production and service activities through localization [78] and to increase their power with respect to engagements with stakeholders in new markets [75]. These lead OEMs are, therefore, able to exert considerable influence over the factors driving value chain choices from one market to another.

The institutional work of officials within the DTI facilitated the market entry of a purely local tower producer (called DCD) and a local turbine and blade fabrication consortium (IWEC). As one of them noted: "it was clear to us that we could not just sit back and wait for international suppliers to come, we wanted to encourage domestic firms to

enter this business". However, this ignored the follower sourcing bias that characterises the GVC [78]. The OEMs often encourage their MNC first tier suppliers (of, for example, towers, blades, and nacelles) with whom they have longstanding trusted relationships to establish a subsidiary plant in the country. They typically start this follower sourcing process by localising the production of towers, then blades (the most expensive component to localise other than production of key elements of the turbine itself), and then nacelles, including assembly of imported components (in some cases also locally sourced inputs). Follower sourcing ensures that critical technical standards are maintained, logistic import costs are cut, and delivery reliability is maintained. But OEMs only encourage follower sourcing if a combination of factors is in place, namely sufficient market demand, and continuity and predictability of bid windows over time to ensure sustained demand is guaranteed by the country's RE programme. Moreover, if the host country has an industrial policy that specifies clear local content requirements coupled to appropriate incentives, then follower sourcing will be modified accordingly.

Interviews with company representatives from the European headquarters and South African offices of some major wind OEMs (e.g. Vestas, Siemens) as well as foreign multinational first tier suppliers (e.g. GRI, LM Wind, Resolux) confirmed that follower sourcing is a key strategy. As one leading OEM representative put it, "we encourage first tier suppliers of critical components to go together into a new market either by using sticks or carrots tactics". First tier suppliers depend greatly on established trust relationships with the OEMs that years of institutional work made possible, and they therefore follow direct requests and established commitments within an OEM's follower sourcing strategy. As a blade manufacturer said: "We have no plans to localise. The OEMs have the plan and we simply react".

Given that these OEMs were dependent on already established, high trust relationships with their own first tier suppliers, they were not willing to take the risk of procuring critical high-risk items from an unknown new local first tier producer like DCD. As one local OEM manager depicted the critical importance of institutional work that nevertheless failed because the learning curves had too little time to reach maturity: "we did share our specifications and certification requirements with the DCD team but they were trying to do in a year or two what other global suppliers had developed in almost two decades". Ultimately, despite the acquiring of equipment by IWEC, the production of a prototype and the official opening of the DCD plant, no contracts were secured over the four rounds by IWEC or DCD. Needless to say, any prospect of securing contracts was undermined by the eventual de facto suspension of the REIPPPP at the policy level. As a former senior DTI official reflected, "there remains a very strong view amongst the political leaders that localisation must be about indigenous firms being grown into this supply chain, but this obsession might well have cost us opportunities to bring more follower suppliers in at an earlier stage".

In short, the evidence suggests that the South African Government misunderstood the significance of 'maintaining'-type institutional work within a complex GVC where learning curves are anything but steep and short. The alternative entails an appreciation of the fact that when it comes to manufacturing, the learning curves tend to rise gradually and stretch out over a prolonged period of time. Accelerating these learning curves requires policy certainty, patience, capacity building support and partnering capabilities. In short, 'creating'-type institutional work reinforced by policy certainty. Neither of these were present.

⁸ This section draws on Morris, M., Robbins, G., Hansen, U., & Nygaard, I. (2021). The wind energy global value chain localisation and industrial policy failure in South Africa. *Journal of International Business Policy*, 1–22. <https://doi.org/10.1057/s42214-021-00123-8> as well as Lars and Hansen 2020.

5.3. Value chain capture⁹

A permanent O&M industry usually emerges in the wake of a RE build programme. This is because a build programme creates significant opportunities for locally-based suppliers of embedded services. However, this does not happen without institutional work to build capacity and facilitate the necessary learning curves.

In South Africa, OEMs established local subsidiaries that focussed exclusively on conducting O&M services on their own turbines, including repair of critical components such as gearboxes. The employees of these local subsidiaries were South Africans. However, the local subsidiaries outsourced the servicing of less critical plant components (including sub-stations) to local third-party suppliers. These local suppliers were contracted to undertake relatively simple scheduled maintenance on turbines, such as lubrication of components, checking the oil and tightening of the bolts.

