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Renewable Energy Clusters

Recurring Barriers to Cluster Development in Eleven Countries

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Series Foreword

The Springer book series *Innovation*, *Technology*, *and Knowledge Management* was launched in March 2008 as a forum and intellectual, scholarly "podium" for global/local, transdisciplinary, transsectoral, public–private, and leading/"bleeding" edge ideas, theories, and perspectives on these topics.

The book series is accompanied by the Springer *Journal of the Knowledge Economy*, which was launched in 2009 with the same editorial leadership. The series showcases provocative views that diverge from the current "conventional wisdom" that are properly grounded in theory and practice, and that consider the concepts of ***robust competitiveness***,[1] ***sustainable entrepreneurship***,[2] and ***democratic capitalism***,[3] central to its philosophy and objectives. More specifically, the aim of this series is to highlight emerging research and practice at the dynamic

[1]We define *sustainable entrepreneurship* as the creation of viable, profitable, and scalable firms. Such firms engender the formation of self-replicating and mutually enhancing innovation networks and knowledge clusters (innovation ecosystems), leading toward robust competitiveness (E.G. Carayannis, *International Journal of Innovation and Regional Development* 1(3), 235–254, 2009).

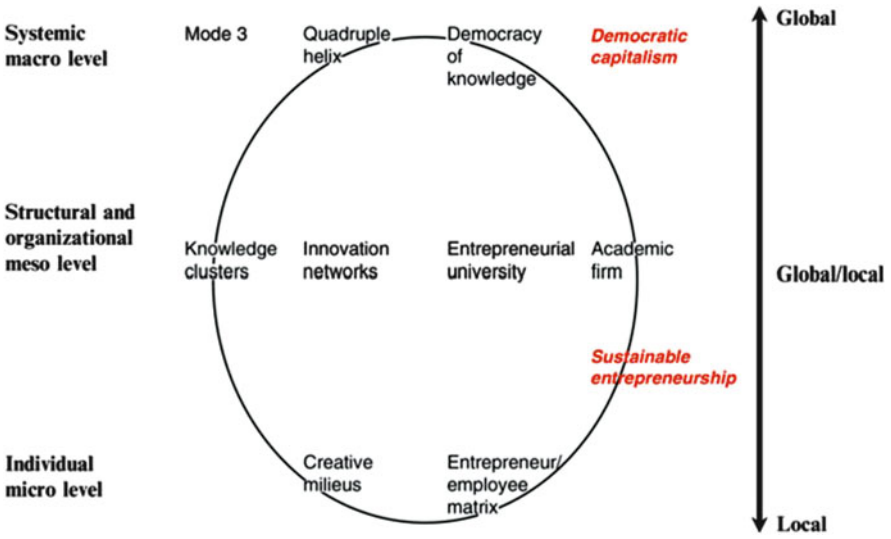
[2]We understand *robust competitiveness* to be a state of economic being and becoming that avails systematic and defensible "unfair advantages" to the entities that are part of the economy. Such competitiveness is built on mutually complementary and reinforcing low-, medium-, and high technology and public and private sector entities (government agencies, private firms, universities, and nongovernmental organizations) (Carayannis, E. G. (2009). *International Journal of Innovation and Regional Development 1*(3), 235–254).

[3]The concepts of *robust competitiveness and sustainable entrepreneurship* are pillars of a regime that we call "*democratic capitalism*" (as opposed to "popular or casino capitalism"), in which real opportunities for education and economic prosperity are available to all, especially—but not only—younger people. These are the direct derivatives of a collection of top down policies as well as bottom-up initiatives (including strong research and development policies and funding, but going beyond these to include the development of innovation networks and knowledge clusters across regions and sectors) (Carayannis. E. G. & Kaloudis, A. (2009), *Japan Economic Currents*, pp. 6–10).

intersection of these fields, where individuals, organizations, industries, regions, and nations are harnessing creativity and invention to achieve and sustain growth.

Books that are part of the series explore the impact of innovation at the "macro" (economies, markets), "meso" (industries, firms), and "micro" levels (teams, individuals), drawing from such related disciplines as finance, organizational psychology, research and development, science policy, information systems, and strategy, with the underlying theme that for innovation to be useful it must involve the sharing and application of knowledge.

Some of the key anchoring concepts of the series are outlined in the figure below and the definitions that follow (all definitions are from Carayannis, E. G. & Campbell, D. F. J. (2009). *International Journal of Technology Management*, *46*, 3–4).



Conceptual profile of the series *Innovation*, *Technology*, and *Knowledge Management*:

- The "Mode 3" Systems Approach for Knowledge Creation, Diffusion, and Use: "Mode 3" is a multilateral, multinodal, multimodal, and multilevel systems approach to the conceptualization, design, and management of real and virtual, "knowledge-stock" and "knowledge-flow," modalities that catalyze, accelerate, and support the creation, diffusion, sharing, absorption, and use of cospecialized knowledge assets. "Mode 3" is based on a system-theoretic perspective of socioeconomic, political, technological, and cultural trends and conditions that shape the coevolution of knowledge with the "knowledge-based and knowledge-driven, global/local economy and society."

- Quadruple Helix: Quadruple helix, in this context, means to add to the triple helix of government, university, and industry a "fourth helix" that we identify as the "media-based and culture-based public." This fourth helix associates with Series Foreword vii "media," "creative industries," "culture," "values," "life styles," "art," and perhaps also the notion of the "creative class."
- Innovation Networks: Innovation networks are real and virtual infrastructures and infratechnologies that serve to nurture creativity, trigger invention, and catalyze innovation in a public and/or private domain context (for instance, government–university–industry public–private research and technology development cooperative partnerships).
- Knowledge Clusters: Knowledge clusters are agglomerations of cospecialized, mutually complementary, and reinforcing knowledge assets in the form of "knowledge stocks" and "knowledge flows" that exhibit self-organizing, learning-driven, dynamically adaptive competences, and trends in the context of an open systems perspective.
- Twenty-First Century Innovation Ecosystem: A twenty-first century innovation ecosystem is a multilevel, multimodal, multinodal, and multiagent system of systems. The constituent systems consist of innovation metanetworks (networks of innovation networks and knowledge clusters) and knowledge metaclusters (clusters of innovation networks and knowledge clusters) as building blocks and organized in a self-referential or chaotic fractal knowledge and innovation architecture,[4] which in turn constitute agglomerations of human, social, intellectual, and financial capital stocks and flows as well as cultural and technological artifacts and modalities, continually coevolving, cospecializing, and cooperating. These innovation networks and knowledge clusters also form, reform, and dissolve within diverse institutional, political, technological, and socioeconomic domains, including government, university, industry, and nongovernmental organizations and involving information and communication technologies, biotechnologies, advanced materials, nanotechnologies, and next-generation energy technologies.

Who is this book series published for? The book series addresses a diversity of audiences in different settings:

1. *Academic communities*: Academic communities worldwide represent a core group of readers. This follows from the theoretical/conceptual interest of the book series to influence academic discourses in the fields of knowledge, also carried by the claim of a certain saturation of academia with the current concepts and the postulate of a window of opportunity for new or at least additional concepts. Thus, it represents a key challenge for the series to exercise a certain impact on discourses in academia. In principle, all academic communities that are interested in knowledge (knowledge and innovation) could be tackled by the book series. The interdisciplinary (transdisciplinary) nature of the book series

[4]Carayannis, E. G. (2000). *Strategic management of technological learning*. CRC Press.

underscores that the scope of the book series is not limited a priori to a specific basket of disciplines. From a radical viewpoint, one could create the hypothesis that there is no discipline where knowledge is of no importance.

2. *Decision makers—private/academic entrepreneurs and public* (*governmental*, *subgovernmental*) actors: Two different groups of decision makers are being addressed simultaneously: (1) private entrepreneurs (firms, commercial firms, academic firms) and academic entrepreneurs (universities), interested in optimizing knowledge management and in developing heterogeneously composed knowledge-based research networks; and (2) public (governmental, subgovernmental) actors that are interested in optimizing and further developing their policies and policy strategies that target knowledge and innovation. One purpose of public *knowledge and innovation policy* is to enhance the performance and competitiveness of advanced economies.
3. *Decision makers in general*: Decision makers are systematically being supplied with crucial information, for how to optimize knowledge-referring and knowledge-enhancing decision-making. The nature of this "crucial information" is conceptual as well as empirical (case-study-based). Empirical information highlights practical examples and points toward practical solutions (perhaps remedies); conceptual information offers the advantage of further driving and further-carrying tools of understanding. Different groups of addressed decision makers could be decision makers in private firms and multinational corporations, responsible for the knowledge portfolio of companies; knowledge and knowledge management consultants; globalization experts, focusing on the internationalization of research and development, science and technology, and innovation; experts in university/business research networks; and political scientists, economists, and business professionals.
4. *Interested global readership*: Finally, the Springer book series addresses a whole global readership, composed of members who are generally interested in knowledge and innovation. The global readership could partially coincide with the communities as described above ("academic communities," "decision makers"), but could also refer to other constituencies and groups.

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Contents

Part I
Setting the Scene

Jaegersberg and Ure

Chapter 1
Supporting Clusters to Create Value: Are We Missing Something?

Abstract The first chapter sets the scene for the book. As clusters have gained increasing prominence in the context of economic development, their promotion and support has become integral to regional and global policy. But do clusters generate in practice what they promise in theory? Does co-location foster the kind of knowledge sharing and innovation that is promised? If not—why not? What barriers do companies encounter on the ground when seeking to develop a project or test an innovation? How do the linkages between stakeholders in education, government and industry impact on outcomes? The book focuses on clusters in the renewable energy sector and presents work with clusters in 11 countries for over a decade. It highlights recurring barriers to value creation in clusters which are not currently receiving the attention they should in policy, in professional development and in research.

1.1 Recurring Barriers to Value Creation Across Clusters

Regional and national policymakers have invested heavily in the cluster concept as a means of generating value for regions, through the benefits attributed to co-location, and the opportunities this may present for small regional enterprises as vehicles for growth and job creation, and as a counter to the threat of competition from regions with lower labour costs (OECD 2007).

Clusters are intended to harness the potential of co-located communities and resources as a means of enhancing regional employment, innovation and competitiveness, within an evolving ecosystem of players, policies, financial incentives and physical infrastructure. Moore's (1993) description of business ecosystems in which players co-evolve mutually beneficial relationships is very apt here.

Although there is a lot of guidance on policy and competitive strategy at a more macroeconomic level, such as Michael Porter's Diamond model for example (Porter 1998, 1990), there is little guidance on managing the more dynamic conditions on the ground which constrain or enable the inter-actor relations which also contribute to economic outcomes.

It is increasingly being acknowledged that barriers and enablers on the ground do impact on the realisation of economic value in clusters (Atkinson and Audretsch 2008) and that engagement between stakeholders in identifying/addressing

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problems is critical (World Bank, 2009). This is a gap noted by Morosini (2004) in a review of the literature, in recent reports on city clusters (Lindqvist and Sölvell 2011) and in a recent McKinsey report considering the role of local government in cluster growth (Kirchherr et al. 2014). Lucy Suchman's paper 'Making Work Visible' in 1995 raised awareness of the extent to which events on the ground are often unmapped and unmanaged, despite their impact on outcomes. This study aims to make that gap visible and bridge it—looking at the barriers perceived by stakeholders on the ground in eleven different countries and considering their implications for policy and practice.

If clusters are to realise their objectives in practice, there is a need for policies and practices that recognise and respond to these barriers and opportunities more rapidly and effectively. As in other collaborative business contexts, there is little practical orientation for policymakers or cluster managers seeking to map or manage these barriers, and to create the conditions for value creation on the ground, nor is there much pragmatic guidance in the literature (Morosini 2004).

What are the most recurring barriers for stakeholders on the ground? What are the barriers to collaboration in critical areas such as innovation? What are the barriers for the SMEs who are the most crucial stakeholders in terms of regional employment and growth? How do policymakers identify and address these barriers? How can regions learn from each other as a means of minimising risks, and optimising value? The book explores recurring barriers in the operating landscape of the cluster from the perspective of stakeholders on the ground in clusters in eleven countries—from Chile, Brazil and Uruguay in Latin America, to Spain, Scotland, Portugal, Italy and Germany in Europe, Canada, California and South Africa (See Fig. 1.1).

Fig. 1.1 The map shows the countries where one or more cluster studies were carried out. Image created by Roman Siegert with data from the study. Original map reproduced from Wikipedia under a creative commons share and share-alike licence [GFDL, CC-BY-SA-3.0]

The book presents a rich and detailed range of new findings on the nature of the most recurring barriers to cluster development from the perspective of stakeholders on the ground,[1] drawing initially on interviews to scope the themes, and quantifying these with surveys across a wider population. The Cluster2Cluster website www.cluster2cluster.org provides access to additional cases and materials as well as outcomes from parallel work on these barriers, in the oil and gas, automotive, business and health sectors in particular.

1.2 Barriers to Value Creation Within Clusters

The promise of clusters hinges in many respects on the communication and collaboration of co-located players as a basis for the creation of shared value originally observed in Alfred Marshall's Italian clusters in 1890. The linkages between SMEs and the other actors they collaborate with (in government, education and industry) are therefore of special interest (See Fig.1.2).

Fig. 1.2 Co-location and collaboration in clusters. Photography by Irene Tischenko. Copyright Shutterstock. Reproduced under a standard licence

[1]Hayek highlighted the need to pay more attention to the local knowledge of players on the ground in the shaping of policy as long ago as 1945, in "The Use of Knowledge in Society".

Complex systems of collaborating players, from clusters to insect colonies,[2] share a dependence on the ability to respond to information about the internal and external environment and implement timely and appropriate responses that optimise their survival (Seeley 2010; Segel and Cohen 2001; Varela et al. 1974). We discuss the results of hundreds of interviews and thousands of surveys on recurring barriers to this and other processes that relate to theory, policy and practice in the development of cluster value for regions.

Barriers for Smes at Key Interfaces

An EC briefing on clusters and networks in 2002 highlighted the particular vulnerabilities of SMEs in this context, and the need to take account of this if their contribution to the cluster and the economy is to be realised.[3] Studies by the EC and the OECD indicate that SMEs are often poorly integrated in supply chains and clusters (EC 2002; OECD 2014; Ure et al. 2007; Jaegersberg et al. 2007; Jaegersberg and Ure 2010, 2011). In presenting the outcomes of the research, we have drawn loosely on the triple helix concept of University-industry-government inter-relationships (Etzkowitz et al. 2008) as a useful framework for highlighting the barriers identified at key interfaces between these actors, and as a locus for targeting intervention (Fig. 1.3).

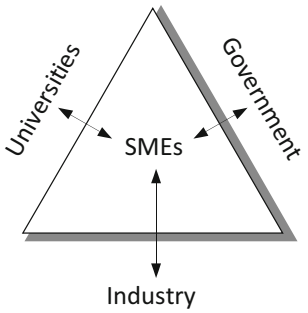

Fig. 1.3 Feedback at key interfaces between companies and key actors in the cluster

[2]Prof. Thomas Seeley at Cornell University describes the basis of optimum decision-making in bee colonies much as Hayek does in economics—as a solution to the problem of harnessing the diversity of information, knowledge and agency distributed in an ecosystem.

[3]In Europe alone, SMEs represent 99% of all European enterprises, contribute two thirds of European GDP and provide 75 million jobs in the private sector (EUbusiness 2010). In OECD economies, SMEs account for over 95% of firms and 60–70% of employment and generate a large share of new jobs (OECD 2000).

1.3 A Focus on Renewable Energy Clusters

The dynamics and tensions in this emergent sector, in a competitive global market, provided a fascinating laboratory for strategy over the decade during which these cases were researched (Fig. 1.4).

Fig. 1.4 *Left*: Image of solar system at the AS solar company building in Hannover, by Christoffer Riemer. Reproduced from Wikimedia under a creative commons licence (https://commons.wikimedia.org/w/index.php?curid=8292751). *Right*: Image of Middelgrunden wind farm in Oresund, Denmark by Kim Hansen, and reproduced from Wikimedia under a creative commons licence (https://commons.wikimedia.org/wiki/File:Middelgrunden_wind_farm_2009-07-01_edit_filtered.jpg?uselang=en-gb)

Challenging Energy Transitions

As renewable use scales up, the potential of renewable energy to create jobs and contribute to industrial development has taken on greater economic importance. The International Renewable Energy Agency (IRENA[4]) report in 2016 for example, highlights the scale of this transition, as renewable energy power capacity has grown 85% over the last decade, bringing economies of scale in wind and solar, such that renewables now make up almost a third of all installed power capacity around the world.

Renewable energy is at a tipping point (JISEA[5] Annual Report 2016), where the costs, benefits and risks in the short and long term are sufficiently different as to

[4]International Renewable Energy Agency (IRENA) 2016 Work Programme and Budget for 2016–2017 Report of the Director-General. A/6/4. Presented 16-17 January 2016, AbuDhabi. http://www.irena.org/DocumentDownloads/A_6_4_Work_Programme_and_Budget_2016_2017.pdf

[5]JISEA Joint Institute for Strategic Energy Analysis http://www.jisea.org/news.cfm#unu (JISEA explores the intersections of the environmental, social, financial, technological, and political elements of energy systems to envision pathways to de-carbonization).

show that policies can create very different cost benefit scenarios, particularly as off grid and micro grid solutions expand.

Energy transitions have foregrounded the difficulties of operating in such a dynamically changing business landscape, where traditional models and strategies may need to be re-assessed, and may require very different relationships between players (Araujo 2014; Stirling 2014).

A Range of Different Contexts and Starting Points

The renewable clusters studied in the book build on very different geographical, historical, political, economic and cultural bases, and implement different policies and different incentives (Mendonça et al. 2010).The actors are typically widely-distributed companies, Universities, utilities, laboratories, industry parks and regional or national government agencies, often based at significant distances from each other, and without a history of collaboration, or incentives to do so.

Clusters are often created top down, as it were, to stimulate economic opportunities for a region with little existing business culture. These are very different from the early clusters that developed organically, with and through the activities of densely connected communities on the ground—as for example in the early Italian clusters of craftsmen observed by Alfred Marshall (1890)[6] Here the different players have had the opportunity to evolve a rich matrix of alliances, and networks of communication and collaboration between different players.

As markets become more competitive and less predictable, the speed and efficacy of feedback to policymakers about barriers and opportunities becomes ever more critical however. There is an urgent need to raise awareness of recurrent and emerging barriers on the ground such as these, which impact on the success of clusters, and different players within them. Our experience of successfully identifying recurring barriers across clusters and distributed networks in a wide range of other sectors[7] suggested that emerging renewable clusters could benefit from the experience of established clusters in other regions and the historical lessons learned in other sectors.

While sectors such as eBusiness and more recently eHealth have learnt to leverage the knowledge of service and system users on the ground to mitigate unanticipated cost and risk in project, product or service development, this is surprisingly absent in these large high cost, high risk investments of public funds in the renewable energy sector.

[6]Chapter 2 looks at different historical views of clusters.

[7]Many of these issues were also evident in our earlier research on collaboration across diverse and distributed communities in other sectors—in oil and gas clusters, the automotive supply chain, networked eHealth and eBusiness systems and services, as well as large scale data Grids.

1.4 Aims, Approach and Structure of the Book

Aims

The book draws on cluster studies, in eleven countries to:

- highlight recurring risks, barriers and opportunities for policymakers
- identify strategies already adopted to address these problems in other clusters
- highlight the need for more collaborative research with companies on the ground

Approach

The approach adopted is unusual in its scale, scope and methodology

- covering clusters in Europe, Australia, South America, Canada, North America and South Africa
- using both qualitative and quantitative measures at scale
- covering a range of stakeholders
- providing a resource for aligning policy and the needs of businesses on the ground
- highlighting new approaches to researching and addressing emerging needs and opportunities
- providing a unique network of cluster contacts and collaborators in each region
- drawing on a database from 11 countries that can be searched by theme, by country etc as a resource for policy, research or professional development.

Structure

Chapter 1 of Part I provides the background to the study and its aims. In Chap. 2 we provide some initial context on the different models that have evolved to support the understanding and management of clusters. In Chap. 3 we look at the potential for researching, sharing and addressing the more recurrent barriers on the ground which contribute to outcomes in clusters, but are often ignored. Chapter 4 uses one of the Case Studies to introduce the qualitative and quantitative approaches used. In Part II, Chaps. 5,6,7,8 provide Case Studies that show the barriers in a real context, from the perspective of stakeholders. In Part III, Chaps. 9,10,11,12,13 then look across the clusters at the most recurrent barriers, and discuss their implications for policy and practice.

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Chapter 2
What Exactly Are Clusters?

Abstract In this chapter, we look at the theoretical concept of clusters. We trace the concept through history starting with Marshall, who laid the foundations for it with his "industrial districts" analysis in the late nineteenth century. We then look at how the concept was revived in the 1970s and 1980s of the last century by the Italian researcher Giacomo Becattini on the move from industrial "sectors" to industrial "districts" as a locus for inter-firm collaboration in Italy in 1979, by the French GREMI group, and later, (in the early globalisation debate of the 1990s) by the American economists Krugman and Porter. This section gives some background to the concept of clusters in the literature, and the particular focus of different theories. This provides some context for the focus of the study in the operating landscape for stakeholders on the ground, rather than at the level of macro-economic conditions that are the traditional focus of the literature on cluster competitiveness.

It is worth considering what we mean by the term clusters. In the simplest terms, clusters can be described as an agglomeration of related businesses and organisations, in geographic proximity, which benefit from co-localisation and collaboration, and for which, as Aristotle said, the whole is somehow more than the sum of its parts (Lawson 2004). It is that 'somehow' that is explored in this book through the eyes of stakeholders on the ground.

We begin with Alfred Marshall's "industrial district" model of inter-firm collaboration (1890), which provided the context for much of the later discussion on how this can create value for regions. We then look at how theorists connected with Marshall's paradigm in the context of the "Terza Italia" in the late 1970s and 1980s, and in the context of the early globalisation debate at the beginning of the 1990s. The constant revisiting of Marshall's original model by later economists and sociologists, points to this as a seminal contribution. It supports the view that local agglomeration, or clustering, is a recurring socio-economic phenomenon, geographically and historically.

G. Jaegersberg, J. Ure, *Renewable Energy Clusters*, Innovation, Technology, and Knowledge Management, DOI 10.1007/978-3-319-50365-3_2

2.1 Marshall's Industrial Districts

The empirical phenomenon of clusters was first discussed in economic terms by Alfred Marshall—a notable British neoclassical economist—and termed "industrial districts". In his famous book "Principles of Economics" (Marshall 1890) he dedicates a chapter to "The Concentration of Specialized Industries in Particular Localities" and analyses the localisation[1] effect on small locally owned firms concentrating on the manufacture of certain products in industrial districts in late nineteenth century Britain.

Value Creation Through Knowledge Sharing

Marshall identifies substantial intra-district trade and an internal market of supply and demand for skills among the effects of localisation, along with the generation of specialised knowledge and expertise in the trade zone. "The mysteries of the trade become no mysteries" as Marshall puts it, "but . . . are in the air, and children learn many of them unconsciously." (Marshall 1890).

Through the Development of a Community of Practice

Marshall (1919) describes the dynamics within these areas engagingly and expressively as "industrial atmosphere". He seems to hint at the value of those less tangible dynamics between players in proximity—be they social, organisational, historical or cultural, along the lines later described by Wenger and Lave (1998) as a community of practice, to denote an informal group of people who collaborate on issues of mutual interest.

Through Asset-Sharing

And where groups of skilled workers are gathered within specific districts, Marshall observes cost advantages through the economic use of expensive machinery. He notes that spatial proximity keeps transaction costs low, and localised industries can create external economies.[2]

[1] With localisation Marshall refers to the co-location of industries.

[2] "External economies" relate to the impact of economic activities on a third party. There is no contractual relationship between the party responsible for the effect and the ones who are affected. The impact can be positive or negative. The social costs of negative effects are paid by the community. External economies are also called "externalities".

Through Inter-Firm Cooperation

He perceives localised industries as entities that create added value in the value chain and underlines the socio-economic aspect[3] of inter-firm co-operation in the "thickly peopled industrial district". A revived interest in Marshall's industrial district model returned when, in the world recession of the late 1970s/early 1980s, a new industrial production model emerged in Italy.

