Greening Regional Cities: The Role of Government in Sustainability Transitions

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Abstract The scale and complexity of the 'wicked problems' posed by sustainability are forcing collaborations between unlikely partners. In many instances, government is choosing to play a critical role in the sustainable innovation process. Yet much of the innovation literature pushes to the fore the ingenuity of the firm, leaving government to play a secondary supporting role. Drawing on ideas from innovations and transitions theory on the role of government in supporting green niches, this paper analyses the example of an evolving biomass project in regional NSW. In particular, the paper focuses upon the role that regional government plays in supporting this community-led collaboration. Based on circular economy principles, the project aims to achieve energy independence whilst simultaneously generating bio-products for the agricultural sector. Utilising a case study methodology including in-depth semi-structured interviews with more than 20 key stakeholders from government, business and the local community, analysis of the data suggests that government is a critical actor in the innovation process; plays a multiplicity of roles across the network; and that these roles vary to a greater degree than previously suggested in the literature. A number of factors are also identified that shape these roles at different stages of the innovation process. This paper sheds new light on the critical role played by government in facilitating and leading sustainability transitions and contributes to our knowledge of sustainable innovations more broadly. It also highlights a need for more research to improve our understanding of appropriate actors at different stages of sustainability transitions.

Keywords Innovation · Role of government · Sustainability transitions Green cities

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1   Introduction: Third Party Actors and Innovation for Sustainability

The role of third party actors in the innovation process recurs constantly in the literatures, particularly in the formation and development of networks and within innovation systems themselves. This cast of third party actors is considerable and varied. Freeman (1991), for example, emphasises the need for diversity in the set of actors within the national system of innovation including industry, government and research institutes.

A broad range of terminology has been used to describe these invariably external actors ranging from 'third parties' (Mantel and Rosegger 1987) and 'intermediaries' (Stankiewicz 1995) to 'brokers' (Hargadon and Sutton 1997; Provan and Human 1999) and 'bridgers' (Bessant and Rush 1995; Zaheer and McEvily 1999). Unsurprisingly the roles of these actors can also be multifaceted. Social network theory identifies other specific roles for third parties such as plugging holes and bridging knowledge flows (Burt 1992). A host of other functions drawn from the networks and innovation literatures can be identified that include acting as catalysts for innovation, information brokers and intermediaries (Popp 2000), information 'bridgers' (Zaheer and McEvily 1999) and facilitating knowledge and technology transfers 'across people, organisations and industries' (Hargadon and Sutton 1997). In some instances, third parties can play a critical role, bringing credibility to a network and enhancing connectedness; in other instances, the role of the third party may be quite minor. For example, case study research of 22 innovation intermediaries in the UK identified a number of differing roles for third parties (Howells 2006). Studies on cross industry innovation conducted by Gassmann et al. (2011) also define three high-level groups of innovation intermediaries, again playing varying roles.

The sustainability literature carries a substantial body of research on third parties in various forms and with broadly similar themes (Blacconiere and Northcut 1997; Bush et al. 2015; Sbragia 2000; Van Kleef and Roome 2007). However, in the context of sustainable development it becomes evident that the theoretical and empirical research on the role of intermediaries in the innovation process itself is relatively scarce (Patala et al. 2014). Hargreaves et al. (2013) reinforce this, arguing that 'very little work has examined the role of intermediaries in sustainability niches and still less has examined the nature and extent of the roles they may play in helping grassroots innovations to develop and grow.'

Indeed it is the role of government as an intermediary in the sustainable innovation process that is most pertinent to this research. Drawing from the industrial ecology literature of direct relevance to the CLEAN case study discussed later in this chapter, there are contrasting and conflicting views about this role. Although industrial ecology appears to promote collaborations between firms along with a more holistic and sustainable approach to business rather than old style 'command and control' by government (Ehrenfeld 2000; Lifset and Graedel 2002), there is limited empirical evidence of this actually occurring. In fact, most research seems to

advocate for government intervention, largely by capacity building through public policy (Wallner 1999), legislation that supports project development (Carr 1998) and the provision of economic and regulatory incentives for collaborative networking across regional platforms (Brand and de Bruijn 1999). Public sector agencies also have a role to play in facilitating and supporting collaboration (Benz and Fürst 2002).

Wading deeper into the broader sustainability literature, we see a varied landscape with a myriad of often contrary findings. Our introduction noted the complexity and scale of many of the challenges emerging under the banner of sustainability and the need for partnerships or multi-stakeholder collaborations (Roberts 2000; Selman 1998). Government is not exempt from this and has started to link with 'unlikely partners' through public/private partnerships to foster collaboration, access information and resources and reduce the risk associated with innovation (Bocken et al. 2014). Drawing on transitions theory and with clear implications for government as a creator of public policy, Van den Bergh et al. (2011) conclude that there is no definitive ranking of the effectiveness of policy instruments on environmental innovations.

