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Abstract

Recent decades have witnessed a surge in international programs set up to assist the transfer and application of renewable energy technologies (RETs) to low and lower-middle income countries. So far, such programmes have yielded a mixed record of success. While partnerships between international, national and local organisations have become the pre-eminent model for programme design and implementation, we know relatively little about their actual contribution. This paper traces the role of renewable energy partnerships in development cooperation, shifting the analytical emphasis from contingency factors to key actors and their relationships. It then presents a relational approach for the analysis of RET transfer through technical assistance, drawing on theories concerning the role of strong and weak ties in inter-organisational networks. Through an analysis of six empirical cases from Central America, the paper provides insights into how different forms of inter-organisational relationships can facilitate the implementation of RET programmes but do not necessarily enhance the capacities of local organisations in a way that they can support a more sustainable adoption of RETs. On the basis of this analysis, theoretical and policy implications are discussed.

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About the Author

Lena Kruckenberg is a PhD student based at the Sustainability Research Institute and the Centre for International Business at the University of Leeds. In her doctoral research, Lena investigates renewable energy technology adoption and market development through inter-organisational networks that link technology suppliers to end-users. Her research aims at illuminating the role of networks of public, private and third sector organisations in creating low-carbon development pathways, and critically analyses what kinds of network relationships drive, facilitate or inhibit the sustainable adoption of renewable energy technologies (RETs) in the Central American region. Prior to her PhD, Lena obtained master's degrees in International Relations from Keele University (UK) and in Sociology from the University of Bielefeld (Germany).

Renewable energy partnerships in development cooperation: Towards a relational theory of technical assistance*

1. Introduction

Renewable energy technologies (RETs) could play a central role in enabling sustainable development in low and lower-middle income countries. They bear the promise of enabling economic growth while at the same time reducing the environmental impact of energy generation. They also come with a potential of decreasing energy dependencies through the diversification of energy supplies and of enhancing energy access for rural populations, in this way contributing to poverty alleviation and improved standards of living (UNDP and WHO 2009). As a result, RETs have become prominent in the field of international development cooperation, where their assumed benefits align with dominant narratives of sustainable development (Pinkse and Kolk 2012). The United Nations' *Sustainable Energy for All*' initiative is just one example of a growing number of initiatives in this field, reflecting a wider recognition of the pivotal role of affordable clean energy sources in achieving human development goals (Chaurey et al. 2012).

A plethora of development programmes aim to assist the transfer of RETs to the Global South, often with a special emphasis on off-grid rural electrification and small-scale applications.[1] Some of these programmes are run by development banks, multilateral organisations and development agencies, others by nongovernmental organisations (NGOs) or national governments. So far, RET programmes have yielded a mixed record of success. Common problems arose from the fragmented

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[1] The terms 'Global South' and 'Global North' refer to the continuing inequalities the Northern and Southern hemisphere. Although not strictly accurate (given the Human Develop Index of e.g. Australia), the term 'Global South' is used as an umbrella term for low and lower-middle income countries with a relatively lower Human Development Index and a less-developed industrial base.

implementation of RET interventions, their limited sustainability and restricted potential for replication (Acker and Kammen 1996; Chaurey et al. 2012; Foley 1992). In the last decade, partnerships between international, national and local organisations have become the pre-eminent model for RET programmes in development cooperation (Pinkse and Kolk 2012). While the number of 'sustainable energy partnerships' seems to grow by the day, relatively little is known about the actual practices of such partnerships, and how they can contribute to a more sustainable uptake of RETs in the Global South (Doranova et al. 2011; Forsyth 2010). A growing body of case studies has informed the progressive development of RET programme designs, but it has fallen short of providing deeper insights into the micro-processes of inter-organisational learning that underlie international technical assistance (Byrne et al. 2011; Grammig 2012; Sovacool and Drupady 2012). This makes it difficult to appreciate the ways in which renewable energy partnerships can give rise to self-sustained development paths by 'empowering' organisations and communities in the Global South through relationships with international partners.

In the first part of this paper, I trace the development of renewable energy programmes in development cooperation since the 1990s and show how RET partnerships emerged as a 'silver bullet' approach for dealing with persistent gaps in programme design and implementation. I argue that in order to better understand the potential and limitations of such partnerships we need to shift the focus of our attention from static factors influencing programme outcomes to the actors involved in such programmes and their dynamic relationships. The second part of this paper illustrates the potential advantages of such an approach. Drawing on existing theories concerning the role of strong and weak ties in inter-organisational networks, I develop a relational approach for the analysis of RET partnerships in development cooperation. Through an analysis of six empirical cases from Central America, I show how the uptake of small-scale renewable energy technologies is affected by the project-centred dynamics of technical assistance, and how different forms of inter-organisational relationships can facilitate but also inhibit a more sustainable adoption of RETs. On the basis of this analysis, theoretical and policy implications are given concerning the role of strong and weak ties for the success – or failure – of renewable energy partnerships in development cooperation.