OEMs have over time devoted significant resources to developing the skills level of their South African employees, mainly through training and supervision (which included longer-term stays at the headquarters of their parent lead firms in Europe). Eventually, the employees became increasingly capable of independently conducting O&M services with a higher level of complexity, such as troubleshooting, endoscopy of gearboxes, condition monitoring, evaluation tasks and special repairs, all of which require specialised skills. According to our interviews, the OEMs clearly had an incentive to localise such service activities. As a representative of a local subsidiary of a lead firm put it: “it does not make sense to send in an engineer from Europe to South Africa whenever there is a problem, which goes beyond simple repairs”. Some of the South African employees with the ability to perform such tasks have subsequently been involved in projects implemented by the OEMs in other countries in Africa. These firms were also directly involved in the training and upgrading of some of their third-party service suppliers, which also included training and external stays in Europe.

5.4. Implications

In short, two mainstream views tend to shape the discussion about the building of innovation capabilities, namely that local firms are the only ones that can do it, but it takes decades; or that MNCs impose their technology solutions on the host country with limited impact on local innovation capabilities. The evidence and discussion in this section suggests otherwise: that the institutional work done by MNC subsidiaries operating within sectors characterised by significant learning curves can help build quite quickly a specific set of innovation capabilities. This may be particularly true if the portfolio of projects managed by the subsidiary is larger than what the parent company manages. It is also valid when it comes to OEMs who set up locally staffed subsidiaries that become active participants in the O&M activities and structures. It follows that policy makers should not automatically assume that MNCs will, by definition, prevent the build-up of local innovation capabilities. If accelerated learning is key to industrialisation, then a more nuanced approach is worth considering that must include policy certainty over

⁹ This section draws on Hansen, U.E., Nygaard, I., Morris, M., Robbins, G., (2021) Servicification of manufacturing in global value chains: upgrading of local suppliers of embedded services in the South African market for wind turbines, *The Journal of Development Studies*, DOI:<https://doi.org/10.1080/00220388.2021.2017892>.

the long term, partnering capabilities, innovative financing and a deep appreciation of the institutional work dynamics of the GVC.

6. Energy transition, industrialisation and local content requirements¹⁰

In addition to the challenges discussed thus far to (a) mitigate the potentially anti-competitive impact of auction mechanisms, and (b) harness the innovation potential of MNC subsidiaries, developmentally-oriented states in the global South are also seeing the energy transition as key to a new type of industrialisation in a carbon-constrained world. Whereas the construction of utility-scale renewables are major job creators (for example, approximately 10,000 construction jobs were created per GW of installed capacity in South Africa's REI4P), equally significant job creation potential lies in upstream import-substitution industrialisation opportunities. To achieve this goal, local content requirements (LCRs) have been introduced in auction schemes in many countries. The effectiveness of LCRs, however, is dependent on the kind of institutional work needed to ensure learning for building productive capabilities takes place over time. Regulations and incentives alone will not ensure the success of LCRs.

In RE auction schemes, LCRs are typically defined as the percentage of the total project cost sourced locally through both equipment and services, including locally produced components, civil engineering work and consultancy fees. As shown by Ettmayr and Lloyd [77], the literature on LCRs has converged towards a common set of key determinants to assess the efficacy of LCRs in promoting local industrial development. Accordingly, as suggested by Veloso [78], Kuntze and Moerenhout [79] and Johnson [80] these are: (i) market size and stability; (ii) policy design and coherence; (iii) the restrictiveness of the LCRs; and (iv) the domestic industrial base (see Table 1).

Comparing South Africa, Brazil, India and China, LCRs have vastly different impacts. In general, LCRs have had a limited impact on South Africa's manufacturing capability (discussed further below). The impact of LCRs, however, has been much greater in Brazil, implemented mainly by subsidiaries and/or affiliates of MNCs. In India, the first generation of LCRs was successful in stimulating the emergence of a conventional

Table 1
Main determining factors for the effectiveness of LCRs in RE auction schemes.