2.2 Becattini's Terza Italia

The networks of small family-owned companies with high degrees of specialisation in Northeast and Central Italy were characterised by strong economic performance, in contrast to the reigning Fordian model of mass production which was being questioned during the economic and structural crises in those days. Companies within this so-called "Terza Italia" district were highly competitive, innovative, and export-oriented, and could maintain their position in the market against low price foreign competitors in the production of textiles and shoes in particular.[4] This "Third Italy" phenomenon became widely known, and stimulated debate amongst scholars.

The central figure in this debate in Italy was Giacomo Becattini, economist and professor at Università di Firenze. In his seminal article "Dal settore industriale al distretto industriale" (Becattini 1979), he discusses the Marshallian "industrial district" model in the Italian context. In his analysis he focuses on the inter-connectedness of small firms located in a confined geographical area.

Value Creation Through Social, Cultural and Historical Relationships

He emphasises the socio-cultural and family relationships linking people and firms that develop over time and shape local production systems (Becattini et al. 1990). He regards a sense of belonging (in which components of material interest and of loyalty to a social group are welded together) as the cement that binds these intermediate bodies together and generates external economies. He also observes that this localised (density) 'thickening' of inter-industrial relationships is

[3]"Social forces . . . cooperate with economic . . ." (Marshall 1890).

[4]Nee and Opper (2012) describe a similar contrast in China, between the more top-down state business model, which was eventually dropped in favour of the more successful approach that evolved in unofficial clusters of companies in the Yangzi region, and is credited with contributing significantly to the so-called Chinese industrial miracle.

reasonably stable over time, especially when it has the ability to renew itself, developing the original industry in more specialised ways and thus strengthening its identity as an industrial district (Becattini et al. 1990, 130–32).

2.3 The Gremi Group and the Milieux Innovateurs

Around the same time (in 1985), a debate amongst a group of French sociologists, economists, and regional specialists named GREMI (Groupe de Recherche Européen sur les Milieux Innovateurs) evolved around the different innovation capabilities and activities of regions (such as the "Terza Italia") which manifested themselves in the so-called "milieux innovateurs".

An "innovative milieu" they define as a 'relational' space, where social interactions, interpersonal synergies and social collective actions of small companies determine innovative capability and economic success (Camagni 1991). These relationships are seen as constituted by shared values and trust as well as geographical proximity. According to the GREMI Group, the embeddedness of these relationships in the wider socio-cultural environment leads to a collective creative learning process and spurs innovation.

A further recourse to Marshall's industrial district model can be observed in the context of the early globalisation debate, in which two approaches stand out: Paul Krugman's "new economic theory" (Krugman 1991) and Michael Porter's cluster model (Porter 1990).

2.4 Krugman and 'New Economic Geography'

With Krugman, the focus shifts to economic geography. Krugman argues in his "new economic geography"—for which[5] he was awarded the Nobel Prize in 2008—that localisation of production in space is a central issue. He goes back to the source and applies Marshall's industrial district model to the historical context of the early 1990s in which markets were increasingly liberalised (supporting free movement of products across borders with factor mobility[6]) and networked (communication technologies). He considers two facts as key drivers in the clustering of industries in certain locations—costs to transactions across space and economies of scale in production. The costs of transacting across distance cause producers to prefer locations where there is high demand and/or convenient supply of production

[5]Together with his New Trade Theory.

[6]Factor mobility refers to free movement of capital and labour (e.g. in the European Single Market).

inputs. Economies of scale incentivise manufacturers to concentrate production/service in a limited number of locations. (Krugman 1991)

Krugman holds that the localisation of economic activity in space is "path dependent", in other words, it is largely shaped by historical contingency, and, once established, it tends to be self-sustaining. (Krugman 1991). Our studies highlighted the extent to which many clusters built on pre-existing geographical, historical, cultural and social resources, and pre-existing arrangements between co-located players. We identify clusters in the study which build recognisably on pre-existing arrangements very successfully, and others which face difficulties because of the dearth of business infrastructure where clusters have been set up as top-down initiatives with the aim of developing rural economies.[7]

2.5 Porter and Competitive Advantage Through Clusters

Michael Porter, one of the leading authorities on competitive strategy and Professor at The Institute for Strategy and Competitiveness at the Harvard Business School, focuses on how these localised industry agglomerations can provide competitive advantage at a business, regional and national level.

Value Creation Through the Management of Functional Relationships

The source of competitiveness and sustained prosperity here is primarily, in the functional interconnectedness of sector-specific companies, suppliers, service providers and associated institutions[8] in the value chain in a particular location. In his influential book "The Competitive Advantage of Nations"[9] (Porter 1990), he terms these agglomerations "clusters" and, based on his research in ten leading nations, he develops his famous "Diamond" model, which is intended to show the forces and the factors that shape the competitiveness of clusters in a global context. Clusters then are a new approach to the competitive position of regions and nations in global competition. We cover this in reasonable depth because it has become the ipso-facto model of choice for policymakers seeking to develop strategies that will allow clusters to create regional value.

Porter's Diamond model suggests that four factors in the national economy shape the environment in which local firms compete:

[7] See the Portuguese case in Chap. 5.

[8] In reference to Universities, research institutes, funding bodies and governmental support agencies among others.

[9] The title of Porter's book is an allusion to Adam Smith's concept of "comparative advantage".

- factor conditions (basic factors such as natural resources and advanced factors such as communication infrastructure, sophisticated and skilled labour, research facilities and technological expertise)
- firm strategy, structure and rivalry
- related and supporting industries
- demand conditions

These four determinants are said to promote or impede the creation of competitive advantage and constitute the so-called diamond, as a mutually reinforcing system, where the effect of one determinant is contingent on the state of others. Porter argues that two additional variables can also influence the dynamics: chance (e.g. innovation, war etc.) and government (e.g. policies such as investment in education or incentives). Here, value is said to be created by managing the relationships between economic forces and factors at the level of the market. Figure 2.1 visualises Porter's model and the salient factors, forces and conditions. His model has become globally recognised both in economic theory as well as in policy, and is widely used as a model in the context of clusters and supply chains. Porter looks at clusters more in terms of the management of market forces, and much of policy has focused at that level, although he and others acknowledge the role of the

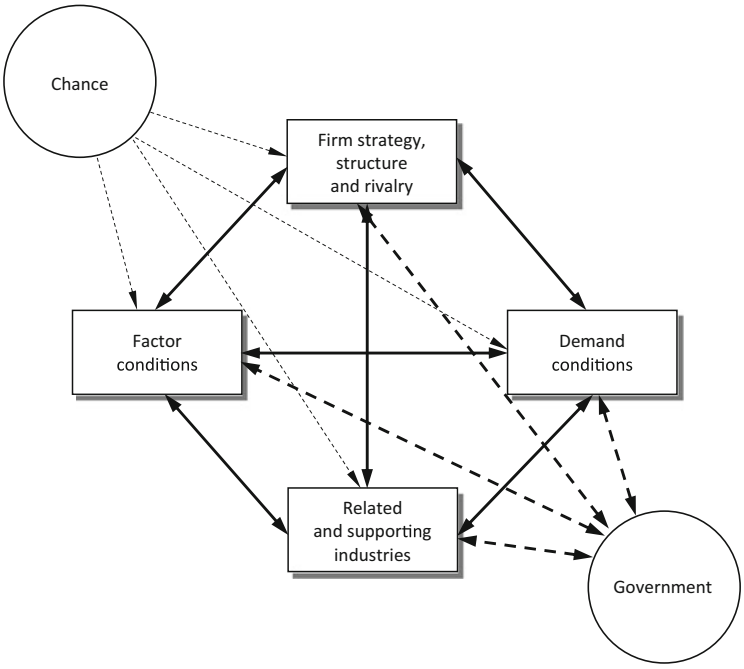

Fig. 2.1 Porter's diamond model (1990). Reproduced with kind permission from Porter ME (1990) The competitiveness of nations. New York: Free Press p. 127

relations between actors on the ground[10] in mediating some of the benefits. While the 'factor conditions' on the ground are part of this model, the emphasis is more on ensuring factors such as skilled labour and research facilities are available, rather than on the management of barriers to creation, provision or access that also mediate their role in the cluster.

There is also a strong case for more detailed exploration of dynamic forces and tensions on the ground, between industry, government and education actors within the cluster. The interviews and surveys in this study highlight the benefits of mapping and managing these recurring issues as a means of minimizing risk and maximizing value for the cluster and the region.

The approach we have taken focuses more on the tensions between stakeholders rather than on the tensions between market forces, and draws also on models from sociology and economic sociology which we enlarge upon in the discussion.

Unpicking the 'Social Glue'

The historical overview suggests that industrial agglomeration has been a recurring socio-economic pattern throughout history, where co-location and collaboration can generate value for regions given the right conditions. Knowing how, where (or even if) value is created through communication, collaboration and coproduction between actors on the ground, and understanding the barriers and the enablers, is arguably a crucial but under-researched aspect of cluster management (Morosini 2004).

The study focuses on identifying some of the very recurring barriers at this level of the cluster, as an additional resource in creating the conditions to

- minimise the cost and risk from common barriers
- optimise the conditions for value creation between actors
- identify practical measures of mapping and managing these

There is a need for better understanding of the linkages between stakeholders on the ground,[11] and particularly in relation to SMEs, given that they are the key vehicles for job creation, and GDP growth. This study—across clusters in

[10]The power of dense local networks of actors on the ground to create economic value for regions in this way has generated enough interest to be adopted by governments worldwide. Many of these clusters have been instituted 'top down' as it were, rather as something that evolved bottom up through the interaction of communities on the ground.While the so-called 'social glue' that Marshall (1890), (Porter 1998) and others refer to is acknowledged as an enabling factor in this, it is largely unexplored in the cluster literature (Morosini 2004).

[11]Awareness is now growing of the need to take more account of such barriers to communication, collaboration and alliancing between stakeholders in the success of clusters. See for example Lindqvist and Sölvell (2011) on EU City Clusters. This aspect is discussed in more detail in the cross-cutting discussion in Part III of the book.

11 countries—seeks to show how barriers at these critical interfaces impact on the competitiveness of clusters in ways which can be seen across clusters, and across sectors, yet figure very little in the recommendations for policymakers and cluster managers tasked with providing the conditions for cluster competitiveness.

Just as conditions can be positively reinforcing (as in Porter's Diamond model), driving value creation, it is also possible for some configurations of factors and incentives to come together in ways that create cost and risk, and this is what is observed on the ground in the clusters we studied.

The study looks at the most recurring barriers in such relationships, across very different clusters, and suggests how these can be better mapped and managed in creating the conditions for cluster competitiveness.

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Chapter 3
Why Share Experience of Barriers?

Abstract This chapter highlights the value of sharing experience of barriers and enablers across clusters, as a means of minimising risks and optimizing value. We illustrate this initially through an early case in the oil and gas sector which shows how an early stage cluster was able to benefit from the experiences of a mature oil and gas cluster to mitigate risks in relation to the retention of SMEs. The case reveals the central role SMEs play in clusters in terms of innovation, employment and niche expertise crucial to the enhancement of cluster performance. The chapter highlights the potential of clusters at different stages of development to learn from each other, as a means of anticipating, minimising and mitigating unanticipated cost and risk. The chapter also highlights the need for a better understanding of the landscape on the ground, at the crucial interfaces where it is assumed that actors in government, education and industry co-produce value.

3.1 The View from the Barricades

The development of clusters in regions around the world is the expression of widely held perceptions of the value they can create for regional economies. SMEs are the engine of the growth and job creation that clusters aim to generate. Yet they are often poorly represented and integrated in supply chains and clusters (Estimé 2008). If clusters are to realise their objective in practice and create wealth for the region, there is a need for a better understanding of the ways in which actors in government, education and industry co-produce the knowledge that shapes policy, particularly where this may constrain access and/or agency for SMEs (Jaegersberg and Ure 2011).

To gain insights into this we focus on the feedback at the key interfaces between the three stakeholder groups (Fig. 3.1).

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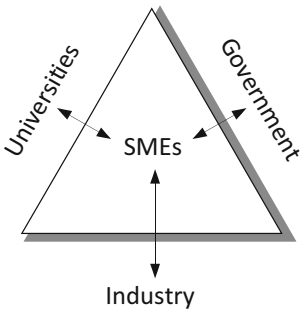

Fig. 3.1 Feedback at key interfaces with other players

Our experience of observing comparable problems in two clusters in particular—one emerging and one mature—triggered an interest in the recurring SME-related issues that impact on cluster competitiveness, and on the potential to learn from other clusters and other sectors we describe in earlier publications (Ure and Jaegersberg 2005; Ure et al 2007; Jaegersberg et al 2007; Jaegersberg and Ure 2008, 2011).

The Western Australian pilot study was one where researchers and students on placement used collaborative action research (Coghlin and Brannick 2000; Kemmis and McTaggart 2000)[1] with a range of stakeholders in the cluster to identify the barriers for SMEs on the ground, and facilitate the sharing of experience of similar problems in other more mature clusters which had already generated strategies to address these. Often crucial problems which emerged in clusters went unnoticed by economic development agencies and policymakers, through lack of representation of stakeholders at key interfaces between stakeholders.

This also resonated with previous work, in other sectors, such as eHealth and eBusiness systems, where it was apparent that managers felt most of the problems they had to solve related to recurring non-technical issues not covered in their training, but impacting on the performance of the organisation (Ure and Jaegersberg 2005; Ure 2013).

Many of the problem scenarios were recognisable across a wide range of other sectors characterised by collaboration at scale across disparate constituencies. In addition to the oil and gas study these included the automotive supply chain (Jaegersberg et al. 2002; Jaegersberg and Ure 2003, 2005; Ure and Jaegersberg 2005), collaborative engineering (Ure et al 2003b; Jaegersberg and Ure 2003, 2005; Jaegersberg et al 2007) large scale data sharing networks in bio-informatics, eHealth and telehealth networks and services (Ure et al. 2003a, 2007, 2009), eBusiness portals (Ure 2011) and eLearning networks (Ure 2001).

[1]Collaborative action research is, as the name suggests, a collaborative and iterative process with stakeholders, to share perceptions of barriers, risks and opportunities. The process of bringing actors together to do this, is often also a catalyst for a process of collaborative re-configuration of roles, risks and resource allocation scenarios. It is analogous to business process redesign (Hammer and Champy 1993), to experience-based design in health and social care service redesign (Bate and Robert 2008) and to Argyris and Schon's (1978) approach to organisational learning through action research and reflective learning.

3.2 The Potential to Share Experience of Recurring Barriers

The clear potential to mitigate significant cost and risk provided the impetus to carry out a large study across country clusters in the evolving renewables sector, to map the most recurrent scenarios in context, and share some of the strategies mature clusters have used to mitigate them.

The early Australian case was the stimulus for looking at how rapidly emerging problems on the ground could be addressed by better communication and coordination at these interfaces, and better alignment of existing resources to support that. Interestingly, many of the problem: solution scenarios encountered in this emerging W. Australian cluster were similar to others we had encountered in other industries, and in other regions (Jaegersberg et al 2002, 2007; Jaegersberg and Ure 2003, 2005, 2008, 2010, 2011; Ure and Jaegersberg 2005; Ure et al 2007, 2009; Ure 2002; Lloyd et al. 2003), most particularly in the mature UK oil and gas sector, which had just identified and addressed a number of those issues as part of a major rethink of policy and practice to facilitate SME-led innovation. Their experience was able to help the emerging WA cluster avoid the emerging risks to their SMEs as they headed down the same cul de sac the UK cluster had just emerged from.

As in many of the clusters we looked at, the lack of representation of SMEs at key interfaces meant the impact of national and regional strategy went unnoticed, or at least unchallenged until it presented a threat to the competitiveness of the cluster itself.

Competitiveness in the UK North Sea was epitomised by the CRINE[2] initiative to reduce costs, however a number of aspects of these lean strategic alliances combined to undermine many regional SMEs (Gray et al. 1995; Mackinnon et al. 2004). For example, SMEs often absorbed higher levels of risk, and had to cut costs and profit margins to unsustainable levels within the supply chain. This was compounded by poor/late payment practices to which SMEs were particularly vulnerable. Outsourcing to other countries with cheaper labour costs also meant many local SMEs were excluded. Standardisation also constrained some aspects of innovation, and added (often unsustainable) costs for SMEs in new software, hardware and training.

As a consequence, many local SMEs disappeared, together with much of the local and the specialist technical knowledge associated with deep sea drilling technologies, and undermining the ability of the region to achieve a knowledge-based advantage in a very knowledge-based market. This was the same problem beginning to emerge from research with SMEs on the ground in the W. Australian cluster. As in the UK, the problem had become apparent as innovation became a more important part of competitive strategy, and the lack of SMEs began to be seen as a problem.

[2]Cost Reduction in the New Era.

As other oil-producing regions also adopted the UK CRINE strategy of strategic alignment to cut costs, it became necessary to compete on other fronts, such as innovation. It was at this point that policymakers registered the extent to which the cost-cutting of earlier years had decimated the SMEs that had been the backbone of innovation. This was most evident in the development, adaptation and use of technology in the difficult environment of deep sea drilling. Local SMEs have a crucial role here (von Hippel 2004; von Krogh et al 2000), not only in leveraging their local knowledge and expertise, but also in sustaining regional employment, in supporting companies in the region, and in the attractiveness of that region as a base for these companies.

The PILOT[3] initiative moved the emphasis of policy and practice to adding value through SME-led innovation, and a focus on identifying and addressing the barriers faced by SMEs, and supporting them in innovation more effectively. In particular, by ensuring better representation of their interests at key interfaces with policymakers, with LMEs and with Universities. The percentage of local SMEs now in the regional supply chain is around 80:20, compared with a low of 20:80 in the CRINE era, reflecting the success of the approaches adopted across the sector.

3.3 Collaborative Action Research as a Catalyst

The research team facilitated exchange between the WA and the UK groups to share experience of the problems associated with the loss of SMEs, particularly in relation to innovation, and to consider the successful strategies adopted in the UK to mitigate them (Jaegersberg et al 2007).

Our experience across the clusters has highlighted the potential to be aware of recurring problems, often associated with particular stages of development, where practice-based research can be the vehicle for both raising awareness of these issues as they start to emerge, and for facilitating learning from other regions. The following diagram illustrates this using the Scottish-W Australian case as example (Fig. 3.2).

The book builds on the outcomes of hundreds of interviews and thousands of surveys across clusters in eleven countries.[4] The study allowed us to look at these research questions across the board, in one of the most dynamic and competitive sectors, i.e. the renewable energy sector, where costs, risks and rewards are extraordinarily high, and received wisdom still embryonic.

[3] http://www.pilottaskforce.co.uk/.

[4] A table of interviews and surveys in each Country Cluster is in the Appendix.

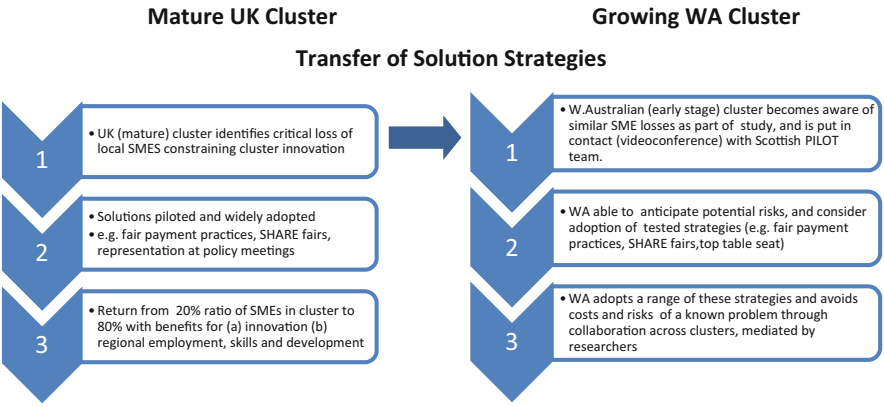

Fig. 3.2 Learning from other clusters: similar problems: different outcomes

- What are the recurring barriers and enablers for small SMEs?
- What are the implications for policy and practice?
- Are there opportunities to learn from the solutions in other clusters/domains?

These are some of the key questions we hope to answer in the following chapters.

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Chapter 4
How Have We Explored the Issues? The Californian Case as an Example

Abstract The Californian Cluster study is presented in such a way as to familiarise the reader with the methods we used to explore the barriers, and to introduce the context on the ground, where different arrangements of people, procedures and technology shape the outcomes. The chapter provides an introduction to the geographical, historical and cultural context, as well as the operating environment of the solar cluster, as context for understanding the issues raised. It also provides an overview of the methodology, highlighting the benefits of combining qualitative and quantitative approaches to understand where and why problems arise, and the potential for addressing or mitigating them. This includes the initial use of qualitative interviews to elicit themes as stakeholders see them, through to the elaboration of semi-structured surveys to validate, explore and quantify the issues in greater depth, with a wider population. The chapter uses the outcomes from the Californian case to introduce some of the recurring barriers that appear in other cases, in areas such as policy, research, innovation and training, and explore some of the implications.

4.1 Mapping the Cluster

Mapping the Cluster in a Geographical Context

The first stage in all the case studies was to map the cluster in a geographical context, as in Fig. 4.1, to better understand the location and co-location of different actors that interviewees refer to. Seeing the different solar installations in geographical context helped in understanding some of the barriers and enablers raised in the interviews in 2010, when this part of the study was completed. Figure 4.1 for example, highlights the fact that most projects in the North near San Francisco were typically small scale PV projects, whereas those in the South, nearer Los Angeles and the Nevada Desert, were often larger-scale solar thermal projects. This provided context for understanding the responses from company managers in these different regions.

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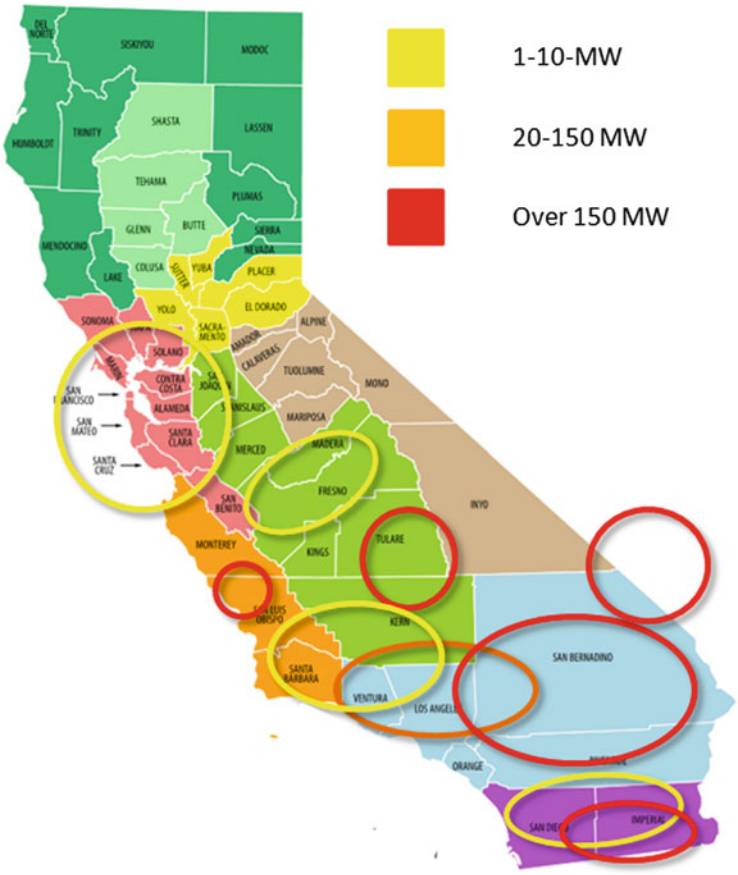

Fig. 4.1 A mapping of the planned and installed solar system capacity in the region at the time. Those in *yellow* are small PV installations, while those in *red* are typically larger solar thermal installations. It draws on data from different sources, including the US Solar Energy industry Association (SEIA). The data is shown on a map reproduced from Wikipedia under a Creative Commons Share-Alike licence. Source: https://commons.wikimedia.org/w/index.php?curid=9620227

In a Historical and a Legislative Context

At the time of our field study in California, between 2010 and 2011, the PV cluster was in the early stages of development but with a history of success in diversifying and building on existing expertise in other clusters.[1] In addition to the advantages of a milieu characterised by high levels of skills in co-located clusters, high levels of

[1]The same silicon which gives its name to Silicon Valley is the basis of the silicon wafers used to harness solar energy.

investment, and an openness to innovation and entrepreneurship, the state had engaged pro-actively in policies to support the development of renewables. These included financial incentives[2] such as tax incentives, grants, loans, Feed-in Tariffs, financing for home installation, and Net Metering,[3] the Regulatory Policy Act (PURPA), the Energy Tax Act (ETA) the Emerging Renewables Program (ERP) and the Self Generation Incentive Program (SGIP). Further spurred by the impact of the energy crisis in 2000, and an awareness of the disadvantages of reliance on providers in other states, the California Energy Commission (CEC)—the primary energy policy and planning agency in the state—also provided market support to existing, new, and emerging renewable technologies; providing incentives for solar electricity systems in new home construction (California Energy Commission 2009).