2. Renewable energy technologies in development contexts: Lessons learnt

Since the late 1990s, a growing body of literature has identified 'best practices' and 'lessons learnt' from past and current RET programmes. Studies focussed on the potential performance of RETs; they assessed technology applications and evaluated RET programmes across the Global South (Brass et al. 2012; Sovacool and Drupady 2012). While the variety of case studies on this topic is remarkable, a closer look at this literature also reveals some shortcomings. Many studies refer to programmes in implementation or only recently completed, making it difficult to assess their long-term viability. Widely reported indicators - such as number of installed RET systems - lack information about the appropriateness and sustainability of the technologies (Brass et al. 2012). Often it seems to be assumed that the expected benefits of RET will materialise (van Alphen et al. 2008; van Huijstee et al. 2007). Notwithstanding these weaknesses, studies of RET programmes have identified important economic, social, and political 'gaps' that affect the potential outcomes of RET programmes in terms of their resources, capacitation, implementation and policy (Forsyth 2010; Pinkse and Kolk 2012). The following sections summarise the latent theoretical and empirical understanding of these gaps.

2.1 Resource Gaps

In contrast to larger emerging economies, most low and lower-middle income countries depend on imports of renewable energy technologies, often supported by international development cooperation. Bilateral and multilateral development agencies generate their own aid-related 'markets', and contribute to "interacting and interdependent levels of political economy from the village to the international arena" (Byrne et al. 2011, 31). Grants from international donors tend to focus on measures enhancing energy access for the poor, and are only available for certain projects and limited periods of time (Karakosta et al. 2010). Insufficient funds for follow-up, evaluation, maintenance and repair limit the sustainability of many RET programmes (Kaminski 2010). Local RET firms and NGOs usually operate several business models at any time, based on different sources of finance including direct sales for cash, credit models, donation models and mixed finance models (Sovacool 2012).

Donor-initiated RET programs may boost their turnover temporarily but they can also add to the volatility of markets (Balint 2006; Martinot et al. 2002). As local banks often lack experience with RET applications, loans are difficult to come by. Changing currency rates bear additional risks (Karakosta et al. 2010). Resource gaps are also a prevalent issue for end-users. The costs of purchasing and installing small-scale RETs are usually beyond the means of the rural poor (Chaurey et al. 2012). With the rise of microfinance, projects now often involve some form of micro-loan that reduces the need for subsidies (Kaminski 2010). A growing number of programmes seek to facilitate the productive use of RETs in small enterprises, based on the assumption that the income generated in this way will cover maintenance costs and contribute to local development (Cabraal et al. 2005; Sovacool and Drupady 2012).

2.2 Learning Gaps

RET systems require installation, maintenance and repair by trained technicians. If these are not available, RET sectors struggle to grow and the sustainability of any RET programme is likely to be limited (Acker and Kammen 1996). In the past, many programmes underestimated the resources and capacities needed for long-term maintenance (Chaurey et al. 2012; ESMAP 2000). Capacity-building measures for local professionals are a key component of successful RET programmes; not merely for organisations installing RETs but also for those involved in project planning and finance (Sovacool and Drupady 2012). In addition, market-based development initiatives have shown that the advancement of emerging RET sectors depends on the transfer of business know-how (Martinot et al. 2002). Donors face learning gaps due to a lack of long-term programme evaluations (Newell et al. 2009). In development cooperation, there is still a tendency to approach technology transfer as a one-way communication process from ‘developed’ to ‘developing’ contexts (Vincent and Byrne 2006). This can leave technology providers with insufficient knowledge about recipients’ local needs, making it difficult to develop and adapt technologies that are more suitable for specific development contexts (Karakosta et al. 2010). Finally, learning gaps also persist on the side of local end-users. Rural populations tend to have limited access to education and little experience with modern technologies. This may discourage them from considering RETs as a viable option. This has also given rise to unrealistic expectations regarding their

performance and durability (Sovacool and Drupady 2012). Unsuccessful demonstration projects have lent themselves as negative learning experiences. Today, most programmes involve capacity-building measures for end-users in order to avoid such problems from reoccurring (Chaurey et al. 2012).

2.3 Implementation Gaps

Implementation gaps persist at multiple levels. Initiatives launched at a global level produce diverse outcomes as they become implemented by different national and local organisations (Newell et al. 2009). The plurality of actors involved in RET programmes makes it difficult to identify governance issues and evaluate impacts (Newell et al. 2009). NGOs and SMEs working in emerging RET sectors face the double challenge of establishing appropriate supply chains whilst simultaneously creating demand through awareness raising and the promotion of RETs - an enormous task given the poor infrastructure, low literacy rates and the absence of market facilitating organisations in many low and lower-middle income countries (Martinot et al. 2002). The sustainable adoption of RETs may also require changes in habits and attitudes (Karakosta et al. 2010). Programmes that did not involve end-users and local technicians in the selection and adaptation of RETs often failed (Acker and Kammen 1996; Sovacool and Drupady 2012). As a result, recent RET programmes have put a larger emphasis on the active involvement of end-users (Sovacool 2012).