With much in common with transitions theory and of direct relevance to the theme of green infrastructure more broadly, the literature on public private partnerships or 'PPPs' unsurprisingly touches on a number of topics related to the role of government. In their wide-ranging performance review of international PPPs, Hodge and Greve (2007) remind us of the confusion surrounding these partnerships and the contradictory results to date relating to roles and their effectiveness. Importantly, a need for improved evaluation of programs is identified, particularly in the social (and environmental) spheres.

Finally and of pertinence to this paper, again from the field of transitions theory, is the potentially critical role played by government in supporting innovation in green niches (Hargreaves et al. 2013; Smith et al. 2016), a theme that will be explored in greater detail in the following paragraphs.

2   Greening Regional Cities—The Case of CLEAN Cowra

Cowra Low Emissions Action Network or 'CLEAN' was established in 2007 as a community-led group originally to coordinate a bulk buy of solar. Since 2011 CLEAN has been collaborating with Local and State Governments, Industry and Community to develop a local biomass to energy project. The goals of the project are threefold—to empower the local agricultural community to generate their own energy from organic waste streams using a model of decentralised energy generation; to distribute the energy through a localised network; and finally, to develop a business model that allows for community involvement and investment. Ultimately CLEAN is hoping to forge a template or framework for regional, decentralised energy generation that is both scalable and replicable (Fig. 1).
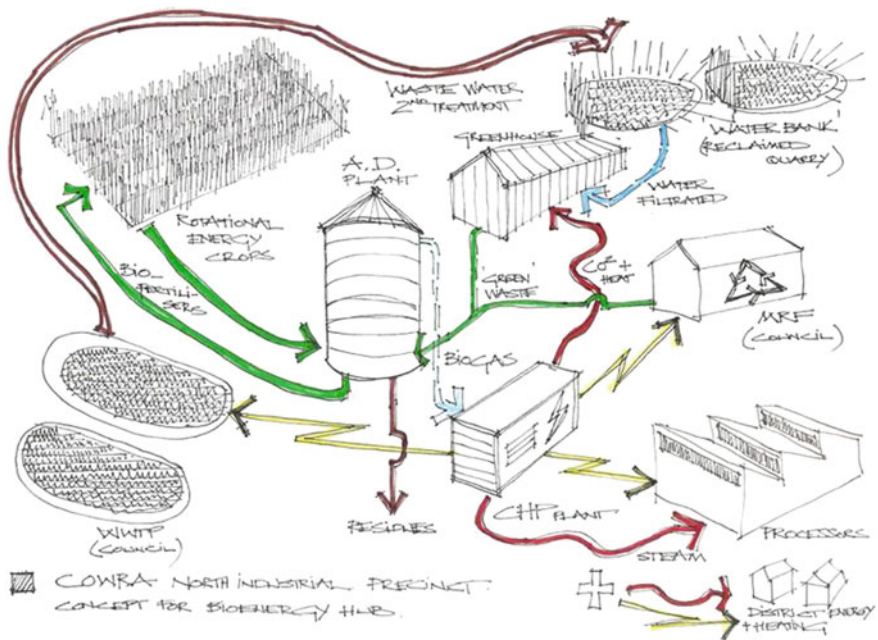
Fig. 1 The CLEAN process (CLEAN Cowra Inc. 2017)

In many ways, the evolution of the CLEAN network has been typical of many community collaborations. Led by a dynamic and committed local architect, the network has relied on the goodwill and support of a range of third parties who have been drawn to the project, primarily because of its highly innovative and unique nature or by the passion and persistence of the lead entrepreneur with a strong community focus. A range of technical and subject matter experts have given their time to share knowledge and introduce other third parties to assist the CLEAN team to take the project to the next stage. As a result of funding and in-kind support primarily from state and local governments, the project achieved a recent critical milestone, completing a week-long trial to assess the suitability of local biomass for gas and energy generation. The project team is now engaged in capital raising for the next stage, namely the much anticipated construction of a 'proof of concept' energy plant in the next 12 months. Ultimately CLEAN hopes to generate 12 MW of renewable energy from local waste, sufficient to power every home in Cowra.