Factors	Characteristics
Market size and stability	The level of domestic market demand in terms of auctioned volumes
	The degree of predictability and long-term stability of the demand, for example, through target setting and political signals
Policy design and coherence	The clarity and transparency of the rules and regulations pertaining to the LCRs, including definition and implementation procedures
	The extent to which LCRs are aligned with and accompanied by the complementary industrial policies supporting local manufacturing in the targeted sectors
Restrictiveness	The level or percentage of locally produced content required under the LCRs
Industrial Base	The level of technology capabilities in the local supply base, including technical skills, specialisation and the production capacity of domestic firms

¹⁰ This section draws on Hansen, U.E., Nygaard, I., Morris, M., & Robbins, G. (2020). The effects of local content requirements in auction schemes for renewable energy in developing countries: a literature review. *Renewable and Sustainable Energy Reviews*, 127, [109843] and Morris, M., Robbins, G., Hansen, U., & Nygaard, I. (2021). The wind energy global value chain localisation and industrial policy failure in South Africa. *Journal of International Business Policy*, 1–22. <https://doi.org/10.1057/s42214-021-00123-8>.

solar technology manufacturing industry [76]. However, the second generation of LCRs focussed on crystalline silicone photovoltaic cells which, in turn, incentivised a switch to imported thin film technologies to avoid LCR strictures – a good example of a poorly designed LCR with loopholes. LCRs worked very well in China. Introduced in the late 1990s, they were phased out in 2009. “[B]y 2000, Chinese companies held 10% of the domestic market share” but by 2009 “the top ten Chinese companies accounted for 85.3% of newly installed capacity” [81].

It is clear from these brief country profiles that although LCRs were applicable in all four, they were not equally effective. The success of LCRs in China is because all four conditions were present, i.e. market size, policy certainty, limited restrictiveness and an industrial base. This was not true for South Africa (where productive capacity was potentially available, but this was not the focus of the LCRs), and partially true for Brazil. India is a case of similar potential to China, but with poor policy design. Overall, LCRs on their own are not a panacea – they need to be seen as part of a wider cluster of coherent industrial policies with a strong focus on technological capability building to drive industrialisation. This, in turn, depends on effective institutional work, as demonstrated below.

The overall strategic significance of this analysis is that the auction scheme must be institutionally part of a wider industrial policy regime with carefully crafted LCRs. The use of LCRs provides an instrument to counteract the normal market forces of economic globalization, which would not necessarily encourage localisation of component production in developing countries.

In our detailed analysis of South Africa's localisation strategy for the RE sector, Morris et al. argue that South African policy makers missed a key opportunity to build technological capabilities for driving industrialisation [82]. This is reflected in the fact that South Africa positioned itself at the low end of the global value chain (as reflected in Table 2).

Despite this, the rather ambitious local content targets were met (Table 3).

However, instead of emphasizing long-term technological capability building for industrialisation, for the South African Government localisation has meant building black-owned South African manufacturing companies and increasing the quantum of employment generated. These short-term goals were built into the character of the local content policy scoring system utilised by the IPP office and built into the auction mechanism. As discussed in the previous section on follower sourcing, in South Africa the focus was on building black-owned manufacturing companies who, it was assumed, would gain experience if they were

contracted by the developers. It did not work out that way. This conundrum was raised by numerous informants during the field research. To take a typical example, an OEM representative argued that compared to South Africa's successful local content programme in the automotive industry, local content within the overall REIPPPP framework was seen by regulators as strategically less important than black empowerment. It is clear that many informants were of the view that the Department of Trade and Industry had either not been involved in using its experience in other sectors (e.g. automotive) to design similar local content regulations for the REI4P, or had not seen it as integral to its industrial policy priorities. Instead, black economic empowerment was emphasized, which included recognising black ownership (minimum of 40%), black staffing levels (especially at management level), and sub-contracting of black-owned firms. While black economic empowerment is obviously a strategic priority in the South African context, it should not be at the expensive of local content and the building of manufacturing capabilities (Table 3).

Given the South African ‘triple challenge’ of unemployment, poverty and inequality, it is unsurprising that the South Africans emphasized job creation and black ownership. But if this translates into an exclusive focus on short-term gains, the potentially more significant long-term gains that flow from capabilities-driven industrialisation can be sacrificed.

Despite the short-termism of South African LCRs, some OEMs did put in place plans to establish local plants. One large wind tower company, GRI, initiated the complex institutional work required to imagine and create the necessary institutional capacity for funding and erecting a large plant in Atlantis (for more details see [78,83]). All these plans came to naught when the REI4P was effectively suspended by Government in 2015 as the coal interests gained the upper hand during the height of state capture [84]. The end of policy certainty terminated the potential for a RE-led capability-driven industrialisation programme. Those South Africans who gained new skills and experience were dispersed to work for MNCs in other parts of the world.