2.4 Regulatory Gaps

As donor agencies generate their own aid-related ‘markets’, they contribute to interacting levels of political economy from local to global contexts. The successful adoption of RETs requires consistent levels of political support on the international, national and local level, as well as the integration and coordination of policies and incentives (Sovacool and Drupady 2012). In the absence of a strong government, such coordination can be difficult to achieve (Newell et al. 2009). Many studies give evidence to the important role of a predictable regulatory environment - but policy makers find it difficult to manage the complex arrays of policy instruments, technical standards and financing models that define the possibilities and limitations of RET

programmes (Martinot et al. 2002). In recent years, it has been suggested that market-facilitating organisations and national RET agencies could foster capacity building and improve coordination among stakeholders (Martinot et al. 2002). However, the establishment of such agencies requires significant investments and long-term political commitment – resources that tend to be scarce in low and lower-middle income countries.

As this brief review shows, various contingency factors affect the potential outcomes of RET programmes in low and lower-middle income countries. Technology transfer in development cooperation does not take place as a linear transmission of technology from a sender to a recipient country, but through dynamic interactions between various individual and collective actors (Grammig 2012). In the past two decades, the complexity of low carbon technology transfer has become more widely acknowledged. On the practitioner side this informed a paradigm shift in RET programme design that is illustrated in Figure 1 (Martinot et al. 2002; Sovacool 2012).

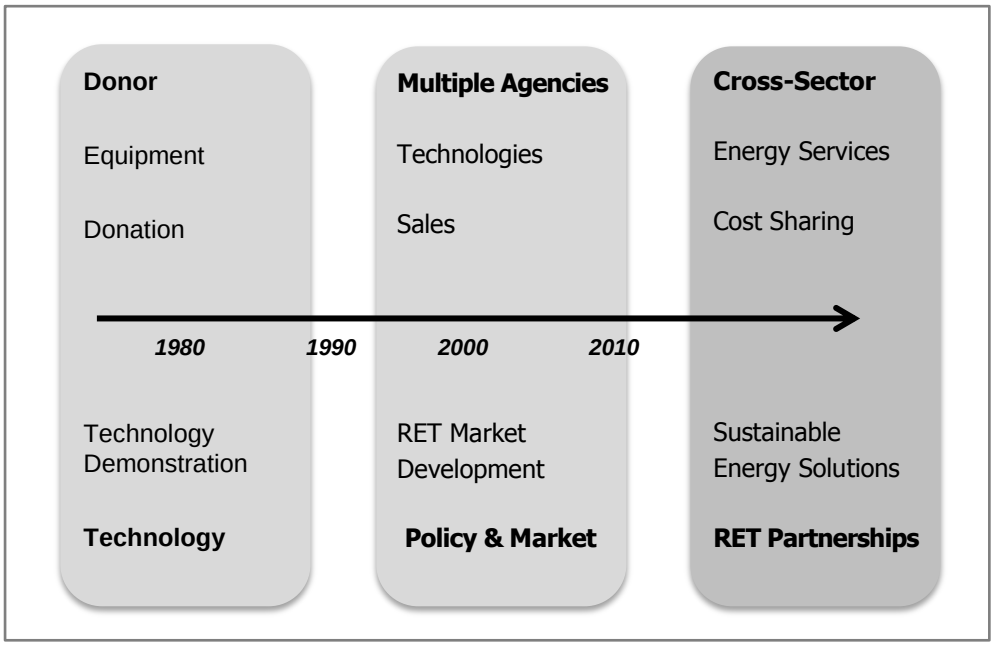

Figure 1: Changing paradigms in RET programme design
(based on Martinot et al. 2002; Sovacool 2012)

From the 1970s to the 1990s, most international donors focussed on technology diffusion through demonstration projects, 'parachuting' technologies developed in the Global North to the low and lower-middle income countries of the Global South

(Acker and Kammen 1996). Notwithstanding significant technological progress, many of these interventions did not turn out to be sustainable and failed to attract further investment (Martinot et al. 2002). In the 1990s and 2000s, the 'donor paradigm' gave way to a more 'market-oriented' paradigm (Sovacool 2012). RET programmes of this type were often led by multilateral and government agencies and followed an agenda of market (-based) development aiming at creating appropriate business models for local organisations, while sharing some of the costs and risks of market development (Sovacool 2012; Martinot et al. 2002). However, the transition from donor-initiated to demand-oriented RET markets proved to be difficult (Acker and Kammen 1996; Martinot et al. 2002). In the last decade, a more holistic 'sustainable energy paradigm' emerged (Sovacool 2012). Acknowledging the multi-level and cross-sector nature of socio-technical change, policy makers started to include a greater variety of stakeholders in their programmes (Sovacool and Drupady 2012). Today, multi-actor partnerships have become the pre-eminent model for donors working in sustainable development (Fowler 2000). Renewable energy partnerships often involve organisations from two or more sectors of society (state, market and civil society) as it is thought that such alliances are better positioned to deliver sustainable energy services through cost sharing and institution building (Sovacool 2012; van Huijstee et al. 2007).