Desktop research on the factors underpinning its development provided further context for understanding the concerns reflected in the interviews and the survey. This initial research also provided useful background information on the region, such as the famous inventiveness of the region as a hotspot for entrepreneurs (Albergotti 2006), the approach to competitiveness (Saxenian 1996; Hanak et al. 2008; Lecuyer 2006; Lee 2000), and the benefits of a whirlpool of mobile talent and skills in an environment where the exchange of knowledge and resources was easier than in many other competing regions, and there were unique opportunities to learn from both the successes and the failures of others. Saxenian for example, says that "The resilience of the Silicon Valley is the product of the region's dense networks of social, professional, and commercial relationships, not simply of unfettered markets or national policy" (Saxenian 1990, p. 91). Although the book focuses on barriers, the study collected feedback on enablers also (See Fig. 4.2). While the enablers are not the focus of this book, it is worth saying that those in California provided a unique profile which contrasted sharply with those in the other clusters we looked at. Some of these enablers (See Fig. 4.2) are revisited in more detail in Part III and in further material available on our website on www.cluster2cluster.org

[2]Database of State Incentives for Renewables & Efficiency (DSIRE)—the U.S. Department of Treasury—Renewable Energy Grants website http://www.dsireusa.org has detailed information by state and by year.

[3]The Net Metering law in 1996 required all utilities to let solar installations feed in into the Grid.

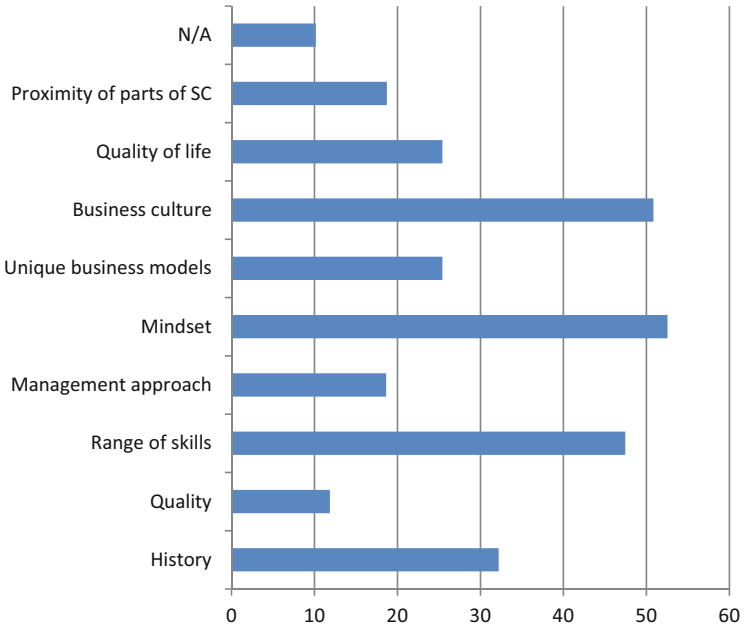

Fig. 4.2 What were the perceived enabling factors in the Californian cluster?

All of this was echoed in the ways in which interviewees described some of the enablers in the cluster, which, emphasise the benefits of a dense network of skilled professionals from different sectors, with intermediary brokers such as law firms, associations and venture capitalists, in a culture characterised by success in generating and successfully supporting innovation.

Mapping the Actors in Context

We also found it helpful to map interview and Survey respondents in terms of geographical context, and in co-location with other key organisations. The map in Fig. 4.3, for example, highlights the location of the 59 company managers participating in the study, and in relation to Universities and research laboratories.

Location

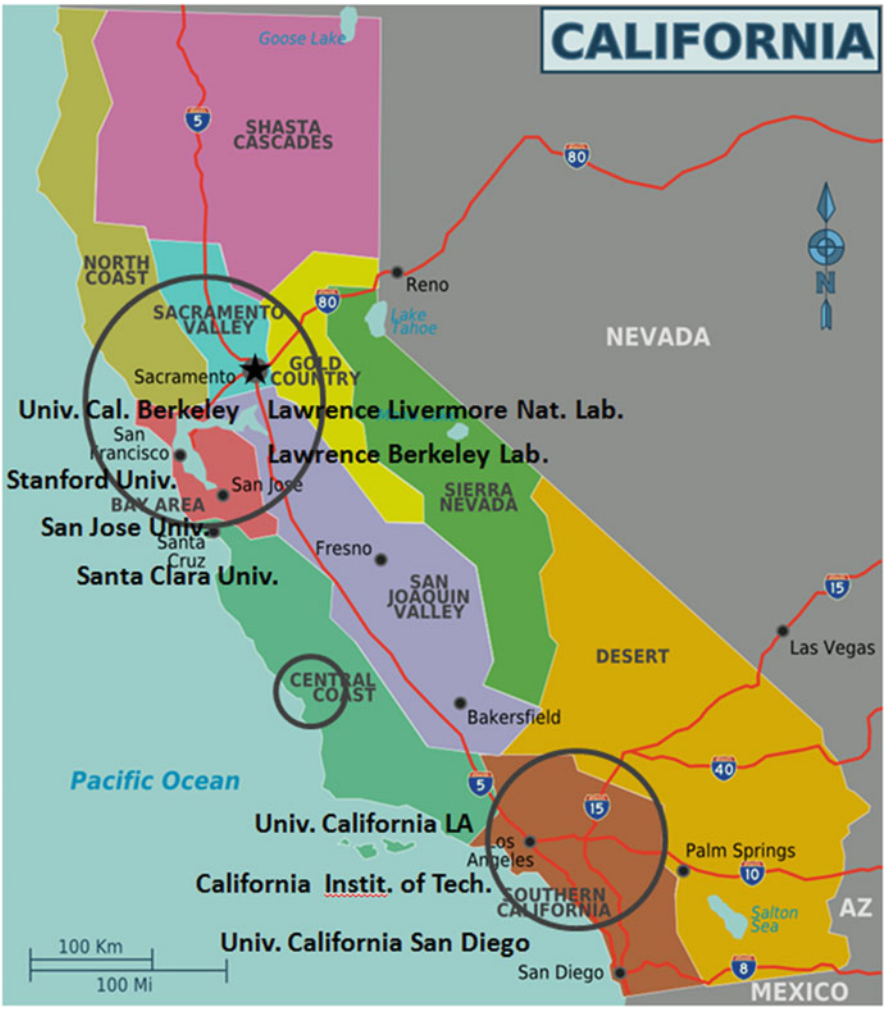

Fig. 4.3 Mapping companies and research organisations in geographical context. Adapted from the original by Romy Rolletschke, using data collected for the project in 2010. The map on which the data is displayed is reproduced from Wikimedia under a Creative Commons Attribution-Share-Alike licence. Source: https://commons.wikimedia.org/wiki/File:Ca-regions.png

Focus

Although the book will focus on the discussion of the most barriers to cluster development, the scale and detail of the additional data collected provides the basis for much more detailed analysis, filtering and cross-referencing than is presented here. The detail on company location, size, activity etc. for example, gives us a means of looking at perceptions of barriers across very different segments of the cluster. The database provides a means of correlating outcomes with a rich range of

other variables—from the size, location and activities of different stakeholders to their perceptions of salient issues. In the Appendix to the book, there is also a breakdown of the surveys and response rates for all the clusters.

Mapping the Field of Activity

In California, as in all the other cases, the majority of respondents were company CEOs, active in the production of the modules and the installation of systems which involves much more collaboration with other small companies than the production of the cell or the wafer. They were therefore well-informed interviewees, familiar with the issues from personal experience. Although this information is not presented in the cases that follow, it has informed our understanding the nature and frequency of many of the different concerns raised. It was evident for example, that many of the companies in the cluster were involved in collaborative activities involving assembly and installation (Fig. 4.4).

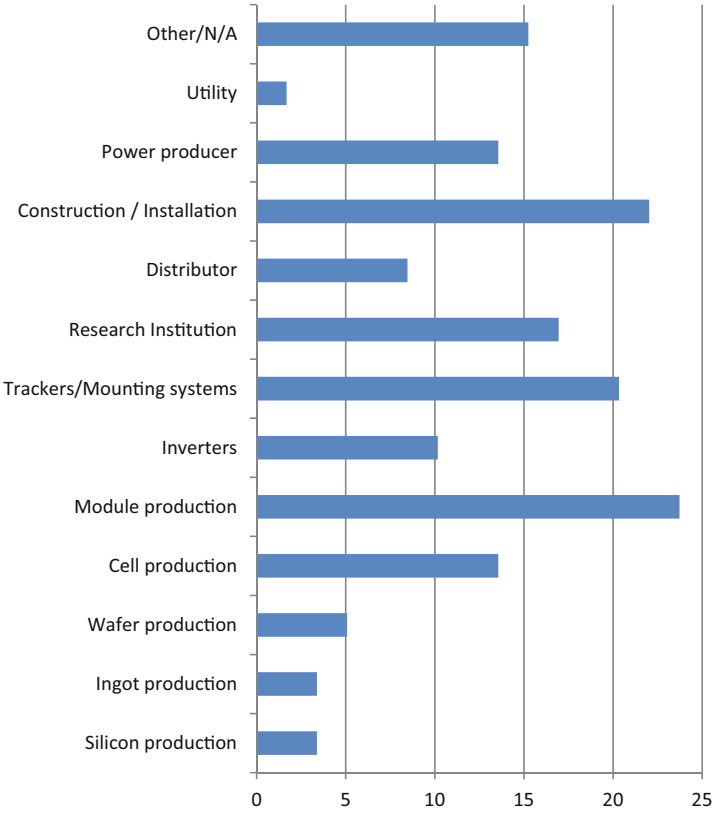

Fig. 4.4 Area of activity. Most respondents were involved in activities involving collaboration with other companies in the cluster, and with administrative and legislative agencies. Note that some companies were engaged in more than one activity. Those indicating 'other' activities included consultancies, government agencies, design companies and testing facilities

Size

We can see in Fig. 4.5 that almost 90% of the company managers who responded were in SMEs, which reflects the makeup of the cluster, and that these were mostly based in the Valley, but with a small group based further afield.

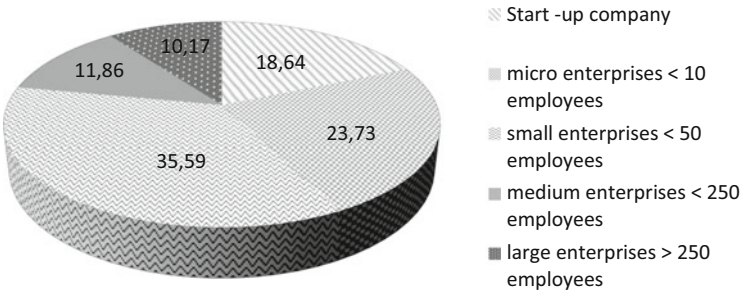

Fig. 4.5 Size of companies in the sample (The definition of the size of an enterprise by staff number is based on Article 2 of the EU recommendation 2003/361. According to this, the staff headcount is the main criterion for size, however further criteria such as turnover or balance sheet total also play an important role. In the survey and the interviews, we only asked respondents for the staff number of their company)

This allowed us to filter the responses, to confirm, for example, that companies in the Valley felt more in touch with policymakers than those further out.

Mapping the PV Production, Assembly and Installation Processes

Understanding the processes companies are involved in also provides further context for understanding the barriers that can arise, and the options for addressing them. In the solar sector, the majority of the companies in the cluster were involved in assembling and installing solar modules. (The surveys have detailed feedback on the size, location and activity of the companies).

As Fig. 4.6 shows, the administrative installation process (within the dotted red line) involves a great deal of engagement and coordination with other companies and other regulatory and administrative bodies. It is at this stage that most SMEs operate, and interact with other players. By definition, this is also where delays and problems can impact on the performance of both individual companies, and the cluster as a whole.

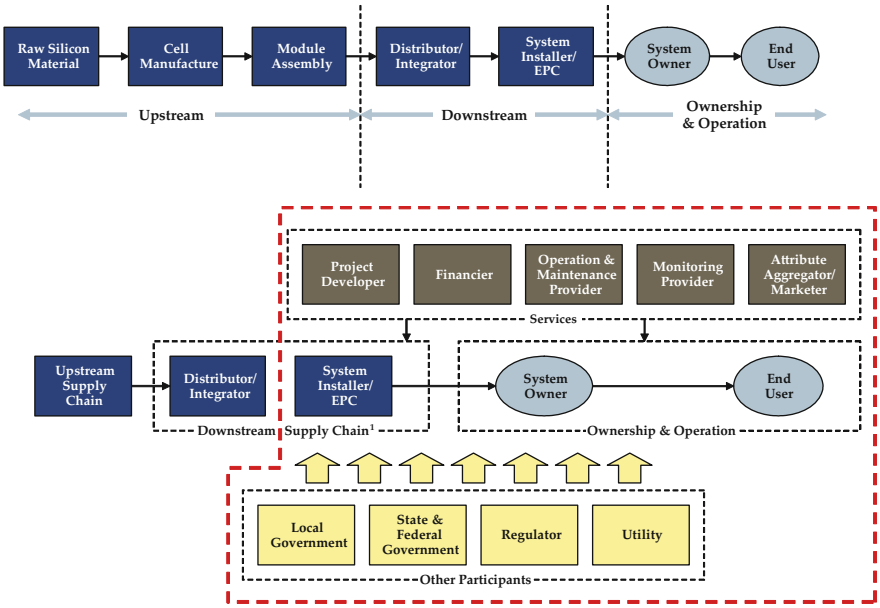

Fig. 4.6 Collaboration between players in the silicon PV supply chain. Image adapted by Romy Rolletschke, and reprinted with kind permission of the National Renewable Energy Laboratory, from http://www.nrel.gov/docs/fy08osti/42304.pdf. Accessed March 14th, 2016

With thousands of small companies integrating, assembling and installing the elements, it is here where communication and coordination between people, processes and technology can be most critical, and where lack of standardisation and inter-operability are also constraining factors. The upstream and downstream PV supply chain is complex because of the range of different companies involved and the number of essential interactions with other agencies providing services, permits, and certificates among other things.

In such a complex sociotechnical environment (involving people, processes and technologies), communication and coordination processes play a key role in mediating performance. Are there bottlenecks? Do some players benefit from arrangements more than others? Are there arrangements that might improve the outcomes for individuals rather than for the cluster as a whole?

These are issues which impact on quantified performance, but addressing them requires an understanding of the issues from the perspective of players on the ground. We adopted qualitative and quantitative methods to allow us to document issues at scale, but also to have qualitative insights to understand how barriers arose, and what could be done to mitigate them.

4.2 Methodology: Qualitative and Quantitative Approaches

The cases presented in Part II of the book draw initially on the issues emerging from the interviews, in the context of that cluster at that point in time, and relate the issues to the findings in the survey so that the reader can see the barriers initially from the perspective of the actors and then validate and quantify them in the surveys with a wider and more representative population across the region. This approach combines the strengths of both approaches, while minimising some of the risks (Table 4.1).

Table 4.1 Value of a combined approach

Methodology	Certainty about themes	Certainty about representativeness	Time required
Qualitative Methods (Interviews)	high	low	high
Quantitative Methods (Surveys)	low	high	low
Combining Interview and Survey Methods	high	high	moderate

Qualitative approaches allow higher certainty about the key themes, being derived from unstructured in-depth interviews that allow the interviewee to structure the data, rather than the researcher. The interviews in the study for example, are transcribed and the themes are coded by two independent researchers in what is an iterative and collaborative process. Interviews and analysis are continued until no new themes appear.[4] This is time and resource intensive however, and thus tends to mean smaller sample sizes, risking lack of representativeness.

Quantitative survey methods on the other hand, allow more certainty about the representativeness of the sample, covering a much wider population. They are also faster and easier to administer. Often however, the questions and the themes represent the assumptions of the researchers rather than the respondents, and questions are often too structured to allow new or unanticipated themes to be identified. Building quantitative survey materials around the qualitatively elicited themes allows the researcher to get the best of both worlds.

In Part III of the book we summarise and discuss the surveys, highlight the cross-cutting issues, refer back to examples from the individual cases, look at the context of the literature and discuss the implications for policymakers.

[4] A process known as "saturation".

Interviews

Initially, we used qualitative semi-structured interviews with well-informed stakeholders, to scope the gaps and the barriers that seemed important to them in key areas, such as policy, innovation, cluster development, as well as their views on how these could be addressed.

The analysis of the recorded interviews allowed us to scope the issues, as a basis for exploring them with a more quantifiable survey structure, and for interpreting the outcomes. Interviews were continued until 'saturation'[5] across a maximum variation sample.

We used an established technique known as grounded theory which is based on two researchers independently coding each section of the transcribed interview to arrive at themes (Glaser and Strauss 1967; Strauss and Corbin 1998).[6]

These semi-structured interviews were typically 30–40 min long, and allowed interviewees opportunities for extended feedback around a topic guide in their native language—English, Spanish, German or Portuguese.

Surveys

The survey in California took place in February–April 2010, just before the expansion of the solar market in California, and only a subsection of this is used in this initial overview of barriers.

Based on the themes in the interviews a questionnaire was drawn up. We used an extensive database of contacts[7] created as part of the original desktop research, and developed with additional information from interviewees and other resources during the study.

An online survey was then sent to as broad and representative a sample as possible. In this way we hoped to optimise the benefits of both qualitative richness

[5]No new issues were appearing.

[6]For those interested in this theme, other very relevant and related approaches are (a) critical action research (Vince 2012; Trehan and Rigg 2011; Ram and Trehan (2010) that looks at barriers to change, and at power relations, often in a business context; participatory action research (Reason and Bradbury 2008; Kemmis and McTaggart 2000) as a catalyst for engaging stakeholders in the process of jointly understanding and reshaping strategy and/or practice. The emergence of 'strategy as practice' (Jarzabowski 2005), is another emerging 'flavour' of this, and also provides a vehicle for more collaborative leverage of what distributed stakeholders know and can do to in shaping strategy.

[7]In some clusters, such as Latin America, it was harder to find representative official lists, especially for SMEs, and here we used the 'snowball' technique, essentially asking those we contacted to recommend further names. In early stage clusters there were often small numbers of organisations where the supply chain was still being implemented. In 2010/2011, Chile, Uruguay and South Africa fell into this category.

and explanatory power, with the benefits of validation and quantification across a much wider and more representative population. Significant follow up was involved to provide support in completing the questionnaires, and we have only included surveys that were complete.[8]

The standardized questionnaire was built around the themes emerging from the analysis of the interviews, under key topic headings. These included perceptions of barriers to

- the development of the renewables sector
- the development of the cluster
- the development of companies

These included more specific perceptions of their experiences in relation to

- innovation
- communication and collaboration with other actors e.g. policymakers, Universities, other companies

Analysis of the interviews generates themes that reflect the landscape as users experience it on the ground, as opposed to those that might be assumed by the researcher. Using this as a basis for developing the survey themes ensured that the surveys did not pre-empt the issues, as is often the case.

These were carried out in the language of the region,[9] and adapted to include questions on relevant regional issues, but coded in English and translated for use here. (A sample survey is included in the Appendix to the book).

In some clusters (e.g. Germany, California, Italy), this was also part of a collaborative action research strategy where the researchers also acted as a catalyst for stakeholders to engage with the emerging issues and consider strategies from other regions, as seen in the W. Australian cluster.

It is worth noting that each of the cluster studies was done independently, and the surveys were developed around the issues arising from interviews in each cluster, so although many of the topics cut across clusters, there are also issues which were cluster specific.

As we completed more cluster cases, it became abundantly clear that there were very recurring issues across these very different contexts, many of which reflected the way people, processes and technologies were configured, particularly on the ground, where gaps, inconsistencies and inequalities shaped interactions and outcomes.

As the study continued, we gained further insight into these issues, and were able to ask more detailed questions to better understand the evolving issues. Therefore, the more recent studies include more detailed questions that were not asked in the very large early studies such as Italy.

[8]Or as fully complete as possible, given that not all questions were applicable to all organisations.

[9]These were carried out in English, German, Italian, Portuguese and Spanish and quotes used in the book are translated from the original.

A great deal of detailed data is available that is not used in the book, as we have focused on the most recurring cross-cutting issues, however more detail can be provided on particular topics, and in correlation with a range of different sample characteristics evident from the sample surveys provided (See www.cluster2cluster.org).

4.3 Stakeholder Perceptions of Barriers

In the discussion of the cases in the book, we look specifically at recurring barriers to development and to competitiveness across the clusters, at the key interfaces where they typically occurred, and where there are opportunities to address or mitigate them (See Fig. 4.7).

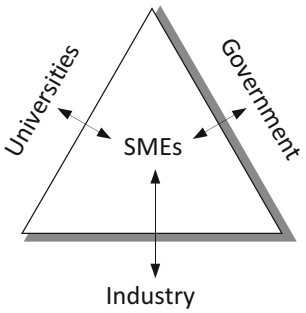

Fig. 4.7 Feedback at key interfaces with other players

Barriers at the Interface Between Companies and Policymakers

The exchange of information at the interface with policymakers is the prerequisite for the development of policies that meet the needs of companies/SMEs and hence also for the evolution of the cluster. We asked company managers about their access to and experience of interaction with policymakers, as well as their views of current policies, such as FiTs and other subsidies, tax breaks, grants, loans, rebates grants and clean energy financing programmes. It was clear from interviews and surveys across all cases that small companies in particular felt their needs were poorly understood or met, and, in the Californian case, particularly at federal level (See Fig. 4.8).

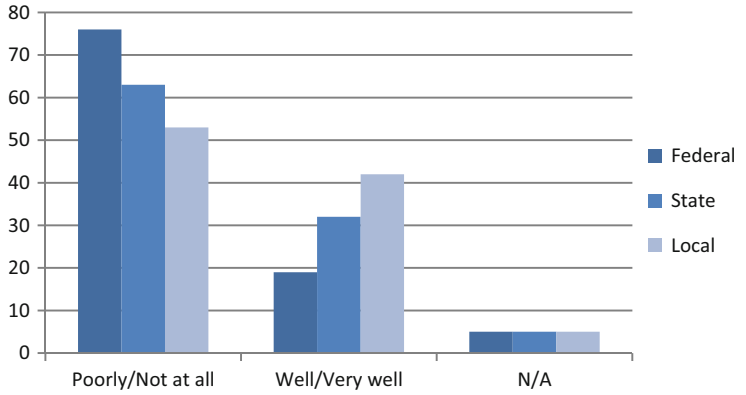

Fig. 4.8 Respondents clearly felt that their needs were less well recognized at a national and a federal level

SMEs Needs Were Less Well Represented at the Policy Level

While there were a number of exceptions with positive experiences in California, many of the interviewees from SMEs and start-ups felt that they needed more input into the policy discussions that shaped the political infrastructure in which they operated, when compared with larger, more established companies in the region. As a result, they felt their needs were often not met. This subsequently emerged as a recurring issue also in all the clusters.

One of the examples of this was in terms of financial support for the kinds of small scale projects that were the focus of the SMEs who made up most of the cluster, where banks were less likely to provide loans, and government funding applications were often prohibitively bureaucratic and time-consuming to complete, or geared more to larger projects.

SMEs also felt disadvantaged in their ability to access funding and support for concept development for company led innovation, given the different incentives and modus operandi of potential University collaborators.