One major differentiator for CLEAN has been the high degree of support the project has received from Government, both local and state. For example, Cowra Council is a key stakeholder on a number of levels. Not only has Council provided financial and in-kind support to the project, it will also be a significant potential supplier of organic matter to CLEAN through its waste water treatment plant and as a primary source of municipal solid waste for processing. To some degree Council is also viewed as a surrogate and representative for local community (Fig. 2).
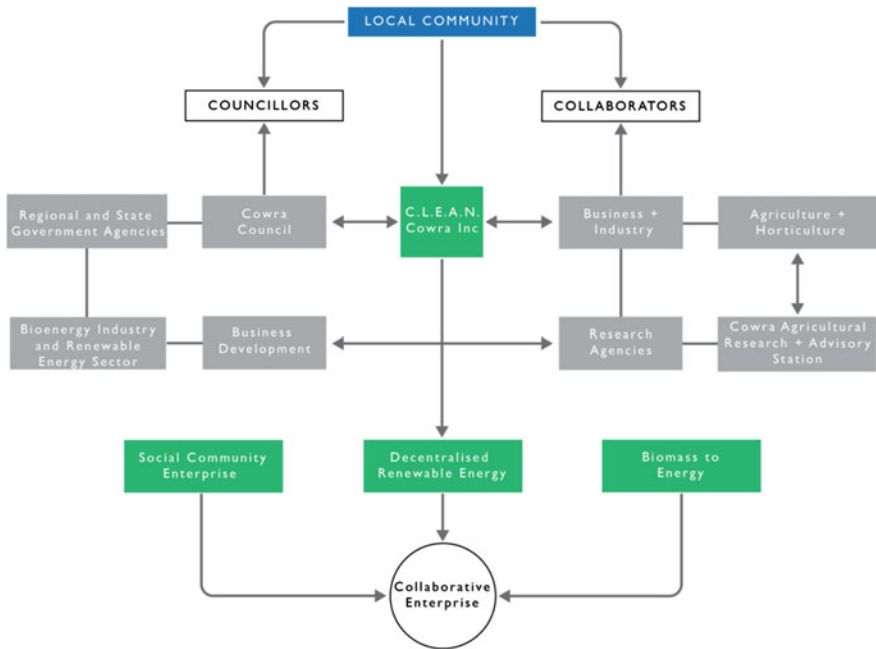
Fig. 2 An overview of CLEAN's stakeholders (CLEAN Cowra Inc. 2017)

Another critical source of momentum has been the support received from the New South Wales State Government's Office of Environment and Heritage (OEH) in the form of the much-feted Sustainability Advantage ('SA') Program supported by the Regional CLEAN Energy Program (RCEP). The overarching objective of SA is to increase the competitiveness and enhance the profitability of member organisations striving to demonstrate environmental leadership in their industry sector. This is achieved by assisting organisations to identify resource efficiencies in the areas of waste, water and energy and to exploit these opportunities through the support of a network of subsidised OEH-affiliated consultants. As a finalist in the 2015 Global Circulars Accenture Award for Circular Economy Pioneers, SA has been acknowledged as an effective and strategic broker in the emerging circular economy, building bridges between unlikely collaborators and traditional competitors. CLEAN epitomises this collaborative approach, indeed it is the role of OEH within the CLEAN network that forms the focus of this paper.

3   Research Approach

Based on a review of the extant literature on innovations, networks and transition studies, a number of potential research areas were identified that would significantly enhance our knowledge of the role played by government in the sustainable innovation process. These were concentrated into core research questions, specifically to explore the role of government in the CLEAN network and determine how it influences the process of innovation more broadly.

In terms of research approach, qualitative enquiry was deemed most appropriate determined by the research question and purpose (Maxwell 2012) A case study methodology was adopted incorporating in-depth, semi-structured interviews with 21 key stakeholders from regional and state government agencies (3), local government (3), CLEAN Cowra Inc. (3), business and industry (3) agriculture and horticulture (3), the local community (3), specialist bio-energy industry representatives (3) and 'other' technical and OEH affiliated consultants (3).

Using open ended questions, research participants were typically interviewed at their place of work and interviews lasted around 40 min on average. The questions posed in the course of the interview and hence the thematic headings in the discussion were strongly influenced by the academic literature and designed to address the research question. Responses were recorded and subsequently transcribed before being aggregated and analysed using established QDA software (NVivo). Focusing on a sample set of interviews, themes or codes were attributed to portions of the text and grouped under appropriate headers. Codes were then rationalised and reorganised before being applied to the broader data set. A further process of rationalisation and regrouping of codes was performed before a final analysis of the data was undertaken.

Drawing on the work of Fontana and Frey (2000), ethical considerations of most relevance included security of the participants during the interview, obtaining informed consent from the respondents and ensuring privacy and confidentiality of the data and the recordings.