3. Renewable energy partnerships

Acknowledging the complex nature of technical assistance, the Intergovernmental Panel on Climate Change (IPCC 2000) defines the transfer of renewable energy technologies as "a broad set of processes covering the flows of know-how, experience and equipment […] amongst different stakeholders". These stakeholders are multiple and diverse, and they engage with one another in varying configurations (Newell et al. 2009; Sovacool 2012): *International partnerships* between governments, multilateral agencies and development banks set up global and regional programme frameworks and funding streams. They are complemented by *regional and national partnerships* that translate global initiatives into national and local programmes, and also initiate additional programmes of a smaller scale. Partnerships of this kind may involve donor organisations, governmental agencies,

banks and micro-finance institutions, utilities, academic institutions and consultants, RET firms and NGOs. Finally, there are *project partnerships* that implement projects derived from RET programmes and smaller initiatives. Project partnerships further extend the range of potential partners to local community organisations, private enterprises and, last but not least, groups of end-users. Partnerships on all levels vary in their particular focus and intensity, as the partnership label is used for continuous and close collaborations as well as for roundtables, repeat contracting and consulting (Forsyth 2010; van Huijstee et al. 2007). In this way, the concept of 'partnership' appears to become increasingly blurred, covering close alliances as well as market relationships and inter-organisational networks in the wider sense of the term (Vincent and Byrne 2006).[2]

RET partnerships of the 'sustainable energy paradigm' are usually defined in terms of their expected potential to overcome the four crucial gaps outlined in the previous section (Pinkse and Kolk 2012): Firstly, they are envisaged to reduce resource gaps by attracting and channelling new streams of investment, and through the creation of innovative cost-sharing models. Secondly, partnerships are expected to foster knowledge transfer and capacity building, thus diminishing learning gaps and facilitating the development of appropriate technologies. Thirdly, partnerships are thought to enhance the integration of donor-initiated and private markets, and to enable a more meaningful involvement of local stakeholders, thereby closing crucial implementation gaps (Forsyth 2010). Fourthly, through networking and advocacy, partnerships may also contribute to the development of more appropriate institutions and regulatory environments. In this way, partnerships of the 'sustainable energy paradigm' are considered as having an empowering potential in more than one sense of the word; they contribute to the provision of (renewable) energy services, and they may achieve this in a sustainable and as such 'empowering' manner.

We know relatively little about whether or to what extend such claims have become reality. Studies of partnerships in development cooperation suggest that there is

[2] This is in stark contrast to the way the term is used across much of the academic literature on partnerships in development cooperation where 'partnerships' generally imply "a joint commitment to long-tern interaction, shared responsibility for achievement, reciprocal obligation, equality, mutuality and balance of power" (Fowler 2000, 3).

frequently a gap between the rhetoric and reality of cross-sector partnerships (Fowler 2000; Lister 2000; Vincent and Byrne 2006). It is not clear to what extent this applies to RET partnerships. Existing empirical research has focussed on international partnerships in global climate governance, rarely touching upon project partnerships on the local level (Bäckstrand 2008; Newell et al. 2009; Pinkse and Kolk 2012; Szulecki et al. 2011). A dominant focus on policy makers seems to come at the expense of the perspectives of other stakeholders, whose ideal role in the overall process might be described, but whose interests and practices often remain unaccounted for (Pinkse and Kolk 2012; for noteworthy exceptions see Balint 2006 and Grammig 2012). Little is known about the actual practices by which particular RET partnerships emerge and become consolidated – and about how these practices relate to their potential contribution to a more sustainable uptake of renewable energy technologies (Chaurey et al. 2012; Doranova et al. 2011; Forsyth 2010). It appears as if 'lessons learnt' have been insufficient guides for the development of theories that move beyond static accounts of 'key factors', 'barriers' or 'gaps'.

4. Strong and weak ties in technical assistance: A relational approach

Rather than adopting what is a factor-oriented approach to research barriers and drivers of RET programmes, this paper follows a different approach by focussing on the *dynamic relations* of actors involved in such programmes. I argue that the adoption of RETs is affected by the relationships that constitute RET partnerships - and how these relationships are embedded in the wider inter-organisational networks of technical assistance. Such an approach is derived from relational sociology (Crossley 2011; Emirbayer 1997; Granovetter 1973). It is based on the assumption that in order to better understand the success or failure of 'empowering' partnerships, we need to open the black box of technology transfer and adoption and examine more closely how development practice is driven by a multi-layered complex of relationships between organisations. These are relationships that are pre-eminently dynamic in nature and hence cannot be grasped by a substantialist analysis of situational factors and actor attributes (Byrne et al. 2011; Mosse 2004; Ramalingam 2013). As noted by Grammig (2012), there is ample scope to explore

the practices of technical assistance on the micro-level, using theories never considered before to assess the potential of partnerships in this field. In this paper I attempt to do just this. Drawing on theories concerning the role of strong and weak ties in inter-organisational networks, I propose a relational approach to the analysis of international technology transfer, focussing on project and programme partnerships involving local organisations, and their efforts to address persistent learning and implementation gaps. My intention is to justify a relational framework for the study of RET programmes by showing how such an approach can improve our understanding of *how* RET partnerships may close persistent gaps in RET transfer and adoption, and *why* they often fail to do so; thereby making an original contribution to both academic and policy discourse.