The discussion thus far in this section has focussed on the way LCRs can catalyse local manufacturing. However, what is missing from the mainstream discussions is that LCRs can also catalyse service industries, and these could in fact generate more jobs than what may be possible in manufacturing (see [85]). Our findings suggest that more attention should be given to the value-add of services in GVCs. Our empirical findings reveal the significant opportunities for local firms to capture value and upgrade from their place as suppliers of high value-added and knowledge-intensive services in (home) markets for infrastructure projects dominated by foreign lead firms. The GVC literature tends to emphasize the need to insert local developing-country firms as suppliers of manufactured goods as the preferred mode of entry into GVCs. However, given the high entry barriers, the prospects for the entry of local manufacturers of wind-turbine components in the global wind turbine GVC are low except for producers of peripheral components, such as towers [86,87]. Our findings show that service provision (e.g. transportation services, maintenance and repairs) may be a more favourable entry point into GVCs for local firms in the context of the growing markets for renewable energy in African countries and possibly elsewhere [85].

The implications of the evidence presented in this section are that LCRs can work, but certain conditions have to be met. They are a set of rules imposed on a market by a developmentally-oriented state to create the conditions for the building of local technological capabilities that drive industrialisation. They can, however, also have a beneficial impact on the service sectors, like transportation, project management and financial services. It would be mistaken to diminish the significance of the latter, especially when it comes to job creation potential. Either way, for LCRs to work, long-termist institutional work is required to imagine and create the required local value chains, rather than a focus on short-term gains. The institutional work involved means working with MNCs who establish subsidiaries who employ locals who learn fast, followed

Table 2
Local manufacturing in South Africa for wind energy projects.

Type of activity/product	Tech level	Status
Civil inputs (aggregate, cement, steel, pre-cast elements, come yellow goods (plant and equipment))	Low/ medium tech	Established
Ancillary structures – fencing, building materials for temporary/ permanent buildings	Low tech	Established
Grid integration – cables, distribution and power transformers, medium voltage primary and secondary switchgear, mineral oil and bio-electra oil pole mount switchgear, pylons, indoor and outdoor ring main units	Low/ medium tech	Established
Towers – steel towers	Low tech	Established
Towers – pre-cast concrete tower units	Low tech	Mostly disestablished
Tower internals – ladders, cabling, lighting	Low tech	Established
Blades	Medium tech	None
Turbines – for the commercial grid wind energy sector	Medium tech	None
Nacelles panels	Low tech	None
Assembly of nacelles & turbine elements	Medium tech	None

*Authors adapted from SAWEA and Urban Econ data.

Table 3
Average local content as a percentage of total project cost versus thresholds and targets.

	BW1			BW2			BW3			BW4		
	Min	Target	Average Bid									
Wind	25%	45%	27.4%	25%	60%	48.1%	40%	65%	46.9%	40%	65%	44.4%
Solar PV	35%	50%	38.4%	35%	60%	53.4%	45%	65%	53.8%	45%	65%	62.3%

*Threshold = Minimum obligation.

Adapted from Eberhard & Naude (2017)

by a transition to locally owned companies who employ those who have developed the required technological capabilities. When it comes to services, the evidence suggests that locally owned and staffed companies can become part of the value chain from the start. However, for both to work a political settlement is required that ensures a stable political coalition is in place that underwrites policy certainty over the long term. Without this, markets cannot mature, economies of scale do not materialise, and prices remain too high for local procurement to be attractive for developers.

7. Towards transformative development practice¹¹

As already pointed out, South Africa was an early adopter of the auction mechanism. But given South Africa's developmental challenges, the auction mechanism needed to reconcile the creation of a new market with specific developmental imperatives. As discussed, LCR rule-setting was one strategy; but developmental impact requirements at the community level were another – a set of rules that are unique to South Africa's RE programme. As a result, this dimension of the REIPPPP was a major focus of our research. During the early stages of the design of the REIPPPP, the policy intension was clear: rules were needed that specified that IPPs require a Social License to Operate (SLTO) that includes (a) investments in Socio-Economic Development (SED) by allocating a portion of turnover to support local developmental projects; (b) promotion of Enterprise Development (ED) by investing in local value chains; and (c) ensuring that a percentage of the shares are owned by the local community (usually via Community Trusts) who then manage the dividend flows. From a financial perspective, these rules have had a profound impact at the local level. Added together, a total of R1.3 billion has been invested in SED and ED since 2011. Locally invested dividends totalled R42.1 billion by 2018. Given that these investments occur mainly in small towns that have hitherto had very limited economic development potential, these financial flows are significant. These SLTO rules effectively enabled the introduction of a sophisticated system of state-driven enrolment of the private sector in community development on a scale never seen before in South Africa [88], and maybe even globally. In practice, the actual realization of this intended outcome is dependent on the ground-level institutional work that is needed to implement this approach.