4   The Role of Government—A Discussion
of Research Findings

In contrast to the management literature suggesting a restricted number of roles played by intermediaries in the innovation process and extending the work undertaken by Howells (2006), interview findings from CLEAN suggest that government plays a wide variety of roles and that these roles vary across the innovation cycle.

4.1 Government as Banker and Funding Advisor

In an atmosphere of resource and capacity constraints that is typical of community projects, it is perhaps unsurprising that one of the two most important and oft-cited roles played by OEH should be as a funder or provider of funding advice. Respondents acknowledged the critical role played by State Government in committing funding to the project by way of SA.

> 'Was the funding important?' 'Very, we wouldn't be where we are without it'.

> They bring some money to the table which at the end of the day's fairly crucial.

Funding typically created capacity for the project team, most notably enabling the lead entrepreneur to dedicate time to project planning, engaging third party assistance and building the CLEAN network.

Introductions to potential funders, sometimes in other State Government departments, were seen as equally important to the successful continuation of the project, as was the case with RCEP.

> Well they brought money ok, the community grant was a very important milestone for the project….

Equally, employing consultants through SA whose primary job was to work with the project team to chase funding was both viewed positively by stakeholders and proved successful, often enabling the project to move to the next stage of evolution.

> so really my involvement for Cowra has been helping them go for grants…. and to some degree that's been supported by the state government, by the treasurer and her team.

Even without conscious introductions, the very presence of OEH as a key supporter was often sufficient in itself to convince others to support and sometimes even fund the project. Council in particular viewed the involvement of OEH as enhancing the credibility and longevity of the project and an important reason to lend their weight to the initiative.

> … when you start getting the long term guys that are prepared to stand behind and put their money where their mouth is and send representatives out, it's a different game.

Whilst the funding in itself was undeniably important and created capacity in the immediate term, the very act of supporting the project financially indicated that government had belief in the project over the longer term. This delivered other tangible and intangible benefits, most notably serving to energise the core network and bring credibility and sustained interest to the project in the eyes of other stakeholders, most importantly potential supporters and funders.

> … key turning point was the initial Community Energy Grant 18 months into the project which served to keep people involved and focused and generated lots of conversations.

4.2   Government as a Relationship Bridger

Government as a 'bridger' or facilitator of relationships was identified by inter-
viewees as being equally as important as government's role as a funder. For a
resource constrained community project in search of support and strategic advice,
identifying potential trusted collaborators willing to invest time in the project to
share expertise and progress the discussion is clearly critical. Moreover, consultants
and subject matter experts recommended by government avoided wasting valuable
time looking for appropriate advisors and ensured they were both credible and came
equipped with the prerequisite knowledge. Government's commitment and interest
in successful outcomes for the project added a further driver to ensure the most
qualified individuals were singled out.

> They are the facilitator, I guess, their role is to put you in touch with the right people to give
> you access to the right people and right analysis and advice without you tripping over and
> going down the wrong oath etc. etc. So OEH has provided good guidance in that respect.

The very fact that potential collaborators were requested by Government to assist
also ensured a degree of commitment on their part, not least because invariably they
sit on an approved panel of service providers and generate significant income from
the broader SA program.

Of significance to key stakeholders was government's ability to link the project
to specialists from the private sector but also to contacts in other government
departments and of course to potential funding. Once finalised, this funding in turn
enabled CLEAN to employ some of these consultants on a short term basis to
progress the project to the next milestone and to extend the network.

> Once we got the money from OEH… that gave us real cash to then spend on other
> consultants so that sort of network started.

Whilst of less overt significance than perhaps much of the networks literature
suggests and although not cited explicitly by many interviewees, it is apparent that
the issue of trust sits beneath the surface of many of these conversations and
remains of particular relevance to relationships with potential collaborators. As
noted above, in connecting CLEAN to consultants, OEH lowers the risk inherent in
these engagements and instils credibility in the minds of the CLEAN network.

> Yep, so sometimes we help them by weeding out the cowboys I guess, so helping them
> with finding consultants who've got some wings under the belt in areas of expertise.

4.3   Bring Credibility, Provide Stability

The relative anonymity of the CLEAN project, at least in the early years, combined
with the volatility and uncertainty of the renewable energy landscape posed par-
ticular challenges in terms of attracting support and investment. Along with funding

and facilitating relationships, bringing credibility to the project and providing stability were viewed by participants as a critical role and benefit delivered by government involvement. OEH's willingness to invest both time and money in the project both placated anxious stakeholders and attracted other key players who would ordinarily struggle to engage in a project that might be perceived as higher risk when compared to their day-to-day business.