As I have discussed above, RET partnerships vary in their composition, duration and activities. Prior research in organisation studies has demonstrated that the structural configuration and quality of inter-organisational relationships can have decisive consequences for the ways in which organisations develop and operate, how they learn, and how they interact with others (Parmigiani and Rivera-Santos 2011). There are multiple ways of categorising inter-organisational relationships or ties. One of the most prominent ways of thinking about them focusses on the strength of ties in terms of their duration, intensity and closeness (Granovetter 1973, Gulati et al. 2002). According to the 'theory of strong and weak ties', ties serve different functions depending on their strength (Granovetter 1973): Inter-organisational relationships that are long-term, intense, and involve frequent interactions are considered to be 'strong' in the sense that they result in greater trust and collaboration, thereby facilitating mutual adaptation and joint action (Parmigiani and Rivera-Santos 2011). There is compelling evidence that strong ties allow for greater knowledge transfer as organisations bound by strong relationships are more likely to understand each other's needs and capacities while they also tend to be more willing to help partners assimilate new external knowledge (van Wijk et al. 2008).

In contrast, 'weak ties' are defined as relatively loose connections between organisations that arise from short-term rationales rather than long-term commitments (e.g. one-off transactions or membership in associations). Weak ties do not lend themselves to the transfer of complex knowledge. Their 'strength' lies in

their fluidity and diversity (Granovetter 1973). Weak ties provide access to non-redundant information - for example on business opportunities and technological innovations - thereby helping organisations to advance their operations and enhancing the integration of wider inter-organisational networks (Brass et al. 2004). The 'strength of weak ties' theory is based on the assumption that strong ties tend to be cohesive ties (i.e. ties between organisations that share contacts with third parties) whereas weak ties tend to be bridging ties, i.e. ties that connect organisations that are not connected through third parties (Gulati et al. 2002).

Applying the theory of strong and weak ties to RET partnerships in development cooperation, it appears that strong ties are likely to enable more complex processes of inter-organisational learning and knowledge transfer, that they are important for a more meaningful involvement of project stakeholders, and for the development of joint visions and problem solving capacities (Uzzi 1996). In contrast, weak ties can be assumed to play a significant role in the proliferation of renewable energy technologies and in the integration and advancement of RET markets. In the subsequent sections of this paper, I discuss the relevance and implications of these two propositions drawing on six empirical cases taken from field research with RET organisations in Central America. For the sake of clarity and space, my analysis focusses on how the reported relationships addressed - or ignored - prevalent learning and implementation gaps.

5. Methodology

All case studies presented below are based on participant observation and interviews conducted with RET organisations in Honduras, El Salvador and Nicaragua between early 2012 and mid-2013. In this context, the term 'RET organisation' refers to local SMEs and NGOs that are involved in the diffusion of small-scale RETs. The majority of these organisations carry out project work created by RET programmes whilst also supplying an emerging private market for such technologies. For the purpose of this paper, the selection of cases followed theoretical as well as empirical considerations: Cases were selected to reflect the breadth of inter-organisational relationships that characterise the relationships of

RET organisations in this region. While the author considers all cases as ‘typical’ in the sense that she has encountered similar cases, she makes no claim on their overall representativeness.

6. Enabling relationships? Evidence of strong ties in technical assistance

Much of the literature on partnerships in RET programmes generally assumes the presence of strong ties in project partnerships. However, there is limited empirical evidence of this. In field research I conducted in the Central America, a more nuanced picture emerged. Many local RET organisations reported their involvement in various projects, but they rarely perceived of their relationships with donors, technology suppliers or end users in terms of more durable ‘partnerships’. The development of ‘strong’ ties with project partners appeared to be the exception rather than the rule. As the following two case studies suggest, the project-centred character of development cooperation imposes inherent limitations to the development of strong relationships (Vincent and Byrne 2006):

> *Case 1* - In an interview in 2012, a manager of a Honduran SME reported that the firm had received substantial donor support for the development of a leasing scheme for rural solar PV installations which unfortunately had not turned out to be successful. During subsequent attempts at developing a more viable business model for the rural market, a multilateral agency launched a major RET initiative. The subsidies provided by this programme rendered commercial business models obsolete. As a result, the SME now installed systems for the international programme. It appeared questionable if the SME would be able to build a viable market after the completion of programme, in particular since the programme did not include sufficient resources for follow-up and after-sales service, costs the firm previously had included in its business model.
>
> *Case 2* - Another SME presented an impressive track record in delivering RET projects for various donor organisations. Its manager was quite outspoken about the lack of sustainability of many of their installations. He had won several tenders knowing that the systems he was about to install were unlikely to last, due to certain technical specifications as well as an obvious lack of resources for maintenance and supporting infrastructure. In his experience, it was pointless to argue with project developers

based in international organisations. They expected him to do his job in a certain way, and he delivered on their expectations.