These SLTO rules effectively imposed on IPPs a new mandate that private companies rarely need to face, namely to engage the complexities of local-level development dynamics. To enable this kind of institutional work (referred to in the industry as 'social performance'), these IPPs needed to employ specialist community engagement professionals and/or community engagement consultants. Referred to in the industry as Economic Development Managers (ED managers), the role and practices of this group has not been addressed in the literature [89]. Despite their pivotal role in developing and mediating community engagement practices, prior to this research project little was known

about their institutional work, specifically who they are, how they deal with their complex tasks, and how this affects the practices whereby renewable energy companies engage communities.

ED managers are employees of a large corporation (usually a MNC with a local BEE partner) and mandated to catalyse community development. This paradox means they are faced with the *external* pressures to respond appropriately to community development challenges, and the *internal* pressures to align with company requirements, including limited budgets. In the South African context, most are black women, which comes with the usual negative discriminatory intersectional implications that have been well-documented in the South African context [90]. As a result, our extensive research revealed that they face three key dilemmas: (a) how to pursue personal ideals of development practice in a corporate context focused on profit, (b) how to empower change from a marginalized position within the company, and (c) how to deliver results without guidance from pre-established practice frameworks for what is, in reality, a newly established professional sub-field (refer to Funder et al. [91]).

In seeking to reconcile personal ideals and company imperatives, ED managers are constantly caught between the company priority to maximise profit in the shortest possible time, and the developmental imperatives of marginalized communities who need time to learn through participation. ED managers manage this paradox by taking risks: they initiate overly ambitious developmental projects and then internally justify community projects in terms of potential threats to the company if the community starts to feel they are not benefitting [84].

In their struggle to empower change from a marginal position, no matter their formal position in the company, ED managers felt that community development is not a priority for the company leadership, and that as black women (in most cases) in a predominantly white-led industry their status was diminished by the inherent biases that are pervasive in white male run organizations. To counteract this, they leverage their exclusive knowledge of 'what goes on' in communities to justify greater corporate emphasis on community development [84].

In order to deliver results, practice frameworks emerged to guide appropriate action. South Africa's extensive community of development practitioners has over the decades evolved a set of frameworks for guiding development practice, including Community-Driven Development, Rights-Based Community Development, Asset-Based Community Development (ABCD) and the Sustainable Livelihoods Approach (SLA) [92]. A similar approach has not evolved in the RE social performance field. As a result, ED practitioners have been faced with the dilemma of being expected to deliver tangible results by their companies, but lack any explicitly defined company approaches and tools for doing so. The result is development practice by improvisation.

Our finding is that as the intermediaries between companies and communities mandated to deliver a key dimension of South Africa's uniquely configured RE programme, ED managers enjoy considerable agency when it comes to formulating strategies to deliver on their mandates. They creatively exploit the opportunities available to them, including the room for maneuver available in their roles as development practitioners. That said, they are up against formidable constraints: the deep-seated marginalization of their work due to the pervasive intersectional race and gender biases within their respective corporate contexts.

¹¹ Funder, M., Wlokas, H., Jhetam, T., Olsen, K.H. (2021) Corporate community engagement professionals in the renewable energy industry: Dilemmas and agency at the frontline of South Africa's energy transition. *Energy Research and Social Science*, 81, [102249]

8. Conclusion

Now that renewable energy is growing faster in developing countries than in developed countries for the first time, it has become imperative to examine the linkages between the energy transition and economic development. This paper has attempted to do this by developing an approach that brought into focus the institutional micro-economics of four key dimensions of the economic development process, namely (a) the impact of the auction mechanism on the energy industry in South Africa; (b) the key role MNCs play in the global value chain; (c) how developmentally-oriented states like South Africa have attempted to harness the resulting investment flows by using LCRs; and (d) the local-level development impacts of utility-scale renewable energy power plants on local communities.