> Once one government entity is involved in it, it provides a lot of credibility.

This was particularly true of Local Government. Whilst hesitant to take a leadership position, Local Government has recognised the enormous potential benefits the project can deliver, both to local rate payers as well as to Council's bottom line through reduced costs for waste processing, landfill and energy.

> They've been very supportive obviously in funding as well as attending meetings and giving their input and their expertise… and that's one of the reasons why… council has joined….

Indeed, OEH acknowledges that through the SA program, delivering credibility to the project to entice others to join is a key strategic objective.

> The fact that I listen… and continue to come to meetings tells them that well maybe they do have something to offer.

Credibility breeds interest and commitment which results in a degree of stability for the project, a critical factor especially for community-led ventures scrambling from one round of funding to the next.

> They (OEH) bring support references and I think that allows it to gain momentum and I think that was instrumental like I said in pulling some more money out of council so it begins to snowball.

4.4 Support Specific Outcomes

Largely due to the strategic objectives of the SA program and the policy goals of State Government, OEH has worked with CLEAN to provide funding or in-kind support for specific outcomes. These have included resource audits, technical reviews and assistance with funding applications. In some ways this has forced structure and focus on what can definitely be described as a predominantly informal, loose and sometimes chaotic network, as well as instilling process and discipline to the project.

> It's great that they did come on board but I guess they could only really support specific outcomes.

A more defined process and structure have certainly resulted in attracting unlikely partners to the project who have proven critical to it success. Again Council would probably be the most significant of these.

… support for the council to know, they want a robust process that's gonna be ongoing, not
some sort of pie in the sky, they actually want to know that there's a process behind it, I
guess that's it.

Whilst enforced structure and process have enabled the project to progress and to
entice other parties to collaborate, it could be argued that it has obliged CLEAN to
take a different path towards its end goal. It is possible that Government inter-
vention has actually complicated the innovation process and delivered outcomes
that may be of limited relevance to the project but provide a means to an end, in this
instance further rounds of funding. This will be revisited later in the chapter.

4.5   Support Early Stage, Replicable Innovation

Much of the innovations literature typically portrays government as a minor actor in
the system. By contrast, empirical evidence from early stage innovations suggests
that government along with industry can play a key role in building momentum for
new products and services. Similarly, transitions theory advocates a critical role for
government in supporting grassroots innovation. CLEAN certainly seems to sup-
port this based upon the findings from a broad range of stakeholders, indeed support
for early stage innovation was cited as one of the most critical aspects of govern-
ment's involvement in the project.

I don't think it would've got off the ground without OEH. OEH opened the door to money,
to reinforce to A2 that if they put a good case up there was funding to push themselves
forward with turning ideas and vision into something more than that….

Stakeholders internal to the core network and external stakeholders alike
recognise the importance of government support in developing the project to proof
of concept. This is particularly important in the context of a community led project
which by definition tends to evolve more slowly than its industry-led counterpart,
largely due to resource constraints. Innovation in this instance tends to be char-
acterised by short bursts of activity and progress fuelled by an injection of capital or
expertise followed by periods of consolidation as results are reviewed and plans are
hatched to attract the next tranche of funding or in-kind support.

They were really important catalyst in getting the project started and that's the hardest
thing.

Ideology and personal relationships are two factors that played a critical role in
Government's decision to lend support to CLEAN's early stage innovation. It is
apparent that the innovation in this instance stems less from product or technology
and more from the collective packaging of three distinct yet highly complementary
initiatives—decentralised energy, circular economy principles and a community led
project respectively. Many stakeholders cite the potential for this template to be
replicated across regional towns and cities and OEH in particular identify this as a
major motivator for their commitment to the project.

Cowra support was due to replicable innovation, a look at a way to solve regional energy and waste problems with a promising project, which needed support for proof of concept.

Government engagement was strengthened by the personal commitment of the individual tasked by OEH to support the project. Across the network they were seen by many stakeholders as a major asset and enabler for the project, both in terms of finding ways to accommodate the project and its key stakeholders within a very tightly defined sustainability program (SA) as well as her dedication and commitment to ensure the project's longevity and success.

My only experience with OEH has been A6[1] so it's a very positive bonus for the network, I'd sorta say A6's almost part of that network as much as I am as, if not from a professional role from a personal commitment to it.

Equally there is an acknowledgement by many stakeholders that beyond this phase of early stage innovation, it is highly likely that Government will play a much lesser role or indeed exit the network entirely at some point, particularly when significant funding is needed closer to full commercialisation and implementation.