Both cases do not speak for the presence of continuous ‘strong’ relationships allowing for in-depth knowledge transfer, joint planning and collaborative action. Instead, they give an impression of RET projects as one particular sector of an established ‘aid industry’, creating work for local organisations that deliver on preconceived development interventions. Projects are not seen as a means for sustainable technology transfer but as an end in themselves. They are characterised by a certain division of labour based on market transactions where communication between ‘partners’ are kept to a minimum. Learning gaps on the local and international level remain unaddressed. It appears as if some interventions by international donors actually widen resource and implementation gaps, given their negative effects on market-building efforts by local organisations (Case 1).

However, there were also reports of organisations that had engaged in more long-term partnerships, in this way establishing trusted relationships with international and local partners:

Case 3 - One Nicaraguan NGO worked closely with a locally-based assistant sent by an international NGO. This assistant provided continuous support in strategic planning and day-to-day operations. The international organisation also sent trained volunteers on a regular basis. Local NGO projects were mostly based in a small number of rural communities where the NGO had worked for several years and had established strong links with community leaders and rural organisations. Local individuals well acquainted with this NGO had bought individual RET systems, in some cases supported by a microfinance scheme that had been set up for this purpose. The continuous presence of the NGO also facilitated maintenance and repair through locally-trained technicians.

Case 4 - In another case of a partnership between a local and an international NGO, the relationship was mostly based on regular long-distance communication. The partnership had evolved over the course of a series of projects, and both organisations had developed and changed in this process. In a meeting in 2013, both managers agreed that their shared history facilitated the communication of problems and ideas. However, problems in programme implementation were usually solved by the local NGO. While the international NGO provided targeted guidance on project

management and funding applications, the local NGO perceived this input to be too focussed on administrative matters, such as the formalities of project documentation. In their view, much of the advice they had received was inapplicable, and their feedback ‘from the ground‘ was not appreciated. This made it difficult for them to make use of available resources in the best possible way.

As Cases 3 and 4 illustrate, strong ties and long-term partnerships do feature in some RET initiatives where they shape technology transfer and organisational development in significant ways. Both examples give evidence to the importance of strong ties in addressing learning and implementation gaps. As the content of such strong ties varies, so does their impact. As Cases 3 and 4 demonstrate, strong ties with international partners can lead to improvements in project implementation. In these two cases, partnerships with international partners helped to reduce some knowledge gaps on the local level but they did so in a way that required continuous support in form of local assistance and training. Projects run more smoothly when partners have the opportunity to develop trust and institutionalised practices in previous collaborations. However, close partnerships have to be continuously (re-) negotiated, and they call for significant investments (as we have seen in Case 4). Unmet expectations may result in tensions; this is an issue that was also identified by Balint (2006).

As illustrated by Case 3, strong ties also evolved between RET organisations and the communities in which they work. Trusted relationships of this kind can improve project implementation and facilitate the capacitation of end-users. Strong links between RET organisations and communities can also provide access to local knowledge, allowing for a more sustainable adoption of new technologies. Local RET organisations that maintain strong links with both external and local partners seem to have an important role as intermediaries, facilitating project implementation and learning processes on both sides (Case 3). If they lack strong ties in one or both directions, the sustainability of their projects appears likely to be limited.

RET partnerships in development cooperation usually evolve around two dyadic relationships: one between an external donor and a local RET organisation; and one between the local organisation and the recipient or ‘beneficiary’. Both relationships are prone to power imbalances that are difficult to reconcile with a seemingly more

balanced ‘partnership’ framework. Organisations higher up this chain tend to see their role as *knowledge senders only*, an attitude which makes it difficult for them to acknowledge knowledge gaps on their side and hence inhibits inter-organisational learning and knowledge transfer (Case 2 and 4). Where local knowledge remains lodged solely in local competences, it becomes more difficult to develop joint problem solving arrangements and to adapt project blueprints to local contexts (Cases 1, 2 & 4).

7. Networking matters: Weak Ties in Technical Assistance

Strong relationships require substantial investments in time and resources, restricting the number of close partnerships any RET organisations can maintain (Brass et al. 2004). Local RET organisations that work with only a small number of partners also run a risk of becoming dependent on them (see e.g. Case 3). Prior research has shown that organisations that focus exclusively on close partners find it harder to access non-redundant information which could help them to advance and update their operations (Uzzi 1997). In this way, a lack of connectivity between different sets of organisations can lead to sector fragmentation and an increased risk of sudden failure (Uzzi 1996). These theoretical and empirical considerations point to the importance of weak ties in complementing strong ties and close inter-organisational collaboration.