> *There is a ton of hurdles for a small company . . . there is a lot that they can do for small companies. (Interview 7, SME)*

> *Policymakers are not interested to talk to small companies. They just talk to companies which have deep pockets and they want to have some donations before they do any decision. (Interview 3, SME)*

> *Unfortunately policymakers seem to listen a little bit more to the big guys. . .and. . .utilities of course. . .some of the larger players in the solar industry resisted us and didn't want a German style FIT.*[10] *That was eye-opening learning for me. Wait a minute. 'Why do they not support it? That is good for them.' But in a lot of cases they did not want to support it I think, mainly, because a Fit will level the playing field, which makes it easier for all to enter*

[10]Feed-in Tariffs as an incentive to stimulate the market.

the market [. . .} And the big players have rolled into the dominant position in the market, so they do not necessarily want to see all these new competitors coming into the market. (Interview 14, Nonprofit Solar Advocate)

The mismatch between policy and the needs of smaller companies was typically attributed to lack of engagement with SMEs, who felt their needs were less well represented or communicated than those of larger companies. This may also have been more marked in this cluster because of the larger number of respondents from the Northern part of the state, where (a) they are further from the legislative centre in Los Angeles, and where (b) the PV installations were predominantly small scale as compared with the greater emphasis on large utility-scale installations (See Fig. 4.1).

The CEOs of SMEs we interviewed often felt they did not get enough support in key areas. For example, smaller firms felt less able to access funding for concept development or commercialisation for example or to deal with the cost of delays or changes in funding, where they were more vulnerable. (Similar issues to those also were experienced in the oil and gas clusters in the UK and in Western Australia (Ure et al, 2007; Jaegersberg et al, 2007) and discussed in Sect. 3.2.)

Having identified this as a theme in the interviews, we were able to validate and explore this more widely in the survey. We could then see that local government agencies were perceived as better at meeting needs than regional or national ones, (See Fig. 4.8), as SMEs were more embedded, and the culture of networking and support within the Valley itself clearly had an impact.

In all the clusters, barriers to two way communication and collaboration was a highly cited issue, and even in the networking culture of the Silicon Valley context, though to a lesser degree. Interviews and follow up surveys highlighted that communication and coordination between small and medium-sized companies and (a) policymakers, and (b) Universities was the focus of a number of perceived barriers for this group.

In California, the communication with policymakers and with Universities/R&D agencies was rated "Poor" or "Bad" by over half the respondents (See Fig. 4.9). Again, the interviews provide much of the context for understanding this.

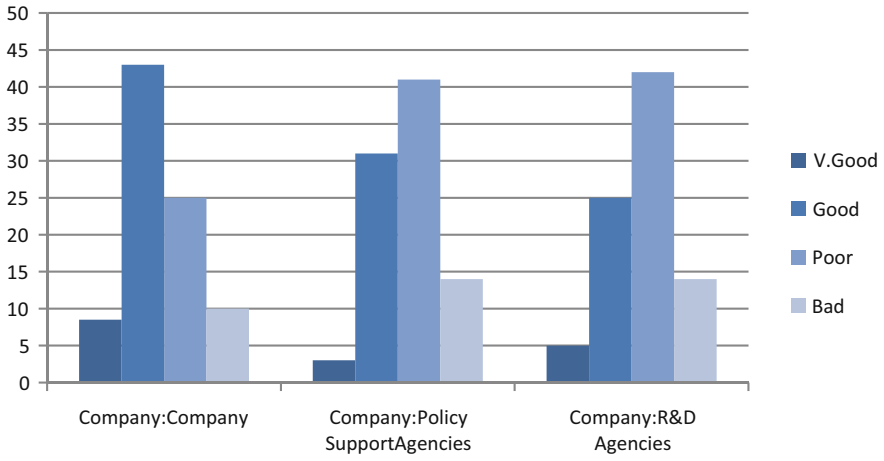

Fig. 4.9 Communication and coordination with other stakeholders

Asked separately about scope for improving collaboration, the government interface was the one where respondents felt collaboration could be improved the most, by 74.6% (See Fig. 4.10).

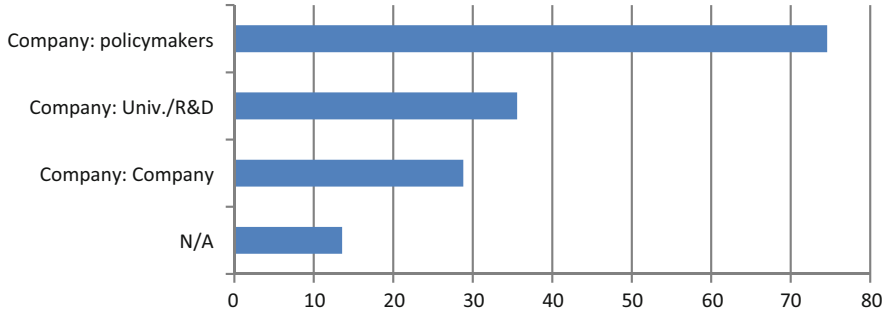

Fig. 4.10 In this question, respondents were asked "Where could collaboration be improved?"

In the context of innovation, where collaboration might have been seen as an opportunity to benefit from complementary skills, knowledge and resources, over a third still felt there was a distinct lack of benefits for collaboration with other companies and with research institutions—particularly SMEs, and particularly out of the central locations in the Valley.

For many SMEs, the match of policy to their needs, and concerns was seen as being constrained by the greater access of other larger players in the cluster, and the direct and indirect subsidies they were perceived as benefiting from. This was again a consistent theme in interviews, and the surveys, as well as being one of the very cross-cutting themes in other clusters presented later.

> *So more on the dark side the nuclear industry, the coal industry and also oil and gas they are fighting hard to keep their laws on their side. You can actually track that. (Interview 3, SME)*

> *Oil companies and their influence on governments ... lobbyists on the payroll of those companies. (Survey respondent)*

> *Oil and coal industries have been gotten too much subsidy from the US government. (Survey respondent)*

Our surveys provided a useful opportunity to quantify themes such as this, emerging from the interviews. This was one of the top two barriers in California, selected by around 50% of those who answered, and respondents rated such barriers as crucial determinants in the development and success of both their own businesses, and the cluster as a whole across different clusters.

One of the selling points of clusters is purported to be the potential value that can be created through the sharing of knowledge and skills across the sector, as well as the more strategic alignment of companies to create shared value—whether in terms of a competitive offer, or an innovative development or proposal. Based on

the themes arising in the interviews, the surveys were developed to explore this in more detail with a wider audience, and we asked companies about communication with the other key actors, and other clusters.

Another recurring issue was the impact of administrative bureaucracy—which introduced costly delays and barriers in the realisation of projects of different types, at different stages.

Bureaucracy and Fragmentation in Policy Implementation

> *In the US bureaucracy is intense . . . a big showstopper sometimes . . . and it costs a lot of money. (Interview 3, SME)*

> *The US is fragmented. You have to deal with local authorities, with regional authorities with the state, with the federal government; with the tax authorities . . . everybody is doing it differently. (Interview 6, SME)*

> *It is an enormous bureaucracy to find government money for your start-up . . . It is a bureaucratic approval process rather than a market mechanism. (Interview 7, SME)*

Bureaucracy was a very significant issue in all the clusters, and California was no exception. Over half the survey respondents highlighted it as a barrier—second only to the financial barriers discussed in the next section. Administrative interfaces and documentation were seen here as constraining or impeding transactions, instead of facilitating them. Companies in the solar sector are heavily dependent on the ability to quickly and easily access a wide range of permits, certificates and other documentation, particularly for the installation of PV modules (See Fig. 4.6), and also for funding applications and proposals. This involves exchanges with a wide range of different regulatory bodies,[11] on paper, or online, to initiate and complete work for clients. These essential administrative processes are characterised by complexity, cost, delay and fragmentation in almost all the clusters, including California.

This was compounded by the lack of coordination between regions, between policies, regulations and between administrative processes, many of which were the responsibility of different jurisdictions—from permits through to building codes.

Such asymmetries can also be reinforced by the nature of real or virtual interfaces for managing such transactions. The increasing use of digital interfaces for such interactions also provided new opportunities both to facilitate and to constrain, (something that sociologists like Paul Dourish (2001) have written extensively about, since it provides a fascinating new set of opportunities for changing power relations between actors).[12]

[11]Standards and regulations are also very fragmented, and this is again something that recurs across the cases as a significant barrier.

[12]The Portuguese case in Chap. 5 provides a case in point.

Interoperability

There was real concern with the problems incurred by lack of standardisation, particularly in building codes (60%), in dealing with obsolete interconnection standards (63%) and in dealing with Power Purchase Agreements (PPAs) that were not standardised.

> *A more uniform US market would help reduce complexity for solar companies who now operate in a patchwork of policies and create extra inefficiencies and costs for all. (Survey respondent)*

> *Let's say you want to put solar panels on your roof—every municipality in the entire state of CA has different building codes. If all of the building codes in California were the same it would vastly reduce the price. It would make it easier for the companies; it would make it easier and faster to put them up. If there were a state-wide policy on building codes and fire codes on solar it would make a tremendous difference. (Interview 17, University professor, Project leader).*

This again was a recurring issue—not surprising given the fact this was a relatively new sector, where many of the regulations, standards and conditions for development were spread across different agencies, as well as different regions.

> *Everybody is doing it differently. If you go to Berkeley you have to deal with a completely different environment than in Palo Alto [. . .] I mean here—if you have to negotiate on your own with the utility over a contract, a Power Purchase Agreement, and then they just tell you "No", we do not like you. You are too big, too small, too far away from the grid. And they have different tariffs for everybody. It is like a marketplace. There are so many different negotiations going on, instead of one standard contract. (Interview 3, SME, Solar distributor).*

Bureaucratic barriers were intertwined with financial barriers also, in that the delays occasioned by complex procedures for permits for example had a financial impact, and the complexity and bureaucracy inherent in applying for funding discouraged smaller companies without the time and human resource to dedicate to it.

Financial Barriers

In California, many felt there was significant financial support for solar, and to a greater degree than in many other clusters.

> *California has the strongest solar incentive program which is called California Solar Initiative, which is a 3 billion dollar program, which is really helpful. And now, on the federal level, there is this incentive tax credit (ITC) so I think that the solar industry has received very favorable support in terms of legislative initiatives. (But) it can always be better right? (Interview 9, SME)*

Although the availability of significant funding from government and investors was in no doubt, however many felt that it was not always equitably distributed, and not always targeted in the key areas for project development, and for innovation. The surveys allowed us to quantify the perceived funding barriers raised in interviews, and to explore other aspects in more detail (See Fig. 4.11).

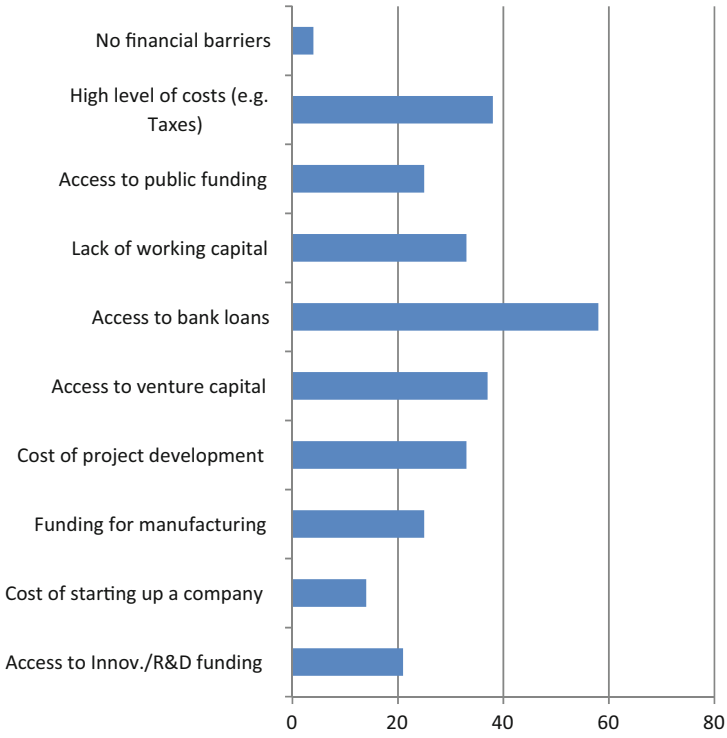

Fig. 4.11 Types of financial barriers identified

Funding Such as Bank Loans Was More Critical, But Less Accessible for SMEs

Access to bank loans, and funding for SMEs and start-ups was clearly an issue in all the clusters which came out of the interview analysis. This gave us the opportunity to quantify different aspects of this in the survey, so that it is clearer how these concerns could be more specifically addressed.

SMEs found it harder to get bank loans to develop projects or innovations, because of the risks involved and the limitations of their working capital, even when banks had funding ear-marked for renewable projects.

Many also felt that the funding offered by government reflected the interests of larger companies rather than small ones, and that accessing them were too resource intensive.

They reflected the perception that the incentives are there, but are less accessible to SMEs and start-ups, for a wide range of reasons, including the perception of risk by banks, the focus of the funding offered, and competition for the funding that was available.

Policy, specifically grants, suck for small companies because we don't have lobbyists, which is the chief and often only way to get attention at the US federal level (Survey respondent)

Most of them just go to big companies who know how to score those grants, which is disappointing [. . .] They are aimed at larger companies anyway. (Interview 7, PV module development/design for rooftops, start-up)

A start-up has rarely the resources to apply for government money. (Survey respondent)

The US will fall behind because we don't make it easier for start-ups to develop new technology, in my opinion. (Survey respondent)

There were interesting comments also about the need to see investment in renewables as requiring a very different model from that of high tech and software of the kind investors in California were familiar with, where Venture Capitalists (VCs) were accustomed to large returns on relatively small investments.

An Uneven Playing Field for Smaller Companies Seeking Funding

While larger companies could cover a shortfall in a range of ways, smaller project developers had to find investment for each project, and as one interviewee pointed out, one of the problems in financing projects is that there was not a FiT sufficient to fund a project.

Even with the federal tax incentives and loans there is still a gap in project finance and a lot of these smaller developers do not have this working capital to fill that need [. . .] But I just think we are kind of in a gridlock, because if we do not raise that then it will be hard to get a lot of those projects financed. (Interview 16, Law firm)

Many felt funding was tailored more for larger companies, with consensus that there was a need for some kind of long-term security of funding regimes if companies (and particularly small companies) were to be able to commit to project and product development. As in the Canadian case (Chap. 7), much of the discussion in the interviews was on the relative merits of tax credits or reductions, European style Feed-in Tariffs (FiTs) and other alternatives.

So I think that the US in general, not only in solar, prefers to provide incentives in such a way that it does not alter the market but it actually helps to lower costs through tax credits or something like that. How policies normally work. There should be something at the end that does not rely on an artificial market but rather is competitive with the existing before. (Interview 12, PV Consultancy Company).

I would relieve the load and tax burden of SMEs. Because SMEs employ 70% of the working force in the US. I would work on a tax package (Interview 2, SME).

SMEs in particular felt taxes and other costs could be reduced—even membership of associations was felt to be at times prohibitively expensive.

The Bureaucratic and Time-Consuming Nature of Applications Was Also a Barrier

The process itself was seen as something that hard-pressed small businesses who did not always have the resources to complete. This in itself was perceived as a disincentive to early stage businesses in particular, and is highlighted in other questions, as well as interviews in all the clusters.

> *It is difficult. The stimulus is there [. . .] I know some companies that got R&D grants of about 150K$ and we applied for three grants and have not gotten anything yet. And I think if we had professional grant writers it would be easier for us, but we do not have the time. But for us it is just easier to go to the Cleantech Open or the Dutch Postal Code Lottery thing—some of these things where they do not expect you to have a special format [. . .]. I do not have the resource. (Interview 7, SME)*

> *The 15 step program (they call it sarcastically "Two Step Program"—as in Step one—fill them all out and Step two—wait for dumb questions..) and over 100 pages will make you pull your hair out screaming. (Survey respondent)*

> *Everybody is waiting for the Obama stimulus money coming through from Washington. But if you see how difficult it actually is to get the money—it is mind-boggling. Again you have to pay a lot for lobbyists and grant writers and still then you have to raise equity in order to get the loans or stimulus money. So this mainly goes to the later-stage companies and not to early—stage companies. (Interview 3, SME-solar distributor)*

There were mixed views of access to other kinds of finance such as VC and Angel financing, which some felt had become less available than had previously been the case.[13] The concerns about long-term funding policy reflected the vulnerability of smaller companies to sudden changes in the political headwinds in relation to renewable funding.

Need for Long-Term Security of Funding Was Critical for SMEs

In California, the long-term commitment to renewables was less in doubt than in other clusters, however there was still a lack of security in terms of long-term funding for small companies, and also for very large high risk projects if they themselves were to commit to taking on staff for large scale projects in a high cost, high risk sector where there is still a lot of uncertainty.

> *If you are a company and you know right now there is money, and if you don't know that there is money next year, you cannot hire a bunch of employees because you might have to fire them all. And pretty much, in the US, the solar industry is a rollercoaster ride. There is a lot of money. There is no money. There is more money. And there is no money. And the companies are very clearly about making a long-term investment. If you want to open a new plant they need to know. I mean, their investment strategy basically says "We need to have*

[13]These interviews were carried out in 2010 and 2011 and reflect economic conditions at that point.

profit over ten years" So then you need to be able to ... as a company ... to budget for that. And right now it is impossible. The funding is completely schizophrenic.

I think it is a question of political willpower. I mean right now the Governor of California is saying the right things but he hasn't put a lot of money behind it. The talk sounds good, but it isn't in fact expensive and it's not something that he has invested a lot of money in, and I would also say from a national perspective, last year was a good year for making some good investments but development of solar needs far more than anything else. They don't need one good year—they need a long-term commitment to investment in the industry. (Interview 17, Assistant Professor, Project Leader).

Asked what changes in funding policy would make a difference, the need for long-term security was very evident, as well as access to capital. (See Fig. 4.12).

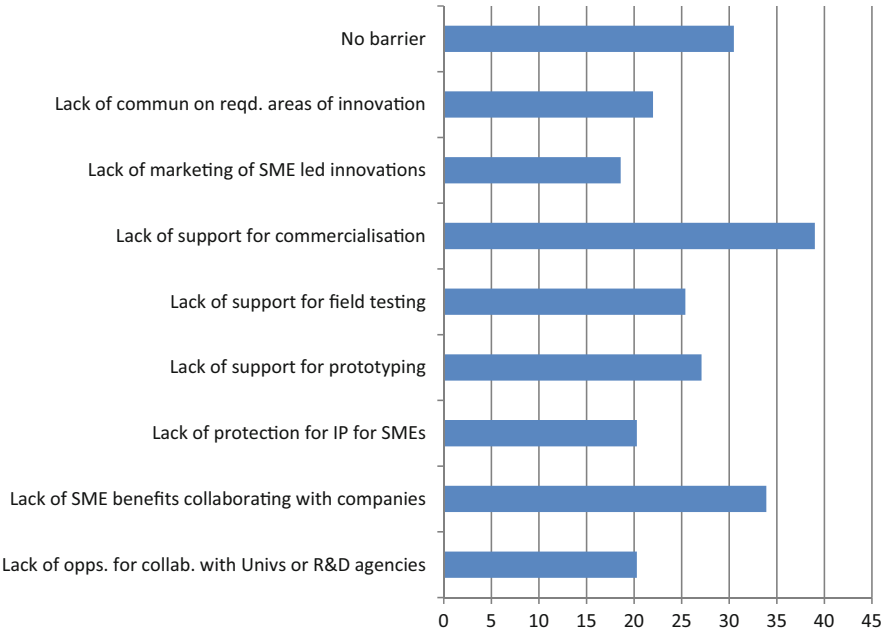

Fig. 4.12 Policies respondents felt would support cluster development as a whole

Need to Offset Risk for Innovative Installations at Scale

Some interviews also suggest that the nature of funding required to support the development of renewables was very different from the funding used in other sectors. They felt that large installations incorporating new technology required more long-term support for infrastructure and for offsetting risk.

So an incentive for some kind of a government program that would allow technology companies to reach a certain level of commercialization with the product—that would be very useful—that could be somehow a financial guarantee or I do not actually know what the mechanism could be—I could be wrong but that is the biggest hurdle for technology companies. (Interview 9, Business accelerator)

> *So the innovation is there and the VC model is putting a lot of money into innovation also, but it is the commercialization—so in an ideal world there would be a program by the government that minimizes the financial risk of building a commercial power plant. And you build the commercial power plant—let's say a 10MW plant that is going to cost you like 15M$. And so that is a big investment for a new technology—hoping that it will last the 25 years—because you only start to make money after 7 or so having some kind of support that—especially these days with the financing of solar projects or any infrastructure projects. Financing is not really available. So what banks are doing—they go to the lowest risk projects [. . .] Projects with new technology inside are not going to be the lowest risk projects. (Interview 2, Consulting Company)*

In other words, despite the funding and development of innovations, there were perceived disincentives to their implementation in novel renewable installations at scale, as well as over the longer term, without a mechanism for offsetting risk.[14]

Barriers at the Company: University Interface

California has a stellar selection of Universities and research institutes including California State University, University of California, California Institute of Technology, Stanford University, Harvard Business School, and the University of California in Los Angeles in Berkeley—as well as internationally known research laboratories, such as the Lawrence Berkeley National Laboratory. These provide an almost unique resource for innovation and knowledge transfer with industry in the clusters based in or near Silicon Valley (Ibrahim 2010). The number and quality of research institutions in California should be an enabling factor in both innovation and in the development of skills and market strategy. What is most interesting is the extent to which even here, we find the same profile of barriers as we find in other early stage clusters—though to a lesser extent.

It is at this interface that SMEs would be expected to create value and find support in (a) innovative concept development and commercialisation (b) professional development, skills and training programmes.

Misalignments Between the Aims of Companies and Universities

SMEs in particular found the interface with Universities difficult and unsatisfactory in many cases, underpinned by very different incentives, particularly in relation to IP and publication. There appeared to be a more general lack of alignment in aims and at this crucial interface—particularly in the key area of knowledge transfer and its role in the creation and development of shared value (Chap. 10 looks specifically at this issue across clusters).

[14]This is something also highlighted by the International Renewable Energy Association as a barrier to the development of the renewable sector (IRENA 2015).

If I work together with a company in a project and a good idea comes out of a project, the policy of the University is that they have 100% ownership of this and no one likes this . . . if a company now is doing a cost analysis it is not a huge benefit because they do not get the IP. (Interview 17, Assistant professor, Project leader)

While there was acknowledgement that spin-out research from Universities was very positive, particularly in relation to scientific innovation, the support for smaller businesses to test, develop and commericalise their own innovations were perceived as being less well-served.

There were some good experiences, though these were more likely to be University spin-offs, than University developments of an idea brought to them by a company seeking support. (Survey respondent)

The US will fall behind because we don't make it easier for start-ups to develop new technology, in my opinion. (SME manager, Survey respondent)

This was compounded by a lack of targeted funding for the development and commercialisation of innovations by SMEs in particular. While larger companies often had in-house laboratory facilities for concept testing, this gap was particularly significant for research-active SMEs and start-ups especially.

A big barrier is how to find the fastest way to test an idea to the market and evaluate it and if the market is ready for you how to move forward really fast. And that is kind of a mindset. (Interview 9, Technology Business/in Business Accelerator)

Government Labs should provide small companies access to high-end equipment without imposing hefty fees[15] *Survey respondent*

This is a cross-cutting finding across all the clusters, regardless of the quality of the institutions, and reflects the gaps in support for SMEs and start-ups that lack the in-house support or the financial backing of larger enterprises in large part. It was clear from some of the comments also, that there was a perceived difference between the aims of industry, government and academia.

And what really jumped out is there is a really big gap between what research is and what companies are thinking and policymakers are funding. And the coordination is very poor. (Interview 17, University professor)

It is perhaps worth mentioning that most of the participants providing feedback for the study were company CEOs, and a significant number of those who participated in the study had already developed an innovation.