4.6   Accelerate the Project to the Next Stage

The early focus of government in the project was to support the network and take the project to the next stage. Key network members identified this as an early contribution of the SA program and helped determine the *modus operandi* for the broader collaboration with OEH. Indeed, OEH themselves were conscious of this and saw it as a means to deliver tangible successes, thus energising the network to focus on next steps. This was achieved typically through the involvement of a number of third parties subject matter experts, other personnel from within OEH (e.g. RCEP) or funding or other in-kind support.

There was very early involvement and support around developing the project to the next level.

The open, loose and agile nature of the network recognised by internal and external members alike allows for the dynamic entry and exit of change agents through the innovation process to inject specialist knowledge and momentum and take the project to the next stage. OEH has facilitated much of this dynamic process ideally suited for this kind of community network. In the words of OEH, they view their role as saving valuable time or providing 'shortcuts' for the project or provide resources when outside help is needed.

4.7   Broker Knowledge, Plugging Gaps

Related to OEH's ability and willingness to broker relationship has been their ability to plug knowledge gaps particularly in terms of the development process. An extensive network of more than 500 businesses has enabled OEH to build experience and knowledge across a broad range of sustainability projects and to share this across the member network. Evidently this has yielded benefits for stakeholders within CLEAN.

> Their role is to put you in touch with the right people, to give you access to the right people and right analysis and advice… OEH has provided good guidance in that respect.

> They have a great understanding of the process and have ID'd I believe gaps in knowledge and expertise.

Given OEH's desire to replicate the model and share the template with similar potential projects, a free flow of knowledge between parties has not only plugged key gaps but has arguably accelerated the process of innovation, again facilitated by an open and dynamic network structure.

4.8   Other Contingent Roles

A number of other roles played by State Government were identified by stakeholders as being important to the network at varying times. Implicit in some of the other roles mentioned is the ongoing stakeholder engagement undertaken by OEH beyond the involvement of third party consultants. Perhaps the most critical of these for both the community and the larger project has been the relationship with local government which has emerged as a critical stakeholder. In a similar vein, the commitment of OEH to a community-led venture has ensured that the 'keep it local' approach has continued past OEH's involvement, something that would have altogether more challenging with the entry of a private investor. On occasions, OEH has also been viewed as a project manager and mediator, able to give technical expertise and resolve issues hitherto unaddressed by the group. At other times, OEH was seen as a critical yet trusted friend of the project, enabling them to obtain unique perspectives on the working of the project and engage in conversations with core members that might ordinarily have been improbable including offering advice and guidance to the CLEAN team.

Other roles that emerged from interviewees included government as a risk taker and accommodator respectively. Risk taking is perhaps more apparent, implicit as it is in supporting early stage innovation in an emerging field such as renewable energy. The adaptability and flexible approach necessary to accommodate this type of undefined and emergent project in a program as well defined and established as SA further demonstrates the extent of OEH's belief and commitment to CLEAN as a whole.

Finally, OEH was seen to play a lead role in resource selection, allocation and direction. OEH itself identifies resource stewardship as one of its three core functions within the project, along with stakeholder engagement and investor management.

5 Government Support of Innovation—A Double Edged Sword?

The interview data from across the stakeholder group affirms a uniform set of largely positive perceptions about the role of state government in the CLEAN project. Yet all relationships experience peaks and troughs and stakeholders certainly saw the relationship with OEH as no exception.

Whilst undoubtedly a network enabler in many facets, stakeholders of all types identified a number of challenges in a relationship of this nature. Funding and program constraints, a not uncommon feature of programs reliant upon the public purse, was the most cited impediment for network members both within and outside of OEH. Breaking down the vision into fundable 'chunks' was a challenging and sometimes frustrating exercise for all parties, as was the process of repositioning these component parts such that they complied with the funding guidelines without diluting the very essence of the project.

> … in the course of 'dumbing it down' to meet government requirements for the grants, they may be losing what they saw as innovative, the real thing that makes a real community project.

Another feature of working with government is the vagaries of political cycles. Whilst not a feature of this particular collaboration, a cloud of concern nevertheless hung over the project with stakeholders worried about how long OEH would remain a facilitating partner in the face of ministerial changes and funding pressures. Similarly, given the relatively high risk nature of the project, many stakeholders working with or for other government departments harboured concerns about State Government's longer term appetite for engagement in the project, particularly in the face of project delays or failures. The relatively slow pace of government decision making combined with the constraints attached to funding served to prompt questions in the minds of the core network about whether a slower, more circuitous route could have been avoided. Mention was made by a few of other minor concerns about the relationship including the vacillating strategic priorities of environmental programs, loss of key personnel and knowledge in head office and the language barrier that existed between bureaucrats and industry.