> *Case 5* - A number of RET organisations reported that they had implemented projects for a regional RET agency. The work of this agency focussed on demonstration projects that covered a broad variety of different technologies and applications. Several of these projects had involved organisations with little experience in working with RETs, providing them with a opportunity to engage with an emerging RET sector. Project partnerships created by this organisation were mostly short-term one-off partnerships. While many of the initial demonstration projects did not turn out to be sustainable in the long-term, they contributed to the wider promotion of RETs by demonstrating new applications, providing learning opportunities, and broadening the local RET sector.

Case 6 - This and other development agencies also ran regular forums and workshops, bringing together RET organisations from across the Central American region. According to several managers of RET organisations, only few partnerships of a more durable nature emerged from these efforts. However, the main role of such events was seen in facilitating networking and information exchange across the region; conferences, forums and workshops allowed participants to access up-to-date information about different technologies, programme designs and funding opportunities.

Cases 5 and 6 testify to the importance of weak ties for the creation, development and consolidation of emerging RET markets, and illustrate their important role in the diffusion of RETs. Weak ties 'spread the news', they raise awareness, trigger interest, and they get new organisations involved. 'Networking' - in the colloquial sense of the term - takes place in networks of weak ties which provide access to up-to-date, non-redundant information (Case 6). Weak ties tend to be bridging ties: Ties that connect organisations that are otherwise not in touch, thereby opening up opportunities for outsiders to engage in RET partnerships (Case 5). Some weak ties lend themselves to closing multiple small-scale learning gaps of the type that do not require the in-depth transfer of more complex knowledge (Case 6). Finally, as shown by Case 5, weak ties bridge implementation gaps through the recruitment of new organisations, thereby contributing to the growth and integration of emerging RET sectors.

8. Partnership Failures

All six cases indicate that the successful transfer of renewable energy technologies to a large extent depends on the creation of appropriate inter-organisational relationships. Different types of relationships perform different functions: Strong ties facilitate fine-grained knowledge transfer, extensive collaboration and the development of joint visions and problem-solving capacities, whereas weak ties aid technology diffusion and prevent the insulation of more durable RET partnerships from the wider sector. Based on this analysis we can also identify different types of partnerships failures. First, there are failures that result from a lack of connectivity, i.e. the absence of ties where they are needed in order to develop and better

integrate an emerging RET sector. Second, there are partnership failures that occur because organisations have established relationships that are inappropriate for the tasks they are meant to perform. For example, partnerships aiming at the sustainable transfer of a new technology are likely to fail if they do not develop ties that are strong enough to facilitate the kind of knowledge exchange needed to fully embed the technology in a new context. A closer look at the above cases also suggests the presence of a third type of partnership failure that arises when the interdependency of collaborative engagement turns into long-term dependency, trapping those to be 'empowered' in unfavourable situations (Jacobsson and Johnson 2000).

Considering the six cases presented above, what did local organisations actually learn from their international partners? In Cases 1 and 4, local organisations learnt to deliver on pre-conceived RET projects. While the local NGO presented in Case 4 also received support and training from its international partner, the main focus of this training was on improved project management and funding applications. Similarly, the international partnership described in Case 3 predominantly aimed at enhanced project implementation. The local NGO presented in this case also learnt to engage successfully with community organisations, in this way strengthening its role as intermediary between its international partner and local end-users. Finally, organisations were trained in the installation and maintenance of certain types of RET systems (Case 3); and they received some support in developing their businesses (Cases 1 and 3). All of these learning processes can be assumed to have enhanced the implementation of RET programmes. It is less clear, however, to what extent they have actually contributed to a more sustainable uptake of RETs in Central America.

Overall, the cases presented above give little indication that RET partnerships in development cooperation have advanced the technological and managerial knowledge base of Central American RET organisations in a way that could decrease their dependence on long-term technical assistance. None of the local organisations introduced above learnt to develop small-scale renewable energy technologies that are more appropriate to their local contexts. Instead, RET programmes seem to have increased their specialisation in delivering on the

changing ‘industry recipes’ of development cooperation. This can be seen as creating a lock-in effect: Local SMEs and NGOs specialise in their niche – administering donor-initiated RET programmes to potential ‘beneficiaries’ without really advancing their technological knowledge to a level that would allow them to become independent. Without a government or external investor able and willing to invest in a home-grown RET industry, they can only specialise further in what they can do already. As local RET organisations adapt to this role, they may forgo opportunities to contribute to more sustainable forms of low-carbon development.

Like other development interventions, RET programmes are driven and consolidated by the interests of the organisations involved in them, and their need to maintain relationships. If Central American RET organisations want to keep their business going, they have to adapt to the priorities of international donor organisations. As demonstrated in the case of a manager who repeatedly installed inappropriate RET systems (Case 2), organisations can learn to consistently fail at delivering on wider objectives that do not appear directly related to their individual interests (Knight 2002). Partnerships thus have the potential of closing important learning and implementation gaps thereby transforming institutional fields - *but they can also reproduce them* when this in the interest of their constituent organisations (Brass et al. 2004). This third type of partnership failure arises from the project-centred character of development cooperation. By prioritising efficient project implementation over the development of a sustainable renewable energy sector, RET partnerships can fail to create the kind of transformative and learning relationships needed to ‘empower’ local organisations and communities across the Global South.