What is distinctive about the rise of RE globally is the way developmentally oriented states have established sophisticated sets of rules and institutional arrangements that shape the way public and private investments flow into renewable energy technologies in ways that drive the energy transition in certain directions. However, instead of focusing on the structural conditions for successful state-led development (as is common in the 'developmental state' literature), the focus here has been on the complex often contradictory rules and institutional configurations that emerge in highly contested political environments. Following the 'political settlements' literature, this means looking for 'pockets of excellence' that enable things to happen rather than general structural conditions that are often depicted as the necessary and sufficient conditions for state action as a whole. This helps to bring into focus the relational dynamics of complex institutional configurations. But deeper insight is needed into how specific actors caught up within these complex dynamics 'create, maintain and disrupt' with their respective operational spaces. By using the literature on 'institutional work' to remedy this by highlighting the role of agency, we have been able to show that actual outcomes often confound common assumptions about the interaction between the energy transition, economic development, nationally determined rules and MNCs.

As far as the auction mechanism is concerned, the widely held view that this policy-driven market approach will result in market concentration, reduced competition and therefore rising prices is not substantiated within the South African context. Instead, there has been some market concentration, but prices have dropped dramatically due to competition, at least up to this point. Nevertheless, over time, despite these challenges, South African firms have found ways to work within the institutional and policy constraints to develop innovative partnerships to strengthen their relative positions over time. This could have been significantly reinforced if the 'political settlement' between government, ESKOM and the RE industry had enabled greater policy certainty and therefore long-term institutional consistency.

When it comes to innovation, the commonly held view within national policy elites is that it either takes a long time to 'grow your own timber' (supporting national industries), or it is necessary to depend on MNCs who tend to impose their own solutions at odds with local interests. Neither, of course, is the preferred option for developmentally-oriented states. The alternative that emerges from this research is to embrace the role of MNCs, but then do the institutional work that ensures policy certainty and capability transfer over time. We discussed three key dynamics: *dual embeddedness* - how MNCs can become increasingly 'localised' over time; *value chain capture* - how OEMs can set up subsidiaries that employ local staff and then capture a significant number of O&M contracts in partnership with IPPs; and *follower sourcing* - how OEMs can choose to adhere to LCRs by building locally-based capabilities.

The South African government's increasingly ambitious LCRs have tended to focus on strategically significant goals like local black ownership and job creation rather than the tougher challenge of capability building to create a new generation of workers, managers, executives and ultimately owners within the RE sector. Black economic

empowerment is important, but on its own it does not build a durable job-creating industry. Despite these constraints, we refer to the kind of institutional work that can result in significant gains within these constraints.

Finally, we examine the role played by ED managers in implementing the SED and ED requirements that are unique to the South African context but could become more generally applied across other jurisdictions as the energy transition proceeds. Building on extensive research experience over many years, the research reveals the complex gender and racial dynamics of community development in practice.

The policy implications for our analysis are, therefore, as follows:

- 'political settlements' at the national level are required to ensure long-term policy certainty - without this, local firms and investors will be outstripped by MNCs and 'localisation' via dual embeddedness will be limited;
- when it comes to innovation and LCRs, a much better appreciation of learning curves is required - policies and rules must enable the building of real managerial and technical capabilities over time for driving sophisticated RE businesses, backed where necessary by DFIs who have a higher risk appetite for an environment where learning through failure over time comes with the territory;
- IPPs need to learn to accept that SED/ED are not simply about securing the SLTO, but are part of the core business - 'from the back room into the board room' is a commonly heard slogan in the social performance sector, but this means shifting power relations in a white male dominated industry.

In short, when the institutional granularity of the relationship between the energy transition and economic development processes are brought into focus, new opportunities for institutional work emerge from the complex and contested spaces that exist in a newly forming institutional environment like the one that emerged after 2010 in South Africa. How agents imagine new configurations and then create them in reality within the interstices of seemingly adverse conditions can make the difference between a successful developmental outcome or not. This is a significant and fruitful research terrain and therefore must be brought into mainstream analysis of the unfolding energy transition in the global South.

Declaration of competing interest

Except for Mark Swilling, the authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. Mark Swilling is Chairperson of the Board of the DBSA which funded the setting up of the REI4P and invested in many of the RE projects.

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