In summary, only one in four stakeholders harboured any concerns relating to government involvement in the project despite direct prompts in the course of the interview. This was overshadowed by the overwhelming focus by respondents on the positive roles played by OEH to support the CLEAN project.

6   Conclusions: The Changing Role of Government

CLEAN is but one example of an highly innovative community waste to energy project still at a relatively early stage of development. The most striking initial observation from our data is that the CLEAN network has survived and prospered due significantly to the intervention of government, in this instance OEH. That is not to say that another suitor would not have materialised in due course and had a greater or lesser impact.

Government has taken different approaches and played a number of different and largely constructive roles in supporting this network. These have ranged from the provision of small amounts of capital to pay for people and expertise at the early stages of innovation to ongoing project advice and guidance; brokering relationships with subject matter experts to bringing much needed credibility to the network to enable stakeholders to engage directly with other parties. The impacts have been many and varied, resulting in the acceleration of specific phases of the project and continued if intermittent progression to the end goal.

Similar to all collaborations, issues arise that need to be addressed and differences emerge between parties. In the context of CLEAN, stakeholder concerns have related to funding requirements and constraints, political cycles and government's usually low appetite for risk, the speed of government decision making and a host of other minor concerns that whilst apparent but do not appear to have had a significantly detrimental impact on the project.

This paper builds on broader research into third party intermediaries and extends more recent research on the role of the government in supporting sustainability transitions. The findings from CLEAN suggest that in this instance, government is indeed a critical actor in these sustainability focused innovation networks, plays a multiplicity of roles in these projects and that these roles vary to a greater degree than previously suggested in the literature. Whilst the necessity of omnipresence is far from proven, this case study provide some clear examples of where government can and is able to make a considerable impact on innovation networks and provide clear, acknowledged leadership in the area of sustainability in terms of tangible, on ground projects, as well as education and the co-creation of a marketplace for industrial waste.

This in itself is an important finding, not least since much of the existing literature sees government as a supporting rather than lead actor, focusing on the role of the firm as a primary source of innovation. Similarly and at an international level, much of the focus on the role of government in advancing sustainability has been at a federal level with only limited coverage of the state, regional and arguably local levels. Looking specifically at the literature on multi-stakeholder partnerships for sustainability in the context of regional development, the role that local government plays in the creation of sustainable development is largely ignored. Whilst not explored in particular detail, this research touches on the critical role played by local government as a funder, supporter and potential beneficiary of the CLEAN project. Whilst a single case study is bounded by obvious limitations, it is hoped

that this work will stimulate broader investigation into the potentially significant role government might play in the sustainable innovation process.

References

Benz, A., & Fürst, D. (2002). Policy learning in regional networks. *European Urban and Regional Studies, 9*(1), 21–35.

Bessant, J., & Rush, H. (1995). Building bridges for innovation: the role of consultants in technology transfer. *Research Policy, 24*(1), 97–114.

Blacconiere, W. G., & Northcut, W. D. (1997). Environmental information and market reactions to environmental legislation. *Journal of Accounting, Auditing & Finance, 12*(2), 149–178.

Bocken, N. M. P., Short, S. W., Rana, P., & Evans, S. (2014). A literature and practice review to develop sustainable business model archetypes. *Journal of cleaner production, 65*(0), 42–56. https://doi.org/10.1016/j.jclepro.2013.11.039.

Brand, E., & de Bruijn, T. (1999). Shared responsibility at the regional level: The building of sustainable industrial estates. *European Environment, 9*(6), 221–231. https://doi.org/10.1002/(SICI)1099-0976(199911/12)9:6<221:AID-EET209>3.0.CO;2-Z.

Burt, R. S. (1992). *Structural holes: The social structure of competition*. Cambridge, MA: Harvard University Press.

Bush, S. R., Oosterveer, P., Bailey, M., & Mol, A. P. J. (2015). Sustainability governance of chains and networks: A review and future outlook. *Journal of cleaner production, 107*, 8–19. https://doi.org/10.1016/j.jclepro.2014.10.019.

Carr, A. J. P. (1998). Choctaw Eco-Industrial Park: An ecological approach to industrial land-use planning and design. *Landscape and Urban Planning, 42*(2), 239–257.

Ehrenfeld, J. R. (2000). Industrial ecology paradigm shift or normal science? *American Behavioral Scientist, 44*(2), 229–244.