9. Theoretical implications: From ‘lessons learnt’ to theory?

Based on a review of literature on RET programmes in development cooperation, this paper provided an overview of critical gaps that were identified as inhibiting the success of international technical assistance in this field. It then traced the incremental development of RET programme designs and showed how they came to involve multi-actor partnerships as a means for improving their impact and sustainability. I argued that the dominant analytical focus on contingency factors

rather than partnership relations made it difficult to appreciate how RET partnerships could actually deliver on such expectations. Drawing on theories concerning the role of strong and weak ties in inter-organisational networks, I proposed a relational framework for the analysis of RET transfer in development cooperation. I then examined six empirical cases showing how different configurations of inter-organisational relationships can facilitate but also inhibit a more sustainable uptake of renewable energy technologies in development contexts.

While these insights can be seen as relevant contributions in their own right, the main thrust of this paper is exploratory and programmatic. The relational approach introduced above brings into view micro processes of inter-organisational learning and collaboration that so far have been hidden in the 'black box' of technology transfer as a macro phenomenon (Grammig 2012; Rosenberg 1982). The theoretical signposts outlined in this paper only give an indication of the potential of such approach. A differentiation between strong and weak ties is just one and perhaps rather simplistic framework for assessing the structural configuration of ties between organisations (Gulati et al. 2002). In addition, the short empirical cases presented in this paper only cover a few individual instances of one type of RET partnerships – namely project partnerships – and their attempts at closing learning and implementation gaps on the local and national level. Such limitations notwithstanding, the paper demonstrated the considerable promise of relational approaches in this field. Further research is needed to better understand the implications of different types of multi-level partnerships and how they address resource, learning, implementation and regulatory gaps at the local, national and global level.

Until now, researchers have not taken full advantage of the vast amount of literature in organisation studies to unravel the complexity of technical assistance for low-carbon development. Future research could draw on theories from economic sociology, organisation theory and social network analysis that seek to explain how distinct network structures and relationships shape organisational behaviour and decision making, giving rise to emergent dynamics of inter-organisational exchange and the evolution of markets (Padgett and Powell 2012). Such 'knowledge growth by extension' may turn out to be a fruitful strategy for all disciplines involved, given the

fact that research into learning processes in cross-sector and transnational settings is still in its infancy (Brinkerhoff and Morgan 2010; Knight 2002; Stagl 2007).

10. Policy Implications

By opening up the black box of technology transfer, practitioners will gain deeper insights into the wider implications of RET programmes. The analysis presented in this paper highlights four policy considerations for RET programmes in development cooperation. Firstly, and perhaps most importantly, it suggests that the sustainable transfer of renewable energy technologies might not be best achieved through the implementation of individual RET projects. Instead it requires programmes that are designed around *organisational and sectorial development goals*. Such programmes appear more likely to be successful in empowering local organisations through relationships with international partners.

Secondly, policy makers need to *better understand the partnerships* they create and in which they operate. As this paper has shown, different types of inter-organisational relationships support different processes of technology transfer and technology adoption. For example, strong and durable partnerships may require significant investments and increase dependencies in the short term. If they involve the incremental transfer of complex technological expertise and appropriate organisational capacities, however, they may allow for self-sufficiency in the long-term. Strong ties should be complemented by weak ties aiding technology diffusion and preventing the insulation of individual RET partnerships from the wider sector. An enhanced understanding of the distinct properties of different kinds of inter-organisational relationships can inform the development of more strategic - and as such more successful - RET partnerships.

Thirdly, when considering the qualities and configurations of RET partnerships, policy makers should not lose sight of the ‘bigger picture’: Individual project partnerships may be able to bridge particular resource, learning, implementation and regulatory gapsbut they are unlikely to dissolve them permanently. For the creation of more sustainable development paths, the performance of the *wider organisational*

network is key (Knight 2002). This will require the institutionalisation of sustainable – and as such self-sustained - RET sectors. Again, it follows that RET programmes need to be designed around organisational and sectorial development goals, and not the other way around (Pettit 2000).

Finally, it is important that policy makers develop explicit learning objectives for their own organisations. As donor organisations provide critical resources *and* influence their partners' needs for such resources (Lister 2000), they shape organisations in emerging RET sectors in important ways. Sustainable energy solutions are unlikely to be achieved by international experts who consider themselves as 'knowledge senders only'. Failures in programme implementation are not merely a problem of implementing organisations, but also a result of unsuitable policies and programme designs, and of inter-organisational relationships that
fail to empower and incentivise RET partnerships in appropriate ways. What this paper has shown is that there are still lessons to be learnt about technology transfer and inter-organisational learning. If such learning extends from "learning about sustainability [to] learning as sustainability" (Stagl 2007, 58), 'empowering partnerships' may go a long way in enabling *Sustainable Energy for All*.

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