[15]It is of interest, writing this in retrospect, that the key issues raised by the respondents have all now been addressed, by the NREL for example—in relation to lab access for SME. Laboratory access for SMEs seeking to develop commercial innovations for concept testing or development is an issue that is crucial for the survival of research-active SMEs, and their clusters. (The National Renewable Energy Laboratory has now started providing support to meet this gap, as has the Small Business Vouchers Pilot, but at the point when the study was being carried out this remained an issue).

So this was a well-informed group, with experience of trying to negotiate the process of obtaining support at different stages of innovation—whether this was concept development and commercialisation of a product, or R&D to support renewable installations incorporating novel renewable technology in new ways, or at greater scale.

Key Funding and Support Gaps for SME Innovation

Figure 4.13 underlines the key areas where there were barriers to innovation, and this is one of the most cross-cutting of issues, even in countries such as California, endowed with world class Universities.

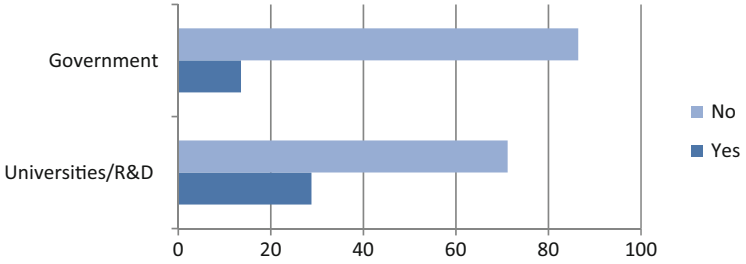

Fig. 4.13 Perceived barriers to innovation

There was also an issue in relation to the different incentives of businesses in this particular industry and universities as scientific research organisations.

> *Company XX did some advanced stuff on the material side some high efficiency cells with University XX professors who basically founded the company. And that is really high tech, but it is more science. To build a company you have to turn the science project into a viable product from finance and R&D to engineering, and from engineering into manufacturing and from there into distribution. [. . .] lots of people can come from other industries but solar is a construction industry. (Interview 7, PV module development and design for rooftops, Start-up manager)*

> *It is absolutely true that a lot of start-ups are start-ups that come out of an idea that was developed in a University that is very common especially out of XXXX. I think the University has been taking the stances for a very long time that they should have the full ownership of all of the IP. And that really hurts the University XX because it is a die for start-up companies.*
>
> *I. cannot speak for any other University. . .I would say I am running into significant difficulties in my interactions with companies because of IP issues. [. . .] So I have two companies which I work with, both of them are companies that make unique materials and research on these materials. And so far it is good that I have interaction with those companies but there have been some issues with IP because they prevented me from getting or publishing materials. (Interview 17, University Professor)*

While companies felt that there was generous funding and regional commitment for renewables in California, as compared with other regions, they would have liked to see more of that targeted towards small research-active SMEs and start-ups, and felt this most acutely in the context of R&D, for concept-testing and commercialisation in particular.

Asked whether they felt they received adequate support for R&D from government, and from Universities or other R&D agencies, this gap was very evident (Fig. 4.14).

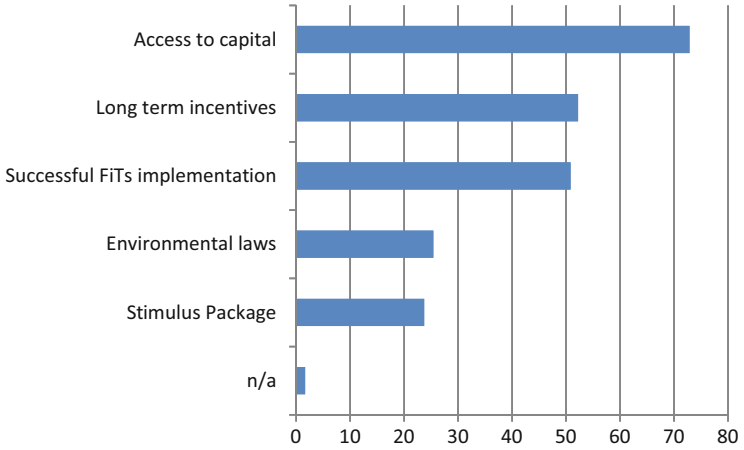

Fig. 4.14 Perceived adequacy of support for R&D from government, and from Universities/R&D organisations

Programmes such as the California Solar Energy Collaborative were just starting at the time of the study, (in 2010) and intended to act as a bridge between academia, industry, policymakers and the public, and the need for greater alignment between aims and incentives was becoming more visible.

Gaps in Professional Development, Skills and Training

> *Benefiting from an innovative culture means investing in an innovative culture—not just financially but educationally—both the workforce and the marketplace (Consultant/Bus Developer Start up)*

Professional development, skills and training programmes with those skills are essential to the development of any cluster, particularly in a new, cross-disciplinary area, yet this depends on having a responsive feedback loop from practice-based research on the ground with regard to the specific kinds of skills and professional

development which are most needed, and incentives from government to encourage Universities to invest in producing these new courses.[16]

The California case is typical in highlighting gaps in skills and PV expertise in some areas of the renewable sector although to a lesser extent than in many other clusters. It was a perceived barrier for some companies, and as a constraint on development as a whole. (It should be remembered however that this study was carried out in 2010, when the cluster was at an early stage). Asked "Is the workforce in your region sufficiently skilled/qualified for PV?" only 20% said it was not. Asked about specific gaps in the PV supply chain, however, 42% pointed to lack of PV expertise.

> *The availability of solar expertise … is lacking … is a barrier … the ratio of solar companies and people with expertise, is still not very good. (Interview 12, SME)*

> *Here I do not really feel like there are many specialists. (Interview 17, SME)*

> *I think we are still kind of immature … the barrier there [2005/2006] was there weren't that many people with experience in solar … it is still an emerging market in the US. (Interview7, SME)*

> *There are no specialists … there is a lack of knowledge everywhere. (Interview 3, SME)*

The interviews and the surveys mentioned gaps at different levels—a general lack of specialists, an unbalanced ratio of semiconductor and PV professionals, and a lack of experience in PV per se. (What is perhaps worth noting here is that many of the companies here are involved in assembling and installing new kinds of installations in collaboration with partners in construction. This requires new knowledge about cost, capacity, length of life, costings, maintenance and so forth that requires research, development and training that is new, practice-based and cross-disciplinary. Looking across clusters at the end, we see that the speed and success of development can be constrained when this kind of research and training is hard to access when it is needed) The speed with which the provision of skills is able to meet escalating demand was a cross cutting issue in all clusters, regardless of the co-location of high quality Universities, and appeared to be an interface where a more effective feedback and incentivisation loop could be set up by government to significant advantage, given the importance of skills in driving both innovation and competitiveness.

Although the cluster was, at this point, an emerging, early stage one, and these issues are now being addressed, it highlights the point that simply having the resource co-located in the region is in itself not sufficient. The density of specialised labour, and the number of Universities, laboratories and other centres of excellence in the region did not mean that these were rapidly aligned with the needs of this new industry. In the cross-cutting discussion in Part III this is shown to be one of the

[16]This is discussed in greater detail across clusters in Part III of the book.

most recurring barriers in all clusters, constraining growth, competitiveness and the ability of policymakers to fully understand the issues.

This had been recognised as an issue in the Californian cluster, and there were a range of initiatives feeding into this space.

> *I think why there was originally a lack (of workforce with expertise in solar) is because this is such a young industry and the people are still trying to catch up with. And how it grew so fast I mean out of all levels of workforces within our workforce development service with which we are targeting kind of those people with barriers of employment, without degree, starting a Green Skills Academy training people in solar installation on the ground [. . .]. Different types of labor and specifically moving into more highly-skilled labor; that is just a question out of delay moving out of the universities and getting into the workforce. (Interview 13, Local government representative).*

Lack of skills and understanding of the PV industry was seen as one of the barriers to development of the cluster here as in all the clusters, although to a lesser degree. In a rapidly evolving, competitive market, where skills and innovation are central, the feedback highlighted areas where Universities could do more to support knowledge transfer and innovation, particularly for smaller companies without in-house support for concept development.[17]

The feedback also reflects views of innovation and research that were not well-aligned. While Universities appeared to emphasise the spinning out of scientific innovation to companies, many companies, particularly smaller companies, sought support for their own innovations, for which they wanted to retain the IP and required targeted help with concept development and commercialisation. In terms of research, the emphasis in Universities was typically more on pure research (for example materials research) while many companies needed cross-disciplinary support and expertise to resolve the very practice-based challenges in the context of the development of novel concepts for integration and installations.

Interface Between Companies and Other Companies

In California, the potential to network with other companies was a strength not always evident in other clusters. Feedback emphasised the enabling role of the Valley culture, and the ease of networking as important factors in the facilitation of networking between companies and other players, and this was bolstered by the perception of many managers that the exchange and collaboration that the SV context facilitated was of real value in progressing ideas and developing innovative projects.

[17]The reader should bear in mind that the case study was carried out 2010–2011, and like the other case studies, provides a snapshot of the issues seen as important by stakeholders at an earlier stage in development. One of the longer-term aims of the study is to see how particular arrangements changed over time as clusters develop, and to look at how clusters at different stages can learn from each other.

> *It is about partnerships, whoever hooks up first with the big distributor is the next . . . it is very easy to get in contact with large companies. (Interview 6, SME)*

> *The small company that has no reputation has to partner with a larger company . . . call them . . . just show up . . . just make the relationship happen . . . we also partnered with local installation companies that would help as an independent consultant on the development of this product so we have access to our clients while developing the product to make sure we make it compatible with their needs. (Interview 15, SME)*

It was clear also from other comments in interviews with those involved in developing regional policy, that there was a view of the cluster as an international hub that actively sought the benefits of international links with companies in other clusters, and as indicated in the introduction, the range of skills, resources and relevant players in the supply chain meant that projects could be put together quickly.

> *Companies who are working with us are seeking markets everywhere in the world. We see SV not as a destination but as a point of contact with the rest of the world. (Interview 9, Technology business Accelerator)*

Strong awareness of the potential to leverage links with clusters worldwide was also a defining feature of the cluster, where many clusters took a more bounded view of other clusters as simply competitors.

> *You also need to be part of the global scene, I think the reason a cluster in the SF Bay Area has a much better chance of success is that it is the gateway from China that is so important in PV. (Interview 16, Law Firm)*

The interviewees and the survey respondents in the Californian cluster commented on the cluster as an international hub, both attracting and benefiting from companies from other regions.

The enablers in California provided a particularly rich and distinctive seam of evidence, in that they related to factors such as easy access to other actors, and to information that was embedded in the culture, and the absence of which were at the root of many of the barriers—particularly in new 'top down' clusters established in underdeveloped areas, with little extant business culture, or formal and informal communication infrastructure for new players.

What Policies Did Companies Want to See?

The interviews and the surveys principally highlighted barriers in relation to access to finance (72%), long-term stability of funding (53%) and bureaucracy (52%). SMEs and start-ups in particular, perceived themselves as disadvantaged in key areas such as the ability to access funding or obtain support for innovation.

It was attributed here (as in other clusters) to the lack of dialogue and influence between SMEs and policymakers to ensure that policy addressed their needs and concerns. Asked where collaboration could be most improved, 74% saw collaboration with policymakers as key. Interviewees in this and all the other clusters often

attributed mismatches between policy and the needs of SMEs in particular to the lack of influence SMEs felt they had in influencing policy (See Figs. 4.9 and 4.10).

Having said that, it was also clear from survey questions on enablers that companies felt that regional and local government went to great efforts to engage with SMEs and take a pro-active role in understanding the needs of emerging sectors such as renewables. At a national level however, SMEs in particular felt that their needs were not sufficiently reflected in policy.

What did respondents think would help at the level of policies (a) for the cluster as a whole and (b) for companies like their own?

Policy Implications

When asked about policy changes participants wanted to see, the responses mirrored the barriers. They also highlighted the very different policy implications for (a) the cluster as a whole, and (b) companies in the cluster.

At Cluster Level

As in the section on barriers, there was a clear emphasis on the access to, and the long-term stability of funding, with mention also of environmental legislation, such as requirements for a percentage of renewables in new installations for example.

From other questions, the impact of bureaucratic processes on the cost and speed of installation, combined with the lack of interoperability in standards and regulations was also a recurring concern, highlighted as one of the key barriers after access to finance, by over half the respondents, in a separate question about barriers to the PV sector. Comments highlighted the financial implications of bureaucracy, and the need for policy to address the fragmentation and the attendant administrative complexity.

In a separate survey question, over 70% also highlighted the potential impact of threats and opportunities, and responses to other question in the survey suggest that the cluster was seen as benefiting from policies that supported California's role as an international innovation hub.

At Company Level

At company level, survey respondents highlighted much more specific implications for targeted policy interventions, in relation to funding for SMES (and particularly start-ups) with limited working capital, in relation to research and innovation as well as in relation to support for start-ups (See Fig. 4.15).[18] These responded more closely to the barriers on the ground which limited companies.

[18]There were some initiatives that went part of the way towards addressing this in 2010, such as Small Business innovation Research (SBIR) programmes and these have since been significantly expanded.

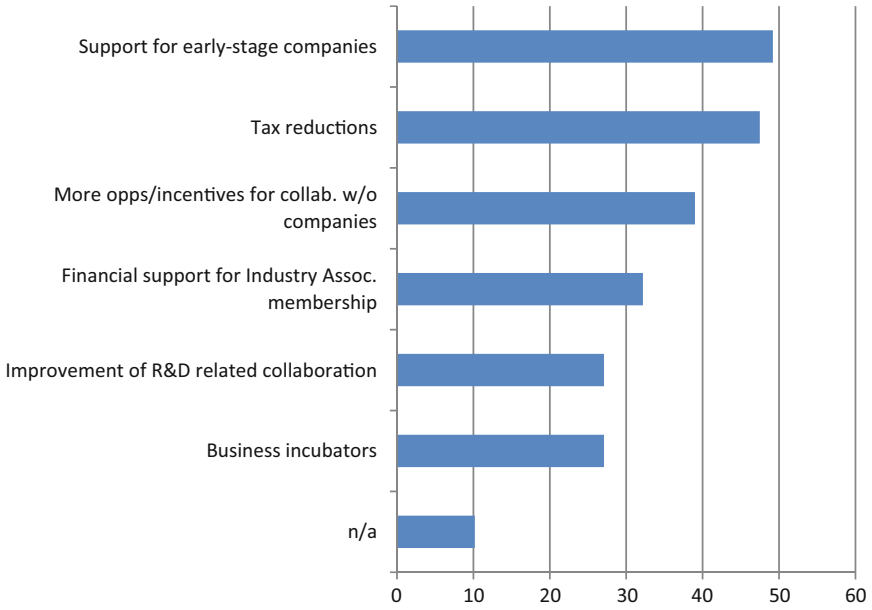

Fig. 4.15 How could support for SMEs be improved?

Here again the emphasis was on the access to and the stability of funding arrangements for companies, the majority of which were SMEs, and felt particularly disadvantaged.

SMEs and start—ups felt particularly over-burdened in relation to tax, and felt policies should address this. Even access to membership of renewable Associations was identified by many as an area where they would have liked to see a change in policy to allow greater involvement of cash strapped start-ups and SMEs.

The smaller the company the more support was seen as required, financially, in business incubators, and in fostering collaboration with other players.

This latter resonates with the clear indicators in interviews and questions on barriers where smaller companies articulate a wish for better access to

- universities and research institutions in areas such as research, development and innovation[19]
- policymakers—particularly at a national level in the shaping of policy around their needs.

[19]This was seen as more accessible to larger companies. Concept testing and commercialisation were areas where smaller, research active companies were dependent on being able to access funding and support from a University or a research lab. While some research voucher schemes were in operation at this point, early in cluster development, more were seen as necessary.

As suggested in the interviews, despite the unique levels of collaboration in the Californian cluster, there was still a wish for more support for collaboration around the needs of SMEs in particular. Earlier questions highlighted a perception of collaboration between SMEs and policymakers as an area where improvement was seen as most lacking (See Figs. 4.9 and 4.10). The feedback suggests that if SMEs and start-ups were more influential in the shaping of policy to target their real needs, this rich ecosystem of knowledge, skills and resources could be leveraged to greater advantage for companies, for the cluster and for the sector as a whole.

4.4 Discussion: Barriers and Recurring Problem Scenarios

Among the recommendations that could have been made when the study was carried out (2010/2011), many were about reconfiguring and re-focusing existing resources to even the playing field for the smaller companies and start-ups which play such a significant role in competitive innovation and regional employment.

- Provision of easier access to capital[20] targeted at concept development and commercialisation for SMEs and start-ups as well as easier access to bank loans, possibly through state guarantees
- Fast implementation of amended FITs. The delay (in 2010) in implementation of the planned Feed-In Tariff was seen as constraining development for smaller companies in particular.
- Reduction in bureaucracy associated with (a) permits and procedures in project realisation (b) funding applications, and (c) compliance with disparate standards in areas such as building codes and procedures
- Provision of support for the integration of SMEs. Better integration of SMEs could be achieved, for instance, through financial support (tax reduction/exemptions, sponsorships for industry association memberships)
- More opportunities for co-production of policy between government and SMEs, to better address the needs of these key players in innovation and employment
- Provision of better support for SME-led innovation with R&D institutions or other agencies, to provide more access to equipment and testing facilities, as well as expertise, without loss of IP

Recurring Scenarios

SMEs make up the majority of all clusters, and are the vehicles for commercial innovation and regional employment which are ostensibly at the heart of cluster

[20]Research vouchers for small and medium-sized companies are now used more extensively in this way.

initiatives. Yet the evidence presented in California, a region where SME entrepreneurship is famously well-supported, and also in all the other clusters, suggests their needs and concerns are the least well represented in the policies shaping the operating environment on the ground.

While the Californian cluster was endowed with many advantages, and better funded and networked than many others discussed in the book, the same asymmetries were evident (though to a lesser degree) as in other clusters, offset by enabling factors such as the ease of networking across communities, and the culture of support for innovation.

The case highlights the importance of ensuring representative feedback from the ground from SMEs in particular if the focus and implementation of policy is to identify and target their needs effectively at critical stages, particularly in relation to the early stages of innovation, and particularly in relation to start ups. These are issues which Kirchherr et al./McKinsey (2014) recently highlighted, as does Bergman (2007) with implications for policy to address the particular constraints for start-ups and SMEs in the critical early stages. Each of the case studies summarises the key barriers identified, and highlights particular risk scenarios that they illustrate in the section at the end.

The Case as a Template

The case in California is intended to provide a vehicle for understanding the approach taken, and for introducing some of the issues which recur in different forms in all the clusters.

In Part II of the book, we look in more detail at a range of individual clusters to better understand how these issues arise in different contexts, their impact on companies and clusters, and the different strategies adopted to address them. Each case is a snapshot of the moving forces at a particular point in time, mapping the key barriers for companies and clusters on the ground as stakeholders see it.

In Part III, we then look at each of the main barriers across the clusters, and discuss the implications for policy and practice. Different clusters address these recurring issues in different ways, providing a laboratory for strategy and an opportunity to learn from other clusters.

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Part II
Case Studies

Jaegersberg and Ure

Chapter 5
The Portuguese Case: The Cost of Inequality

Abstract This chapter presents a case study of the Baixo Alentejo photovoltaic cluster in the South-East of Portugal. The cluster is a good example of an early stage cluster that had been initiated largely 'top-down', in a rural region with no real business/entrepreneurship culture or well-established networks of communication and coordination between players. The case shows how limited opportunities for SMEs to engage constructively with other stakeholders can constrain value creation for the cluster and the region. SME interview and survey feedback was characterised by a perception of real inequalities between SMEs and other players. The case highlights the impact of a very unequal relationship between SMEs and (a) policymakers shaping the business environment (b) large companies administering access to key services (c) Universities charged with supporting research and innovation.

5.1 Background

The emerging Baixo Alentejo photovoltaic cluster in Portugal was characterised by many of the recurring issues seen in other clusters, however the most striking obstacle to the development of the cluster arose from the limited opportunities for SMEs to engage constructively with other stakeholder groups.

SMEs felt that they were competing on an uneven playing field where power and influence were mainly shared between large companies and government, and they felt commercially and politically disadvantaged. The dependence of SMEs on collaboration at these many interfaces meant SMEs were particularly disadvantaged by procedures which either delayed their operations, through bureaucracy, or restricted their access to the necessary documentation. This was evident in a range of contexts of central importance to an emerging cluster—from publicly-funded research programmes and financing opportunities right through to the management of the online portal for the registration of microgeneration licences.

This chapter gives some background to the location and history of the cluster, and then looks at this and other barriers SMEs experienced at key interfaces, exploring the impact and the implications for individual stakeholders, and for the effectiveness of the cluster itself.

The cluster is in a predominantly rural and sparsely populated area in the region of Baixo Alentejo in the South-East of Portugal, bordering on Spain (See Fig. 5.1).

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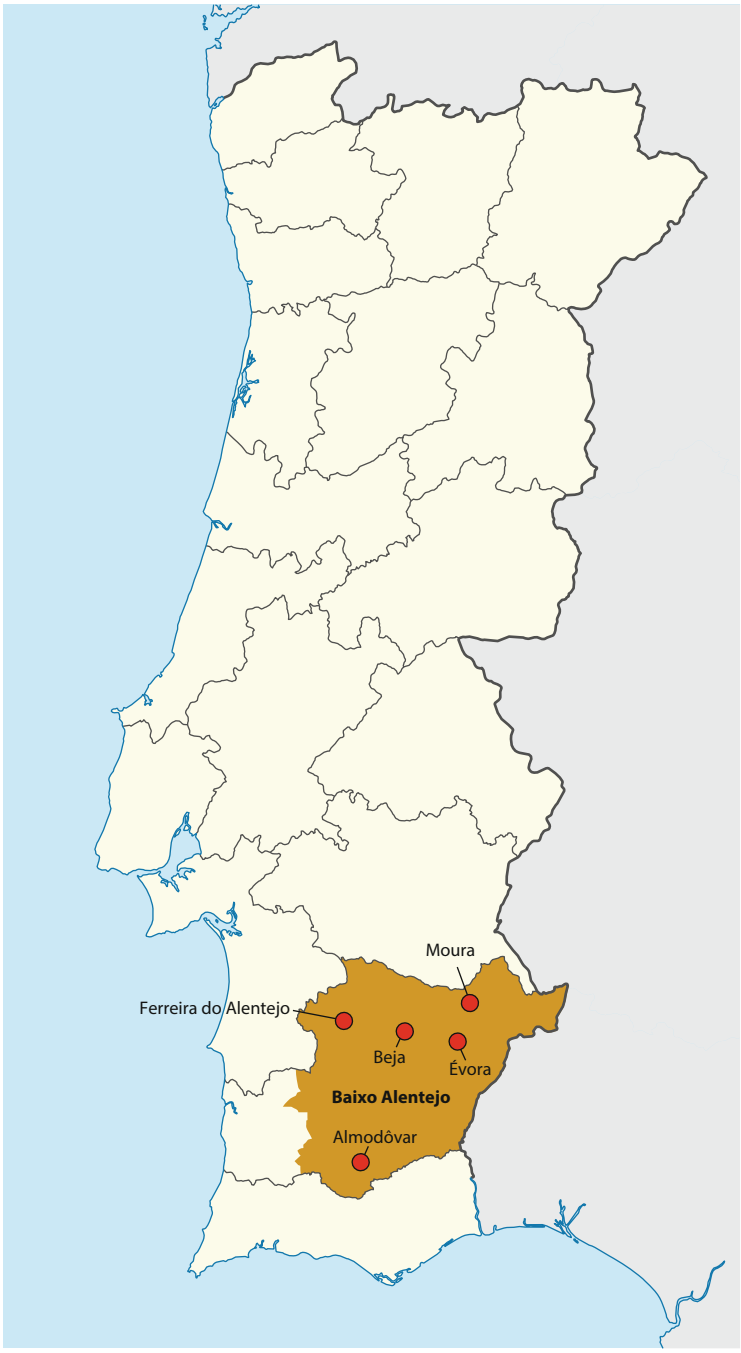

Fig. 5.1 The Baixo Alentejo region in Portugal. The image was created by Roman Siegert using data from the study, and a map by NordNordWest, reproduced under a Creative Commons licence from Wikipedia. The original map is Available on: https://upload.wikimedia.org/wikipedia/commons/4/48/Portugal_location_map.svg

The Baixo Alentejo cluster can be regarded as an example of a top-down cluster initiative to address the lack of industry and employment opportunities in the region. The development of the cluster reflected a wish to transform the region into a centre for the production of renewable energy electricity and a centre of excellence in photovoltaics, and thus enhance employment, innovation, skills and inward investment. Ninety four percent of survey respondents viewed this as a cluster created by government policies.[1] The lack of an existing business culture and infrastructure is a salient feature of such clusters, (contrasting sharply with clusters such as California, where clusters benefited from a pre-existing matrix of skills, experience and resources). This has implications both for the particular risks they face, and the policies likely to mitigate them.