Fontana, A., & Frey, J. H. (2000). The interview: From structured questions to negotiated text. *Handbook of Qualitative Research, 2*(6), 645–672.

Freeman, C. (1991). Networks of innovators: A synthesis of research issues. *Research policy, 20*(5), 499–514. https://doi.org/10.1016/0048-7333(91)90072-X.

Gassmann, O., Daiber, M., & Enkel, E. (2011). The role of intermediaries in cross-industry innovation processes. *R&D Management, 41*(5), 457–469.

Hargadon, A., & Sutton, R. I. (1997). Technology brokering and innovation in a product development firm. *Administrative Science Quarterly*, pp. 716–749.

Hargreaves, T., Hielscher, S., Seyfang, G., & Smith, A. (2013). Grassroots innovations in community energy: The role of intermediaries in niche development. *Global Environmental Change, 23*(5), 868–880. https://doi.org/10.1016/j.gloenvcha.2013.02.008.

Hodge, G. A., & Greve, C. (2007). Public–private partnerships: An international performance review. *Public Administration Review, 67*(3), 545–558.

Howells, J. (2006). Intermediation and the role of intermediaries in innovation. *Research policy, 35*(5), 715–728. https://doi.org/10.1016/j.respol.2006.03.005.

Lifset, R., & Graedel, T. E. (2002). Industrial ecology: Goals and definitions. In *A handbook of industrial ecology* (pp. 3–15).

Mantel, S., & Rosegger, G. (1987). *The role of third-parties in the diffusion of innovations: A survey* (pp. 123–134). Innovation: Adaptation and Growth.

Maxwell, J. A. (2012). *Qualitative research design: An interactive approach* (Vol. 41). Thousand Oaks, CA: Sage Publications.

Patala, S., Hämäläinen, S., Jalkala, A., & Pesonen, H.-L. (2014). Towards a broader perspective on the forms of eco-industrial networks. *Journal of cleaner production, 82*(0), 166–178. https://doi.org/10.1016/j.jclepro.2014.06.059.

Popp, A. (2000). "Swamped in information but starved of data": Information and intermediaries in clothing supply chains. *Supply Chain Management: An International Journal, 5*(3), 151–161.

Provan, K. G., & Human, S. E. (1999). Organizational learning and the role of the network broker in small-firm manufacturing networks. *Interfirm networks: Organization and industrial competitiveness* (pp. 185–207).

Roberts, N. (2000). Wicked problems and network approaches to resolution. *International Public Management Review, 1*(1), 1–19.

Sbragia, A. (2000). Environmental policy. In *Policy-making in the European Union* (pp. 293–316).

Selman, P. (1998). Local Agenda 21: Substance or spin? *Journal of Environmental Planning and Management, 41*(5), 533–553.

Smith, A., Hargreaves, T., Hielscher, S., Martiskainen, M., & Seyfang, G. (2016). Making the most of community energies: Three perspectives on grassroots innovation. *Environment and Planning A, 48*(2), 407–432.

Stankiewicz, R. (1995). The role of the science and technology infrastructure in the development and diffusion of industrial automation in Sweden. In *Technological systems and economic performance: The case of factory automation* (pp. 165–210). Berlin: Springer.

Van den Bergh, J. C., Truffer, B., & Kallis, G. (2011). Environmental innovation and societal transitions: Introduction and overview. *Environmental Innovation and Societal Transitions, 1* (1), 1–23.

Van Kleef, J., & Roome, N. (2007). Developing capabilities and competence for sustainable business management as innovation: A research agenda. *Journal of Cleaner Production, 15*(1), 38–51.

Wallner, H. P. (1999). Towards sustainable development of industry: Networking, complexity and eco-clusters. *Journal of Cleaner Production, 7*(1), 49–58. https://doi.org/10.1016/S0959-6526 (98)00036-5.

Zaheer, A., & McEvily, B. (1999). Bridging ties: A source of firm heterogeneity in competitive capabilities. *Strategic Management Journal, 20*(12), 1133.

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Professor Damien Giurco is Director (Innovation) at the Institute for Sustainable Futures. Concurrently, he is Professor of Resource Futures, team leader for the research areas of Resources and Energy. With a focus on strategies for responsible prosperity, Damien has worked collaboratively with government and industry clients spanning the minerals, water, waste and energy sectors to create change towards sustainable futures in a digital age. On behalf of ISF, Damien is also leading the CSIRO Wealth from Waste Cluster to identify pathways for creating wealth from waste containing metals, including e-waste. The $9 m three year collaboration partners with researchers at The University of Queensland, Monash, Swinburne and Yale.