The cluster was intended to take advantage of unusually high levels of solar radiation in the region (See Fig 5.2). When the research was carried out, between November 2009 and September 2012, the City of Moura was seeking to exploit these resources, and create sufficient critical mass to promote the development of a photovoltaic solar energy cluster that might support the socio-economic development of the region of Baixo Alentejo, in addition to increasing the production of green electricity.

The study was carried out between November 2009 and January 2011, starting initially with desktop research as a basis for mapping the cluster and drawing up a database of stakeholders. Semi-structured interviews were then carried out with stakeholders, and these were transcribed and thematically coded until the stage of saturation (no new issues) was reached. The interviews were carried out in two series: the first, series A, from November 2009 to January 2011, with a second, follow-up series B, from May to September 2012.The interviews were used to scope the issues, and then a standardised questionnaire was drawn up and a survey was run.

Almost 85% of the survey respondents were SMEs. The distribution of companies by size is shown in Fig. 5.3.

[1]This contrasts with some of the other clusters we have looked at, which build on an existing base, with skills, networks and an established business culture.

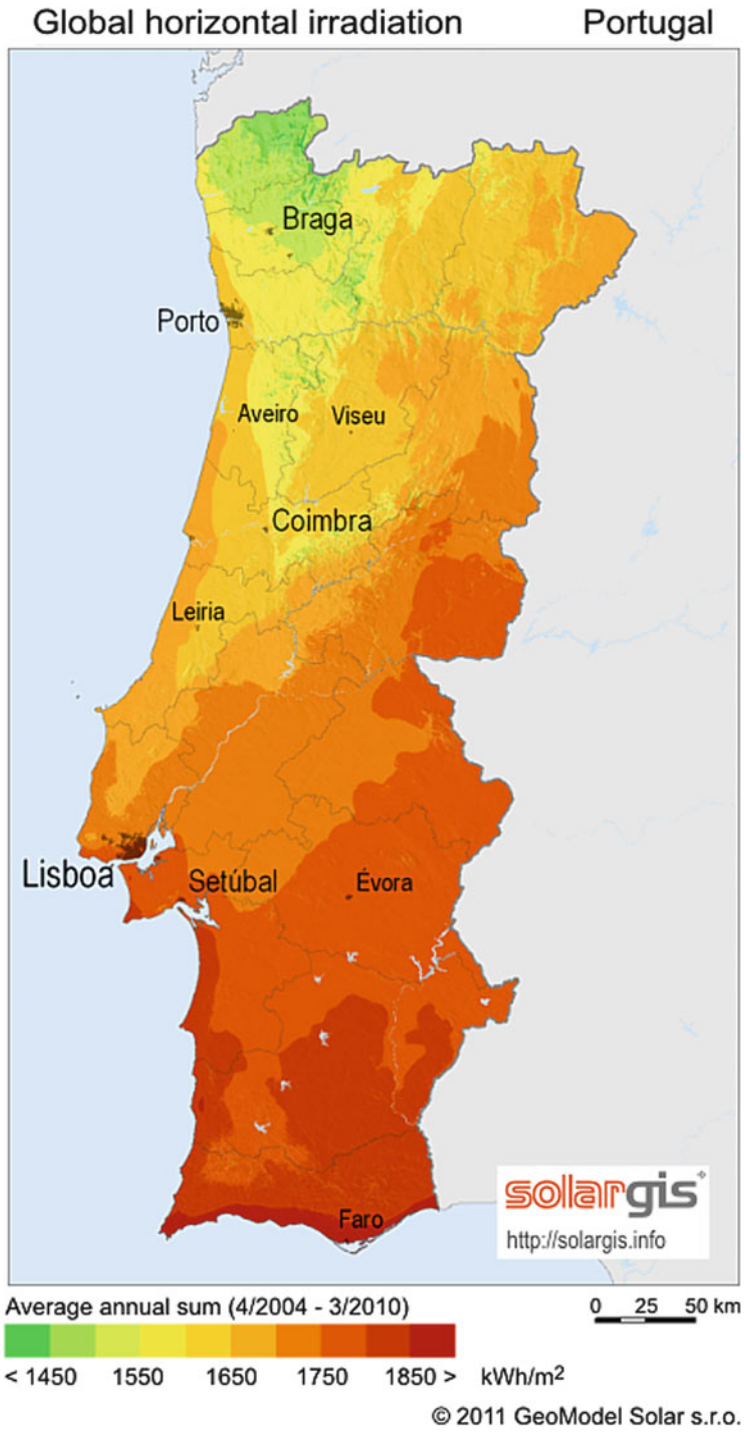

Fig. 5.2 SolarGIS © 2011 GeoModel Solar s.r.o. Map created by SolarGIS and copyright of GeoModel Solar. Reproduced under a Creative Commons Attribution-ShareAlike Licence. Available on rGIS-Solar-map-Portugal-en.png

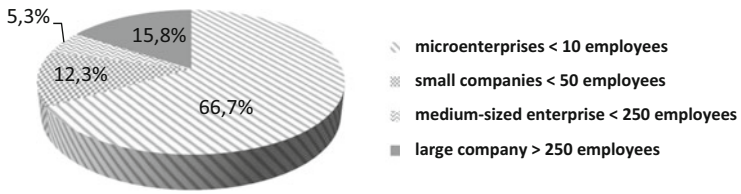

Fig. 5.3 Distribution of companies taking part in the survey. The definition of the size of an enterprise by staff number is based on Article 2 of the EU recommendation 2003/361. According to this, the staff headcount is the main criterion for size, however further criteria such as turnover or balance sheet total also play an important role. In the survey and the interviews, we only asked respondents for the staff number of their company

Assembling the Pieces

At the time of the field study in the Baixo Alentejo region, a social fund of 3 million Euros had been created to set up a technology park and to support micro-producers and SMEs, as much needed sources of employment in the region—this being a key justification for investment in the cluster. In 2008, a company (in which the City of Moura was the biggest stakeholder), was founded to establish and administer this technology park, including a laboratory specialising in photovoltaic solar energy technology accredited to certify quality standards for new products. A large Spanish PV company was set up which was, at that time, one of the largest photovoltaic power plants in the world, producing 62 MW, equivalent to the consumption needs of 30,000 households, and using a new tracking system that follows the sun's path across the sky. They had also constructed a PV module assembly factory, creating over 120 jobs. In addition, a Centre for Competitiveness in Energy Technology had been created, amongst whose members were the central electricity provider in Portugal, and the company managing the Technological Park. The City of Moura had also launched the "Sunflower Project" setting up a network with eight European countries. This project, financed by the European Union, aimed to transform the participating countries into a "Zero Carbon Community" (Mario De Queiroz 2008). Key elements for the development of a new cluster were thus in place, including

- research facilities and universities
- a technology park with specialised laboratory facilities
- national/international networking activities with relevant international organisations
- a large photovoltaic panel production plant

- an agreed policy framework and clear public commitment by regional government
- a new 'feed-in' law for the installation of photovoltaic microgeneration systems with generous Feed-in Tariffs,[2] which was implemented in 2008.

Creating Value

The challenge for the region and the stakeholders was to support the alignment of these elements in ways that generated value for the players themselves, for the cluster, and thus for the region. The particular role of SMEs in mediating regional employment, innovation and increase in GDP made the needs and perceptions of this stakeholding group an important resource in this regard (Jaegersberg and Ure 2011).

Figure 5.4 provides a simplified overview of the stages in the supply chain. SMEs are most involved downstream, where solar modules are installed. It is at these interfaces that much of the collaboration with other stakeholders takes place—particularly at the assembly stage, with other companies, with distributors, with regulators, with government agencies, and in registration for licences and permits for example.

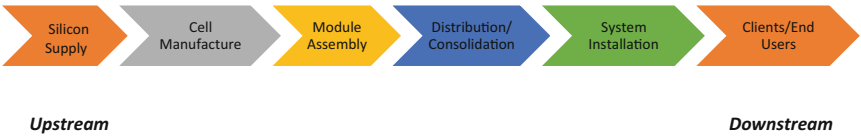

Fig. 5.4 Simplified overview of the process from raw material to installed solar module

The small companies that install solar modules for clients (micro-generators such as home users) constituted one of the largest groups of SMEs in the cluster. Their survival depended heavily on the ease and speed with which they could collaborate with other agencies to ensure the relevant permits, licences and statutory arrangements were put in place (Fig. 5.5).

[2] A new Feed-in Tariff (FIT) law for the installation of microgeneration systems came into force in April 2008, based on Decree 7363/2007. It included a special regime for microgeneration technologies, (amongst others solar photovoltaics), limited to 3.68 kW (16A single-phase). This special regime offered generous tariffs which were annually adjusted, and introduced an online registration process for applicants.

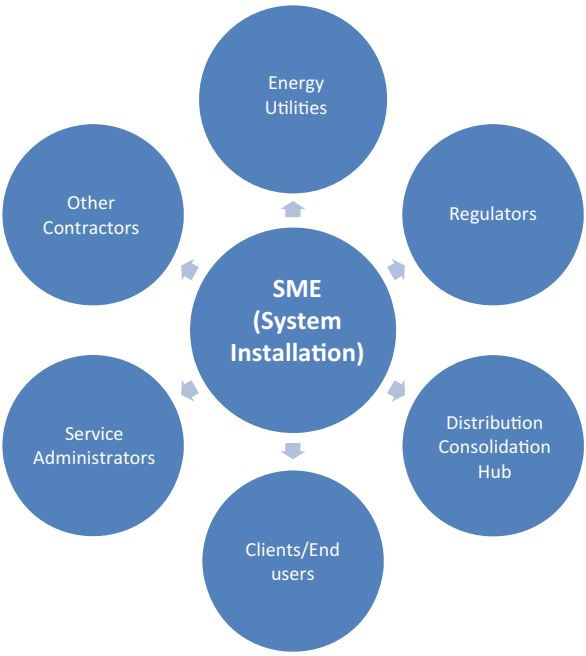

Fig. 5.5 Simplified overview of the range of interactions SMEs need to manage to complete installation

These are interfaces that are critical for SMEs and thus for the employment they create for the region. What was the experience of SMEs at these crucial interfaces in the supply chain? What were the barriers in relation to the interfaces managed by government and bodies such as regulators and administrators mediating government legislation? What was in place to support communication and collaboration between companies with complementary know how and resources? How well did Universities play their role in facilitating innovation in the process of manufacture/installation or in providing the skills and professional development needed?

5.2 Stakeholder Perceptions of Barriers

The interview analyses and the subsequent survey results show how stakeholders perceived the development of the emerging cluster in general, and the evolving relationships between education, government and industry in particular.

The over-arching theme emerging from the interviews, and substantiated at scale in the surveys, was the perceived inequality of SMEs in relation to communication and collaboration with other players, and which subsequently disadvantaged them commercially.

We asked specifically about their experiences of interaction with different stakeholders in education, industry and government, in both interviews and in the survey.

Interface Between SMEs and Large Companies

The difficulties at this interface are perhaps best exemplified in their experience of registering for licences to install solar panels for individual clients, to generate and feed in electricity to the Grid. As Fig. 5.5 shows, this requires effective interfaces with other players at different junctures, particularly in the final stages:-

- the administrative process for permits and certificates to connect to the Grid, and to install solar modules (managed centrally by one of the companies on behalf of the regional government.)
- the procurement and installation processes, involving collaboration with a range of other companies (predominantly other SMEs)

The dependence of SMEs on the collaboration at these many interfaces meant SMEs were particularly disadvantaged by procedures which either delayed their operations, through bureaucracy, restricted their access to the necessary documentation or limited their ability to feed back problems or influence their resolution.

Perceived Barriers

In the first instance, SMEs installing solar products for small-scale producers had to face a lengthy and bureaucratic process including the following steps: registration at the SRM portal,[3] installation of the photovoltaic system, a provisional certificate (Certificado de Exploraçao), inspection of the installation arrangements, issuing of a permit, and finally the drawing up of a contract. The lengthy delays entailed in these processes impacted on the speed with which they could fulfill the needs of clients.

> *We always have problems of an administrative and bureaucratic nature because the process of licensing and authorisation are always lengthy. (Interview A/1, government)*[4]

[3] Systema de Registro de Microproduçao, www.renovaveisnahora.pt

[4] All quotes in this chapter are translated from original interviews in Portuguese by the authors.

When asked more specifically how support for their own organization could be improved 47% underlined the need for the online registration process to be simplified (Fig. 5.6).

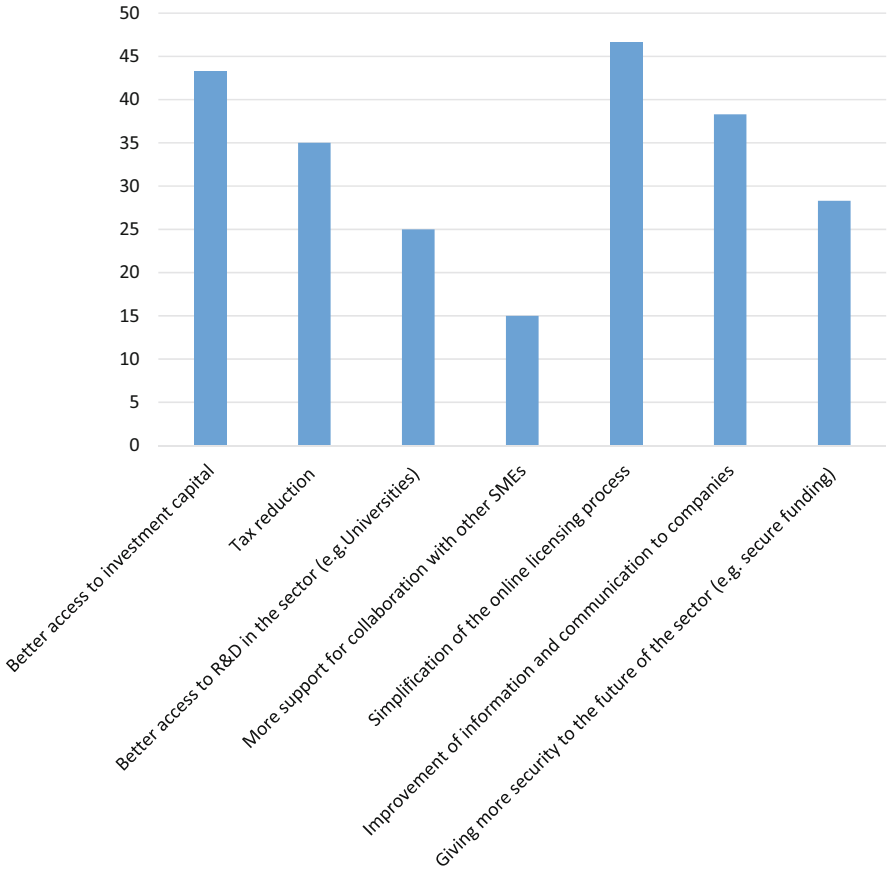

Fig. 5.6 How could support for your own organisation be improved? Survey responses

As Fig. 5.7 shows, more than 40% of the survey respondents regarded bureaucratic barriers (e.g. online registration system for microgeneration and the process of product certification) as one of the principal barriers in the sector, and more than 45% thought the slowness of implementing policies was one of the major barriers. This is a recurring issue in almost all the other clusters, and was the focus of a European project (PVLEGAL 2009–2012), looking at bureaucratic barriers in the PV sector in eight countries. In the case of Portugal, the complexity of these processes was exacerbated by the use of an online portal for some of these transactions.

The registration procedure at the SRM portal was a major concern for SMEs in the cluster who were involved in installation, not only because it impacted on their ability to succeed in this market, but because it highlighted the difficulties SMEs felt they faced in influencing the policies that shaped the conditions in which they operated.

Only 1000 registration slots were made available on the online portal and on only 1 day each month. These meant companies were often unable to get the necessary registration documents, and often lost clients to other companies—including the company which managed the portal.

SMEs repeatedly criticised the influence of the company administrating the portal, and the perceived conflict of interest in the use of confidential client data by the operator. The following quotes give a sense of the scale and consistency of this theme from the interviews, and which are validated more quantitatively in the surveys.

As for the dispute about registration in the field of microgeneration, there is a cartel -.there is a procedure at the beginning of the process here that benefits some and prejudices others. (Interview A/10, SME)

..the market structure is still more or less a monopoly (Interview B/12, SME)

Anyone who has no links to large companies faces difficulties in getting access to the portal (for registration and licensing of installations for clients). (Interview A/6, SME)

SMEs don't succeed in registering. Yesterday was registration day. We had 134 people enroll and 7 were successful. Other companies with 40 people enrolled didn't succeed with any . . . There are large companies that make the registrations and don't even have clients interested in installations. It's very difficult at the moment. There are many SMEs that are on the brink of going bust. (Interview A/6, SME)

Our problem with microgeneration ... there are entities succeeding in 150 to 200 registrations. They normally have links with [the large company at the centre] . . . Those who administer the registration are/is also the [same large company]. Nobody can prove this but there might be corruption --- This server is tightly linked to the [cartel]. (Interview A/11, SME).

The licensing system is an online system which facilitates access for large companies. Presently, SMEs have around 50% of their work at risk because they don't have access to the site on the day of registration. (Interview A/6, SME)

If all companies had equal access [to microgeneration], there would be competition based on technologies and sales and not a question of who has the best access [to the large company at the centre] (Interview A/8, EconDevOrg, Assoc, ChCommerce)

A company of an ex-governor succeeds in getting registrations with the help of government. That's favoritism. (Interview A/11, SME)

XXX is the only distributor making contracts for buying electricity from microgeneration. The XXX site is on the same server as the site for registering for microgeneration. (Interview A/6, SME)

The unequal access to the registration portal is also echoed in the survey results. More than two thirds of the respondents estimated competition to get access to the SRM portal as being intense. Perhaps the most direct (and explanatory) comment on the abuse of power by large companies in comparison with SMEs is in the following extended quote, which sets out exactly how some companies were perceived to be taking advantage of a privileged position on an uneven playing field.

.. the laws of the European Union were not properly applied in Portugal, that is to say, the European Union normally requires a separation from the network operator, which is XXX Interview B/12, SME)

They operate a low tension network in Portugal which should be separated from the commercialization of the energy. That is to say "they" have the medium for transmission (the network), and "others" have the product—the energy generated "They" are the XXX Distributors, for example, while the "others" are XXX Commercial. Moreover, the EU obliges the XXX to separate these two companies. Officially, that happens, but unofficially they are able to use the same database. So XXX Commercial has knowledge of our registrations, for example, the names of our clients, which can be used to make copied offers of microgeneration. That is to say, that a client of mine that is registered online through the SRM (registration portal)—their details will be transferred to XXX Distribution, which operates the network, to confirm the technical details, to see if it is technically possible to link to the system. So one day later, my client receives a phone call from XXX Commercial, (which normally cannot access these details), and XXX Commercial makes a microgeneration proposal to my client. XXX Distribution cannot legally pass these details to XXX Commercial, but does this on a daily basis. This is completely illegal, but it is difficult and complicated to prove these things. (Interview B/12, SME)

The asymmetric power relation between SMEs and policymakers was very evident in interviewee and survey respondent feedback. As in other clusters, SMEs typically felt less well represented, and as a result, their concerns and their requirements were often not recognised, or reflected in policy measures at crucial points. The perception and experiences of SMEs were inconsistent with the professed objectives of regioal investment. Policies seemed poorly designed to support SMEs as vehicles for growth and job creation.

Interface with Policymakers

There were a number of barriers at the policy interface, many of which recur across clusters (See Fig. 5.7).

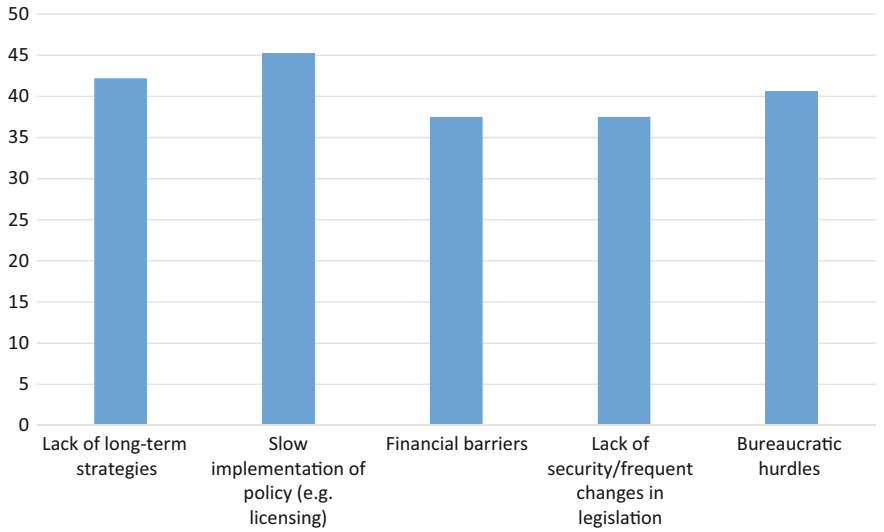

Fig. 5.7 Principal barriers identified by survey respondents

Many felt, for example that there was a lack of long-term stability, particularly in areas such as access to funding, with much of this being attributed to short-term political changes in strategy which was then a disincentive for investment, and long-term project development. The slow speed with which policy was implemented was also seen as a barrier constraining the development of the sector. The bureaucratic implementation of policy in terms of the administration of essential paperwork and permits was also perceived as a significant hindrance.

SMEs saw themselves as being particularly disadvantaged in all these areas. They expressed the view that their voices were not heard by policymakers and that their needs were therefore not taken account of. This was a cross-cutting theme in other clusters (Jaegersberg and Ure 2011) and was attributed in part to (i) a lack of appropriate mechanisms and opportunities for representation and communication, and in part also to (ii) the lack of influence their views had on policy outcomes.

Lack of Representation

> *The major barrier is the lack of coordination between the legislative bodies, and the associations representing the sector. This lack of communication causes laws with gaps that lead to serious consequences in the future. (Interview B/14, economic development organisation/association)*

Lack of Influence

> *They (policymakers) are not very interested in our arguments . . . with government organisations the experience has been negative, in the sense of difficult, very difficult.*

There is a lack of dialogue in areas of mutual interest [between SMEs and policymakers] to speak about what people think. (Interview A/6, SME)

We don't have any influence on political processes. (Interview A/10, SME)

Government doesn't really listen to associations . . . from the point of view of government, a suggestion of an association never is an acceptable suggestion. (Interview B/14, SME)

Interviewee comments were confirmed by a large number of survey respondents (See Fig. 5.8). Almost 65% estimated the exchange of formal/informal useful knowledge between government agencies and companies as "Poor" or "Bad".

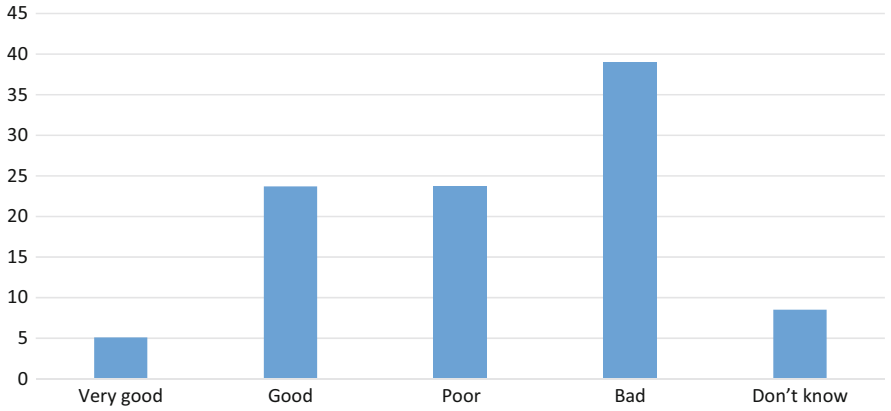

Fig. 5.8 Exchange between companies and government support agencies. Survey responses

Fifty six percent of companies also thought the exchange of formal/informal useful knowledge between companies and the associations and regional economic development agencies was "Poor" or "Bad" though not to the same extent (See Fig. 5.9).

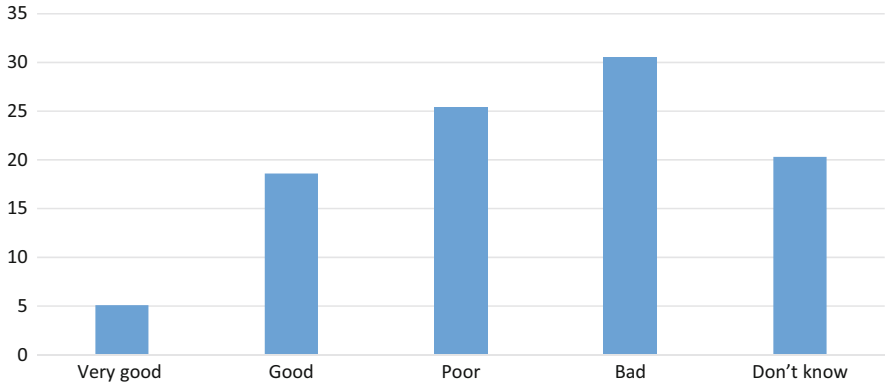

Fig. 5.9 Exchange between companies and regional association and economic development organisations. Survey responses

The lack of representation, and the lack of opportunities to voice concerns to policymakers was seen as a threat to the survival of SMEs. There was a perception that government needed to ensure policy was implemented more effectively, and more equitably. For some there was a more direct assumption that some players were cooperating in their own interests at the expense of others, and ultimately at the expense of the cluster as a vehicle for regional development.

There is a lack of political will. Basically the law is good, but with the lack of a mechanism and the lack of political vision, it's not functioning the way it should. This must be changed rapidly … [otherwise a great number of recently established SMEs] must close down. (Interview, A/6, SME)

The lack of political will to find solutions to strengthen the sector is notorious. (Interview B14, EconDevOrg, Assoc, ChCommerce)

Of course, we are disadvantaged … government always gives preference to the big companies. If someone here is running a small company with 10 or 20 people the support is zero … Everything that's big automatically receives support. Everything that's small automatically does not get support—this is the basic policy." (Interview B/11, SME)

The market is dominated by governmental companies, and one hand washes the other. (Interview B/11, SME)

The biggest companies have very strong links with government or certain parties. They are big families." (Interview A/8, EconDevOrg, Assoc, ChCommerce)

The management of XXXX already told us it is normal that in all sectors of the market it is like that—the small die and the big survive. (Interview A/6, SME)

Looking at the history of the country, I suppose that, primarily large companies who are going to invest and make their money will survive. Only a few SMEs will survive, and they will survive in market niches." (Interview A/8, EconDevOrg, Assoc, ChCommerce)

Lack of Access to Funding for SMEs

This perception of an uneven playing field extended to finance, including the interface with banks and other funding institutions supporting both research and development. This was also perceived as unfavourable to SMEs, despite the provision of EU funding through the ECB, and almost 45% of survey respondents raised the need for better access to investment capital (See Fig. 5.6).

The banks leave SMEs completely out in the rain, without loans, without financing … It cannot be that the European Union, the Central European Bank, lends a lot of money to Portuguese banks and very cheaply, and afterwards nothing gets to SMEs. (Interview B/11, SME)

Normally, for some reason, the money ends up in the pockets of large companies, when it comes to research. Because it's distributed through big programmes. . . and for some reason, it's normally large companies winning projects. (Interview 8, EconDevOrg, Assoc, ChCommerce)

Barriers at the Interface with R&D Institutes and Universities

For a cluster to develop successfully and unlock growth opportunities, dialogue between companies, in particular SMEs, and R&D Institutes and Universities is generally taken to be at the heart of value creation. The results suggest that the players were all there, but the social and organisational opportunities and incentives were lacking, including the access to research funding referred to earlier in the chapter.

Lack of Support for Research and Innovation by SMEs

As far as support for innovation is concerned, 70% of survey respondents thought that SMEs were not sufficiently supported by regional organisations in general and by Universities in particular (See Fig. 5.10).

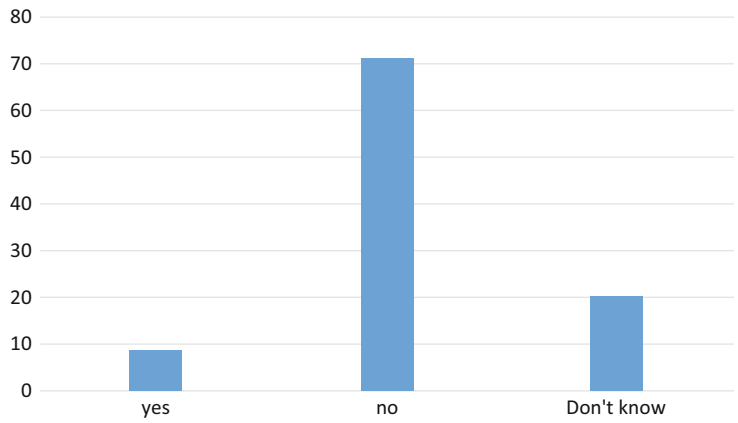

Fig. 5.10 Do you think regional organisations support SME innovation sufficiently in this sector? Survey responses

Knowledge-sharing with Universities and R&D Institutes was considered as "Poor" or "Bad" by more than 60% of all respondents (Fig. 5.11).

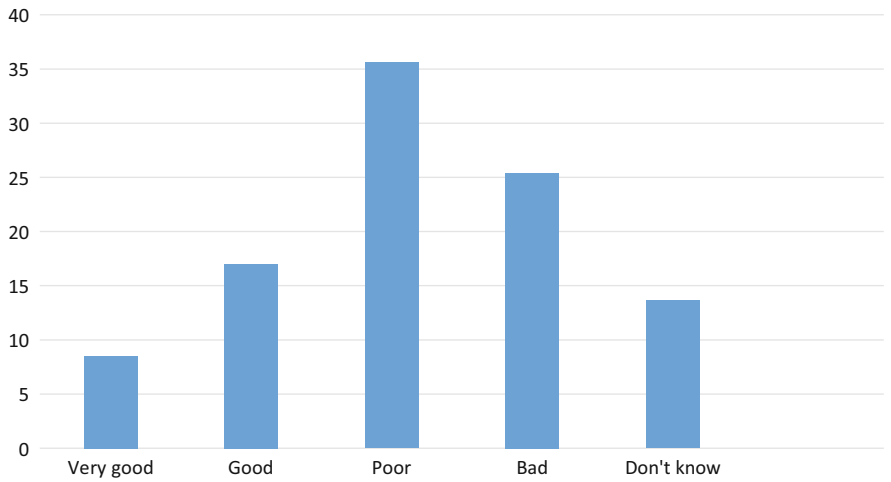

Fig. 5.11 How would you assess the formal and informal exchange of useful knowledge and information between companies and Universities/R&D institutions? Survey responses

Interviewees typically indicated that Universities conducted joint research only with big companies, and not with SMEs, or were out of touch with companies.

Universities don't carry out research projects in partnership with small companies . . . there are only partnerships with large companies . . .

In our research it was evident that SMEs felt they did not get the same support by politicians like large companies. (Interview B/14, EconDevOrg, Assoc, ChCommerce)

The Universities limit themselves to research with no direct contact with SMEs (Survey respondent)

Feedback also revealed the gap between the theory of research programmes for SMEs and their applicability in practice by SMEs.

Many of the funding programmes for SMEs are well designed in theory, but normally the bigger companies benefit from these programmes, . . . because, in theory things function well, but in practice they don't . . . (Interview A/6, SME)

Lack of Research to Support Development and Innovation in the Cluster

Interviewees criticised the lack of basic research from which they could benefit, and the lack of a clear strategy for research or for a vision of internationalisation.

Government doesn't conduct any basic research, and this is needed to make progress in general in the field of technology. Also, practice-based research is needed. But without basic research you'll get nowhere. (Interview A/8, EconDevOrg, Assoc, ChCommerce)

Products need research first, to be developed in the first place, and then to enable them to be sold in the international market . . . It's the vision of internationalisation companies still don't have, because the products they develop can't just be for Portugal. They must be for the international market. (Interview A/8, EconDevOrg, Assoc, ChCommerce)

Lack of Skills and Professional Development

Interviewees strongly underlined the lack of skills and training as a barrier to development which were not being addressed by Universities in the region.

It's difficult to succeed in finding and retaining qualified human resources. (Interview A/3, SME)

The mobility of human resources at a national level is still missing. As far as candidates in general are concerned, the number with the necessary qualification is not high. (Interview A/9, EconDevOrg, Assoc, ChCommerce)

There is no university qualification in this specific area [solar energy]. (Interview A/8, EconDevOrg, Assoc, ChCommerce)

The first construction courses for photovoltaic systems only appeared recently, but the practical side of these courses is still poor. It's also necessary to offer more photovoltaic training in the fields of energy policies and strategic planning. (Interview A/9, EconDevOrg, Assoc, ChCommerce)

At the moment, there's no basic course ... in renewable energies. (Interview A/8, EconDevOrg, Assoc, ChCommerce)

In the Alentejo region there are no technological universities in the field of renewable energies. ... There's a lack of qualified human resources to develop innovative products. (Interview A/8, EconDevOrg, Assoc, ChCommerce)

While this may be less surprising in an underdeveloped rural region, it is one of those barriers found to some extent in all the clusters. The presence of centres for research and training did not always translate into the provision of timely and appropriate resources for the sector. Again this is a surprisingly frequent criticism across clusters, even where they are well-established, and with well-regarded centres of academic excellence. It tends to suggest that the physical infrastructure was not matched by the less tangible social and organisational infrastructure that can provide incentives and opportunities for more strategic alignment by players towards common ends.

5.3 Discussion: Barriers and Recurring Problem Scenarios

The Portuguese case is a notable example of an early stage cluster that had been initiated largely 'top-down' in a rural region with no real business/entrepreneurship culture, little engineering expertise, and without the established opportunities for communication and coordination between different players.

According to the Mayor of Moura, the justification for investment in such a cluster was "sustainable development, not just in the field of renewable energies, but also in terms of regional development" (De Queiroz 2008).

One of the main obstacles to the success of the cluster in achieving regional benefits of this kind was the limited opportunities for SMEs to engage

constructively with other stakeholder groups to create shared value, and the lack of incentives for larger players to do so.

In the Portuguese cluster SMEs felt that their relations with other stakeholders were very asymmetric. From their point of view, power was concentrated in the hands of a few and this manifested itself in contexts where large companies gained advantage from being part of the "big family". This had serious implications for the working of the cluster at key interfaces, such as the portal for registration and licensing of clients on the Grid. Here, and in other key contexts associated with funding (e.g. research funding schemes), access was perceived as very unequally distributed in favour of larger players (Fig. 5.12).

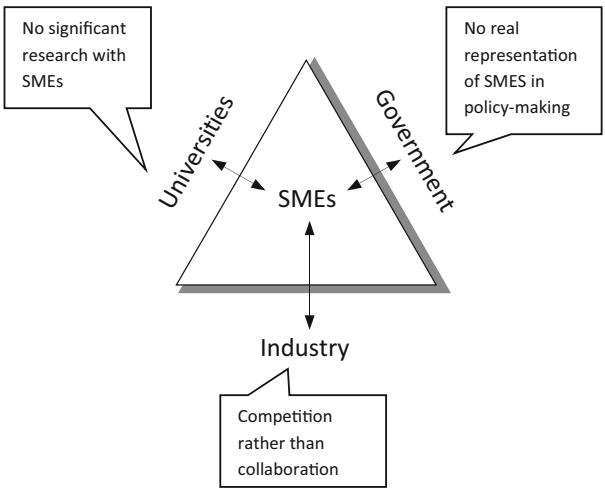

Fig. 5.12 Lack of representation and agency of SMEs compared with other stakeholders

Key Barriers

Between SMEs and Universities

Universities preferred to run research projects with large companies and failed to generate shared value from SME niche knowledge. As other clusters have shown, the failure to support SMEs and nurture local innovation disadvantages both the cluster and the region—the cluster in the loss of its ability to compete through innovation, and the region in terms of the loss of SMEs that generate regional employment.

Between SMEs and Government

Policymakers did not offer opportunities to SMEs for real representation in decision making, with the subsequent risk that policies did not then respond to SME

concerns or requirement, ultimately harming the development of the cluster and the region.

Between SMEs and Industry (Large Companies)

Large companies did not take account of the requirements of SMEs in the development and implementation of administrative services. The restrictions on access to online services in particular constrained the ability of SMEs to take advantage of the opportunities in the market, with the consequence that many SMEs were bankrupted, or close to bankruptcy.

Connecting the Circuits to Create Value

If SMEs are the bedrock of the regional economy, then any successful cluster initiative might be expected to enhance their survival and growth through strategic alignments as well as spillover effects. However in reality, different actors often worked at cross-purposes, to the detriment of the cluster.

Although all the pieces were in place in the Portuguese cluster, the social and organisational infrastructure was incomplete and unbalanced.[5] There were no other related or supporting industries/clusters in the region that could have fostered an "industrial atmosphere" (Marshall 1919), or supported cross-fertilisation (as in the German and Californian cases). There were no policies or incentives to support stakeholder exchange and collaboration. There was a lack of 'shared spaces' for this to evolve (Nonaka and Konno 1998).[6] Some of the crucial inter-organisational infrastructure could have been nurtured as part of a regional strategy but as respondents pointed out in interviews—there appeared to be a lack of vision and/or a lack of political will.

In a top-down cluster established in a rural region like the Baixo Alentejo Portugal, the particular configuration of risks and opportunities arguably has implications for government policy which are different from those in established cluster regions such as Germany and California, where there was a long-standing tradition of engineering as a collaborative enterprise, a strong and established culture of R&D and entrepreneurship, and links to other successful clusters.

While established clusters are able to leverage shared resources more cost-effectively, stakeholders in new clusters such as Portugal appeared less likely to make use of the potential for creating shared value for the cluster as a whole, and more likely to act as individual actors in competition.

[5]Burt (2001) describes this in terms of structural holes in networks.

[6]Nonaka and Konno (1998) speak of 'shared spaces' as a necessary vehicle for interaction. There has been a resurgence of interest in the sociology of interaction in economic contexts some of which is reviewed in greater detail in the cross-cutting analysis in Part III of the book. At times the collaborative research process itself can provide a catalyst or even a vehicle for this.

One of the lessons from the Portuguese cluster is that inequality between actors in a shared venture comes at a cost. In this case it was a cost to the region. The high investment by the regional government in the solar cluster provided significant benefits for the largest and most powerful players, often apparently at the expense of the smaller local players, and ultimately for the region itself.

Recurring Problem Scenarios

Problem Scenario

Top-down establishment of a cluster in rural/remote regions raises particular challenges which must be addressed if there is to be successful cluster evolution and return on public investment in terms of regional development.

Key Issues

- lack of an even playing field (e.g. from legacy problems, such as monopolies) to create fair competition
- lack of established communication and collaboration infrastructure e.g.to facilitate interaction, collaboration, or to inform policy
- lack of supporting industry sectors/clusters/lack of established business culture to foster interaction

Risk

The cluster benefits individual companies, at the expense of SMEs, and thus of the region.

Implications

In top-down clusters, there is more need for policymakers to ensure there are both vehicles and incentives for communication and collaboration across the cluster as established business communities or related industries are not existent. The dynamics which develop organically in a densely networked cluster, in a top-down cluster, must therefore be supported by policies to facilitate the benefits clusters promise, such as knowledge spillovers.

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Chapter 6
The German Case: A Cluster Under Threat

Abstract The German photovoltaic cluster is a prime example of a rapidly grown cluster driven by Feed-in Tariffs (FiTs) and special funding programmes. The cluster was helped by cross-fertilisation and mobility between chemical and semiconductor industry clusters in the region, and a strong regional tradition of mechanical engineering as well as a strong R&D culture. Stakeholder interviews and survey perceptions provided particular insights into the external threat of increasing competition from China, as cheap imports threatened local production, and some companies started migrating to low labour-cost countries, taking with them cutting edge know-how developed in the German cluster. This external threat coincided with an internal threat from the rapid reduction in FiTs, which disproportionately penalised those SMEs at the forefront of innovation. Managers felt that they did not have the necessary influence with policymakers to make the rapid and radical changes required to sustain SMEs, and to facilitate faster innovation in response to the external threat. This chapter outlines this and other perceived barriers to the development of the cluster, and their implications.

6.1 Background

Geographical Location

The Central German photovoltaic cluster is located in the triangle bordered by Saxony, Thuringia and Saxony-Anhalt, with a regional tradition of investment in engineering and technology (Fig. 6.1).

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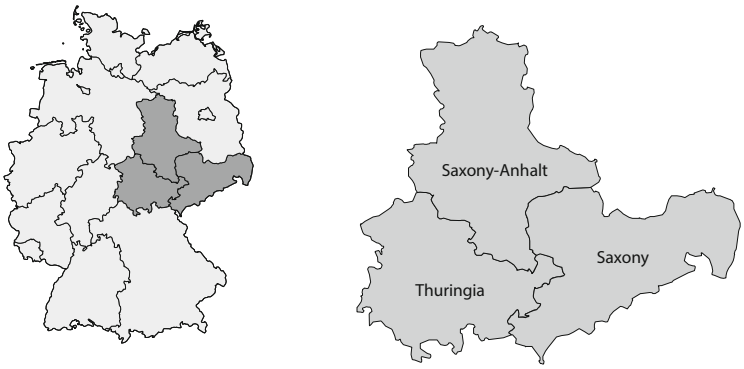

Fig. 6.1 Maps of Germany and Central Germany. Adapted by Roman Siegert from originals by David Liuzzi and reproduced under a Creative Commons Share and Share-Alike Licence from Wikipedia. Available on: https://upload.wikimedia.org/wikipedia/commons/e/e3/Karte_Deutschland.svg

The Field Study

The field studies were conducted in 2007 and then again between October 2009 and October 2011, and a follow-up study was run in 2013. Semi-structured interviews were carried out with senior managers, transcribed and thematically coded until the stage of saturation (no new issues). A questionnaire was circulated (using an online tool) to validate the issues emerging from the interviews. This was done between November 2010 and January 2011, with a return rate of 23%. More than half of the survey respondents were micro and small enterprises (<50 employees), almost one third medium-sized (<250 employees) and less than one fifth large companies (>250 employees) (Fig. 6.2).

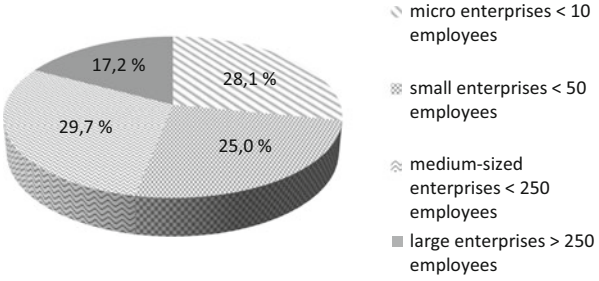

Fig. 6.2 Size of enterprises—survey respondents (The definition of the size of an enterprise by staff number is based on Article 2 of the EU recommendation 2003/361. According to this, the staff headcount is the main criterion for size, however further criteria such as turnover or balance sheet total also play an important role. In the survey and the interviews, we only asked respondents for the staff number of their company)

Infrastructure

Business Infrastructure

When we conducted our field study, between October 2009 and January 2011,[1] the Central German cluster had a complete photovoltaic value/supply chain, mainly made up of suppliers and, above all, industrial companies (Ruhl et al. 2008). Figure 6.3 gives some context to this.

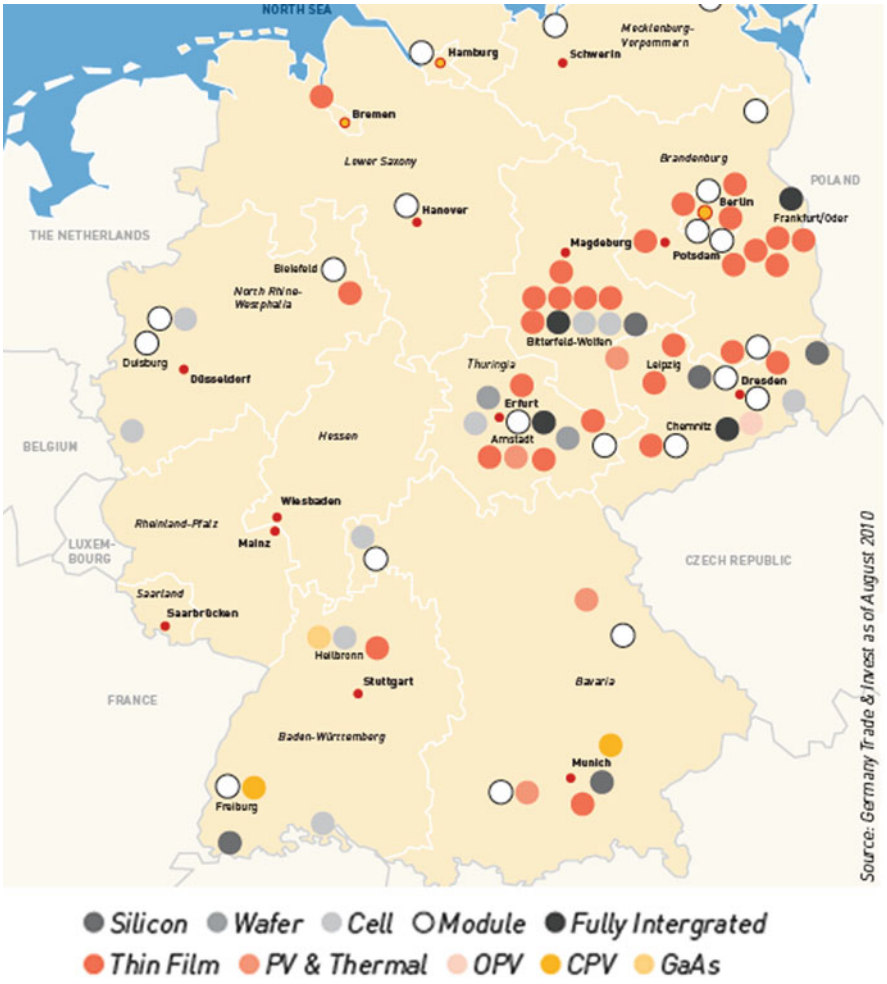

Fig. 6.3 Overview of photovoltaic supply chain in the Central German cluster. Reproduced with kind permission of Germany Trade and Invest (GTAI 2010)

[1]The study took place before the Fukushima disaster in 2011. Since the disaster in Japan, the German Government has decided to shut down all of its 17 nuclear power plants by 2022.

R&D Infrastructure

The strong R&D culture of the cluster is reflected in the presence of many research institutes, primarily Fraunhofer Institutes[2] with a focus on photovoltaics (See Fig. 6.4).

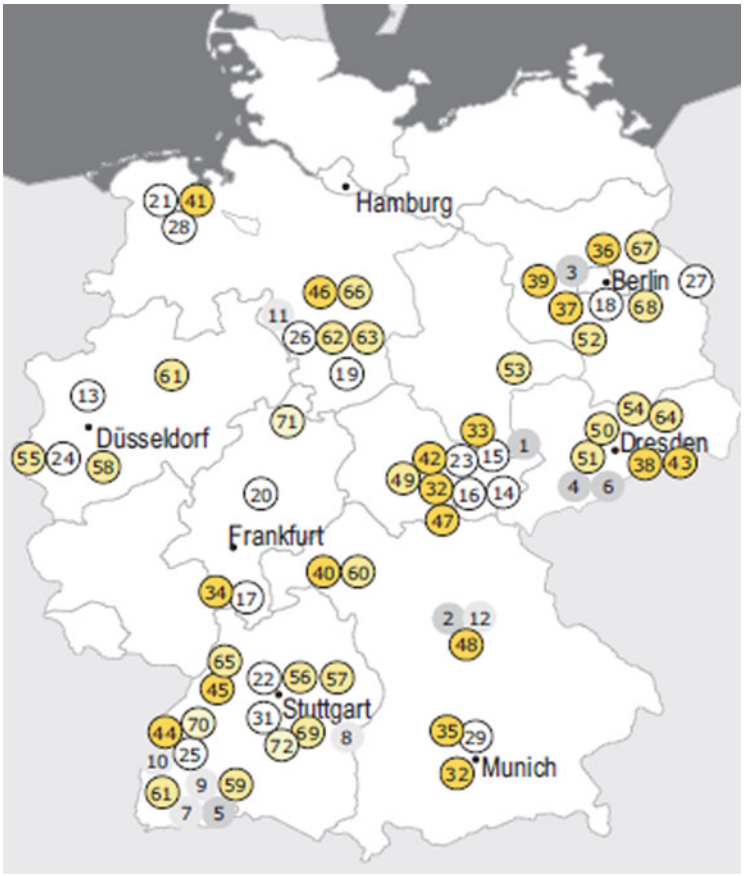

Fig. 6.4 Research and Development Institutes (in the photovoltaic sector) in Germany. Reproduced with kind permission of Germany Trade and Invest (GTAI 2009)

The strength of the research infrastructure was also shown in the feedback by interview and survey respondents when asked about the strengths of the cluster (Fig. 6.5).

[2]The Fraunhofer ISE (Institut für Solare Energiesystem) is the biggest solar research institute in Europe with main offices in Freiburg and Halle/Saale, as well as in Chile and the US.

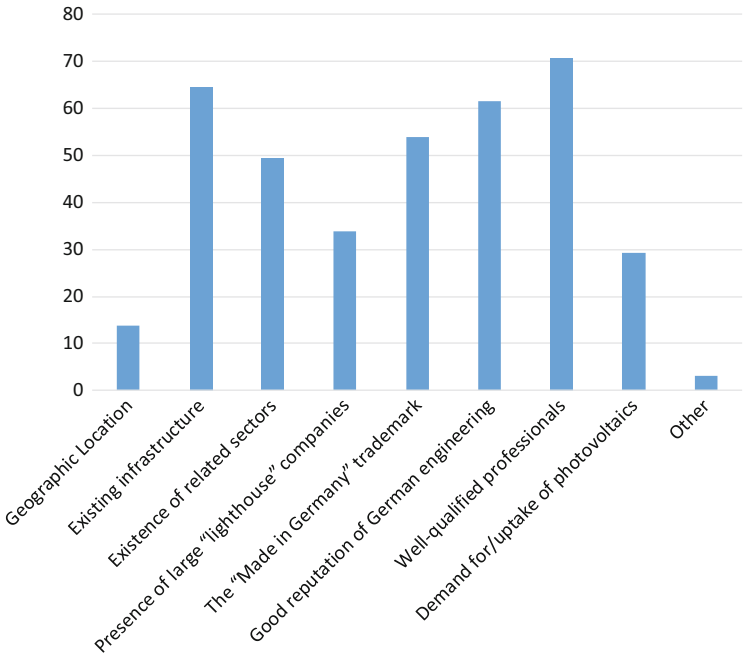

Fig. 6.5 Perceived strengths of the cluster. Survey responses

Two comments from interviewees and survey respondents are particularly representative:

> *We have had quite excellent experiences here in Saxony. We are in touch with various Fraunhofer Institutes . . . with Universities and technical institutes . . . with the Economic Development Corporation of Dresden . . . and this Silicon Saxony. So we are really well networked here. (Interview 3, SME)*

> *There are enough networks . . . research institutes . . . universities in the Saxon region . . . so in that regard we are very well networked—we have all sorts of relationships and research projects running. (Interview 5, large company)*

Key Cluster Initiatives

In addition to the excellent infrastructure, there were key cluster initiatives such as the Solarvalley cluster (one of the German Spitzenclusters/Excellence Clusters), together with associations and organisations such as the Bundesverband Solarwirtschaft e.V. (BSW), Germany Trade and Invest GmbH (GTAI), and the Solarinitiative Thüringen, all of which supported networking across the cluster. Table 6.1 shows the range of associations or organisations survey respondents were members of.

Intermediary organisations such as these were seen very positively in all the clusters, both in terms of networking, and in representing the views of the industry, although they were also typically seen as having limited influence on policy.

Table 6.1 Associations or Organisations survey respondents belonged to

Answer options	Response percent
Bundesverband Solarwirtschaft (BSW)	16.9
Solarvalley Mitteldeutschland	26.2
Silicon Saxony	32.3
Work groups of the Fraunhofer Institutes	13.8
SolarInput e.V.	12.3
Cluster für erneuerbare Energien Sachsen-Anhalt (CEESA)	3.1
None	20.0
Other	27.7

Feed-in Tariffs (FiTs): A Double-Edged Sword?

Rapid Growth Driven by Feed-in Tariffs

> *If there were no Feed-in Tariffs (EEG law), the whole German photovoltaic industry wouldn't exist. (Interview 8, cluster network manager)*

At the stage when the study was carried out, between 2009 and 2011, the cluster had been growing fast, boosted by Feed-in Tariffs, special funding programmes in East Germany for industries based on photovoltaics, the tradition of mechanical engineering, the chemistry and the semiconductor industry—as well as the strong R&D culture in the region.[3] Figure 6.6 shows the dramatic increase in installed photovoltaic capacity in Germany between 2000 and 2011.

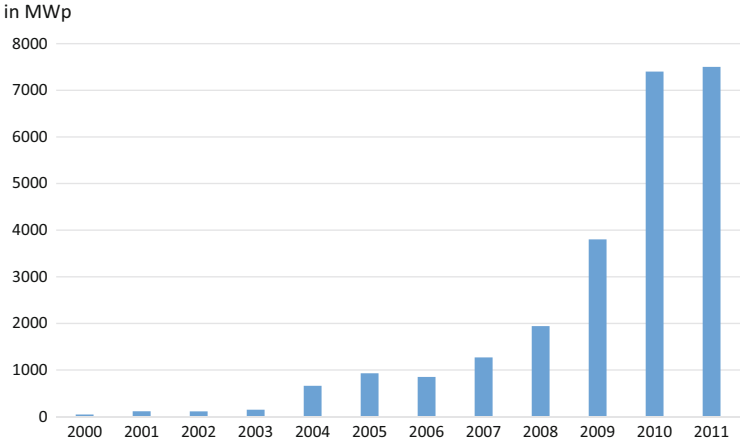

Fig. 6.6 Increase in installed photovoltaic capacity in Germany between 2000 and 2011. (MWp—MegaWatt peak rating is used to measure the capacity of photovoltaics in utility-scale systems). Reproduced with kind permission of Bundesverband Solarwirtschaft e.V. (BSW 2012)

[3] See Germany Trade and Invest (GTAI 2010) and Georgi (2008).

This rapid growth had mainly been driven by Feed-in Tariffs according to more than three quarters of survey respondents (Fig. 6.7).

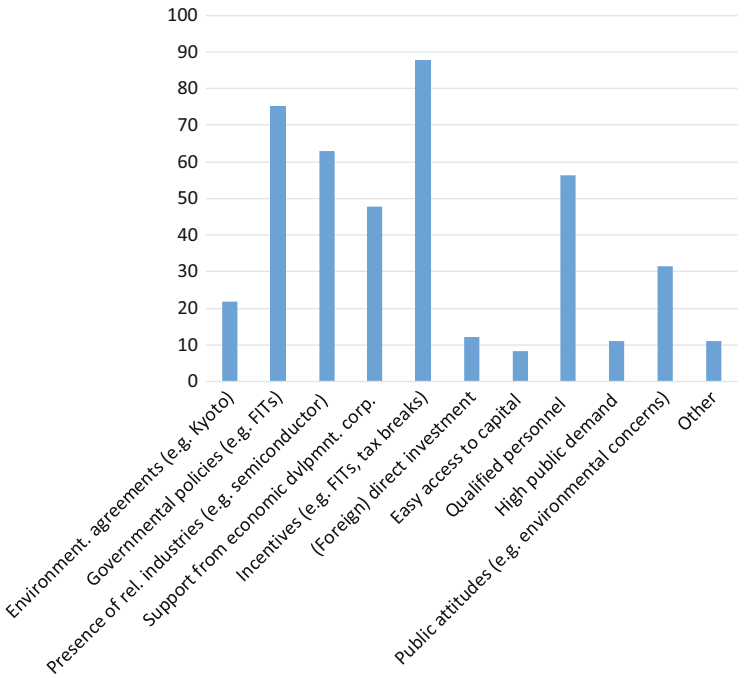

Fig. 6.7 Perceived drivers of growth. Survey responses

In 2011, Germany saw a record rise in installations (See Fig. 6.6).[4] The European Photovoltaic Industry Association (EPIA) reported that Germany had the biggest photovoltaic market worldwide, with a capacity of 24.7 GigaWatts (EPIA 2012). To put stakeholder feedback in context, the German Feed-in Tariff scheme and its impact on market dynamics is explained here in a very simplified way. The Feed-in Tariff scheme defines the responsibilities and rights of all agents involved, the renewable energy (RE) producer, the utility and the final client. The RE producer is guaranteed

- access to the grid
- stable long-term purchase agreement
- payment level based on the cost of RE generation, technology investment and size of the installment

[4]See Umweltinvestmentfonds (2010). Photovoltaik – Rekordzubau in 2010, 13% EEG-Reduktion für 2011. This record rise can be seen in direct connection with the planned reduction in Feed-in Tariffs by the end of 2010.

The utility must

- provide the appropriate infrastructure to guarantee RE producers access to the grid
- make long-term purchase agreements
- pay tariffs according to the scheme

The utility passes on the cost of the FITs scheme to all their electricity customers. All electricity customers (final clients) must pay a surcharge that pays for the supplier's additional costs through FITs, in other words, the clients fund the FIT scheme. Figure 6.8 shows a highly simplified overview of the key actors and relationships of the implemented Feed-in Tariff scheme in Germany at the time when we carried out the study. Feed-in Tariffs were subject to changes. The rates were designed to decline annually based on expected cost reductions (degression).

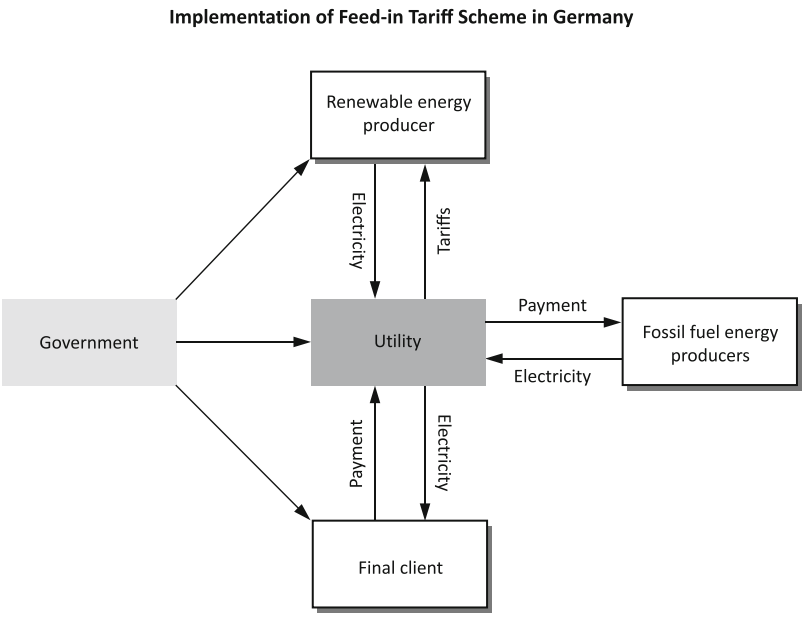

Fig. 6.8 Simplified overview of key actors and their relationships of the implemented FIT scheme in Germany at the time of the study

Between 2000 and 2009 degressions in FIT rates were modest and adjustments occurred at regular intervals. From 2009 to 2011, a dramatic increase in demand of solar panels prompted a rapid fall in costs, and government had to adjust the photovoltaic Feed-in Tariff. Figure 6.9 shows the impact the Feed-in Scheme had in Germany at that time.

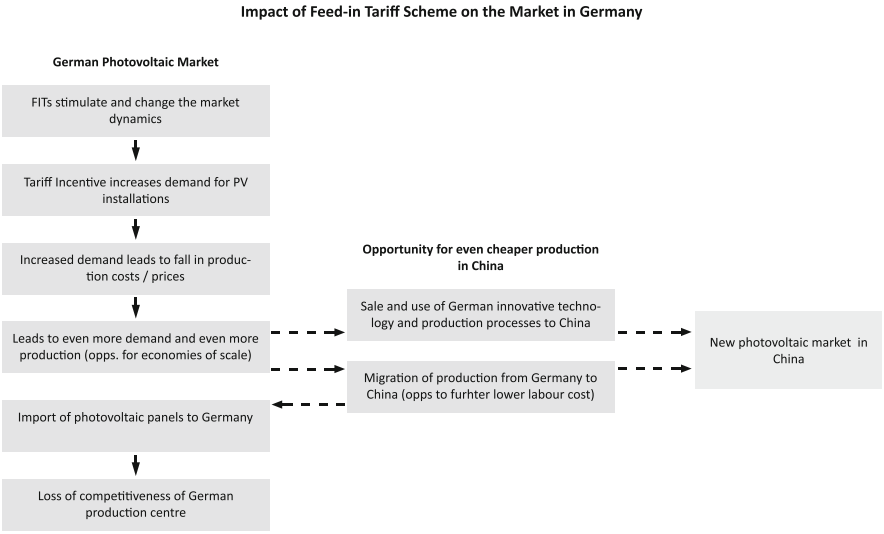

Fig. 6.9 Impact of Feed-in Tariff scheme on the market in Germany

6.2 Stakeholder Perceptions of Barriers

The Threat of Competition from China

The over-arching theme of interviews with company managers was the many-faceted threat from China, which was compounded by the reduction in FiTs. As we can see from Fig. 6.10 three quarters of survey respondents saw production migrating to countries such as China with cheaper labour costs, and were concerned that if this trend continued (or even accelerated), mechanical engineering enterprises, suppliers and finally R&D would soon also be off-shored.

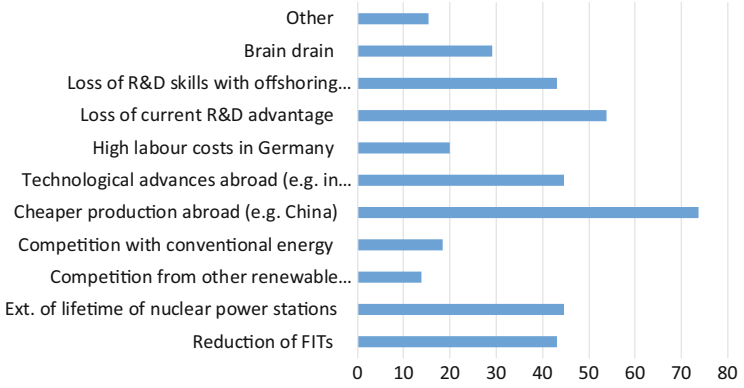

Fig. 6.10 What do you regard as the most serious threat to the competitiveness of the Central Germany photovoltaic cluster? Survey responses

What did this threat to the cluster really look like from the inside? How was it perceived by different players, and how did it evolve? And how were issues and concerns on the ground fed back to policymakers?

The competitive threat from China was very frequently mentioned in interviews by companies in the Central German photovoltaic cluster. This was one of the strongest themes coming out of the analysis of the interviews over this period. It provided the lens through which a range of other issues were viewed. The quotes paint the picture very clearly:

> *It's the competition from China that's giving us very big problems at the moment . . . the great threat is prices, of course. (Interview 10, SME)*

Distortion of the Market

Managers also complained about the distortion of competition as a result of cheap Chinese imports.

> *The greatest danger is cheap labour production in China, because it's heavily subsidised and simply leads to distortion of competition. (Interview 5, large company)*

The argument of unfair competition was put forward by almost all interviewees—for reasons such as low labour costs, low social and environmental standards, a favourable demographic situation, lack of a welfare system, huge interest-free loans, tax breaks and currency disparity. The following quotes reflect these points:

> *As soon as industrial production migrates to countries with cheap labour costs . . . the biggest danger is, that we really can't produce competitively here any longer. (Interview 11, SME)*

> *There will certainly be disruptions, because a lot of production will be off-shored to China. (Interview 1, SME)*

> *... of course there is certain danger that the production of modules in Germany will disappear (Interview 3, SME)*

Unfairness of Competition with China in Terms of Labour Costs, Finance and Environmental Standards

> *There are certain parameters that are different, more loosely-regulated in China. A short time ago, for example, we had a press release that the Chinese state bank had given billions of low-interest loans to two named companies. In practice, low interest means for free in China. (Interview 9, large company)*

. . . if there are different conditions in other countries and companies from there enter the German market and get unjustifiable start-up opportunities. So just looking at China, there they recognised the thing with photovoltaic relatively early, and, of course, there are clear advantages in the production of modules and for cell producers, they get interest-free loans over there, tax breaks or whatever else. And so that is surely a problem, when we then have to compete with them. (Interview 4, large company)

...the competition is just a bit distorted because there is a currency disparity as the Euro has just risen again. This means, the Chinese just have an advantage because of their currency situation which we can hardly compensate for here. (Interview 8, cutting edge collaborative of players)

There are, of course, different conditions of financial nature which make it very attractive to produce elsewhere. (Interview 11, SME)

Chinese companies were also seen as gaining competitive advantage from the lower environmental standards required of companies, and the less demanding regulations in other areas including the cost of labour.

. . . certain environmental standards . . . eco tests . . . test methods . . . it's all the same to the Chinese . . . use of coal energy . . . work and social standards. (Interview 9, large company)

There were some whose concerns were tempered by other arguments, however. One interviewee, for example, felt that the unfair competition argument about low labour costs was only part of the story, pointing to the fact that other production costs were much more significant.

The argument that the Chinese can do it so cheaply because labour costs are so wonderfully low, is very dangerous in my opinion. It makes up about 10% of the manufacturing costs, in some companies of 15%. It's no more than that. The rest goes on materials, logistics, depreciations of the incredibly expensive equipment that is needed to process silicon. That's one thing. The second point is: 40% of the value creation . . . is service (installation costs) which cannot just be outsourced to China. (Interview 3, SME)

Exporting Equipment to China: Importing Competition to Germany

German companies were selling equipment to China and the Chinese were now competing with Germany with better equipment and lower labour costs. This was seen as something of an own goal.

The Chinese are competing with German equipment. That is to say, the manufacturers have German machines. (Interview 8, SME)

On the other hand, there are many Saxon/German companies who profit from the fact that the Chinese have become involved in this industry on a massively scale . . . It's all machine and equipment manufacturers, partly also material suppliers, who, of course, really profit from the huge increase (in demand) in China/Taiwan. There we cannot complain that we are losing production because we are actually helping the Chinese to build up their own site . . . with complete turn trade solutions, where the Chinese can really buy a complete factory/plant, even including training manuals for personnel . . . We are actually competing against ourselves over there at the moment. (Interview 3, SME)

Reductions in FiTs as a Further Threat to Competitiveness

Most of the interviewees, and some 45% of survey respondents, thought that the speed and timing of planned reductions in Feed-in Tariffs constituted a threat to competitiveness at a critical juncture (See Fig. 6.10). This exacerbated the wide-ranging concerns about competition from China that dominated the interviews and the survey. Media discussion of additional reductions in FITs created greater uncertainty.

> *What hinders us is the whole uncertainty that surrounds everything, . . . all these media campaigns . . . Feed -in Tariffs are simply necessary because the sector still cannot support itself. (Interview 10, SME)*

> *We are completely dependent on the Feed -in Tariffs in the EEG law. (Interview 7, SME)*

The intention was that the guaranteed Feed-in Tariffs would be reduced if more photovoltaic capacity was installed than had originally been planned.[5] There was a lot of indignation and debate in the media, with talk of additional cut-backs in 2010 and a decrease of 13% at the turn of the year 2010/2011.[6]

There were widespread concerns about the impact of these changes on competition with China, given the subsidies available to Chinese companies, the lower labour costs and the high labour costs in Germany (Fig. 6.10)

> *We always have a problem in Germany . . .in relation to mass production. In solar cell production we have a cost disadvantage of about 15% or more compared to Asian manufacturers. And one cannot even make up for it by delivering 5% better quality . . . and there will be no option to off-shore such mass production activities to such countries, in fact, like China, Malaysia or India . . . We are not competitive as far as any kind of mass production is concerned. (Interview 6, large company)*

There was also consensus that the suddenness of these short-term changes in policy was very counter-productive, because companies could not prepare for the change so fast, having costed projects and proposals on the basis of the expected tariff.

The competition from cheap Chinese exports further exacerbated the crisis.

> *If we have them (China) as competition, then suddenly there'll certainly be a very strong cost factor . . ., to which we will not be able to react fast enough with R&D . . . longer adjustment times would be more helpful if something like quite rapid changes in EEG law are intended. (Interview 4, large company)*

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[5] If the installed capacity is below the planned volume, Feed-in Tariffs will slow down in the following year.

[6] An amendment of the German Renewable Energy Act (EEG) eventually came into force. Two additional reductions in Feed-in Tariffs were decided, one in July 2010 of 13% and another in October 2010 of 3%. Contrary to media predictions, Feed-in Tariffs sank in line with the planned annual reduction of 9% by the turn of the year 2010/2011 (EPIA 2012; OnlineSteuerRecht 2010 in BMU 2014).

(We should) not discuss everything again every day . . . this constant change of direction. (Interview 4, large company)

As indicated earlier, the timing of planned reductions in incentives compounded the perceived threat of competition from China. There were also statements to the effect that German Feed-in Tariffs could be seen as indirectly funding Chinese competition.

Indirect Funding of Chinese/Asian Modules with German Feed-in Tariffs

Also the media and politicians have picked up on the idea that our German EEG law supports production in China or in Asia more generally . . .. That really is a problem. (Interview 10, SME)

. . . but if competition is unfair, at least German funding/incentives for such modules should be forbidden. (Interview 5, large company)

Loss of Innovation by Decoupling of Production and R&D

One respondent warned that off-shoring production would not only lead to competition but would even lead to the de-coupling of production and R&D, and finally to reduction in innovation capacity, which has traditionally been a German strength.

The problem is, if/when production disappears from a region, then, over the medium-long-term of five to 10 years, such a lot of know how will disappear . . . And that idea—we develop here and our extended workbench is in South-East Asia—that doesn't work. If there is no regular coupling of development and production, then, at some time or another, the potential for development will be lost. Therefore, it is extremely important to retain the production site in Germany. (Interview 3, SME)

This concern was also expressed by nearly 55% of survey respondents who felt threatened by the loss of R&D competence/advantage. A further threat was perceived in the loss of skills (almost 45%) and a brain drain (30%) caused by offshoring production. Nearly three quarters viewed this as the most serious threat to the competitiveness of the cluster (See Fig. 6.10). One manager went as far as to predict that the loss of competitiveness would lead to the complete disappearance of the photovoltaic sector.

As soon as industrial production moves away . . . if that happens, with a certain time lag, the corresponding machine manufacturers and suppliers will also move away, and, after that, ... research and development will follow. It's a slow process of creep . . . it is simply a law of the market. (Interview 11, SME)

Others blamed the changing preference of German buyers for low cost rather than quality products.

The competitiveness … is made more difficult due to the fact that buyer behaviour has changed to become very, very price dependent within the last 10 to 15 years … This phenomenon is, of course, a consequence of countries like China that produce so cheaply. (Interview 9, large company)

Perhaps we've also got to learn that cheap does not mean sexy, that it's quite OK to buy a German module knowing that the cousin of the cousin works for XXX (Interview 3, SME)

Timing of the Cuts

Many regarded the timing of further cut-backs as too early, given the situation, and as likely to threaten their survival.

It's not yet the case photovoltaics has turned into the cheapest source of energy … that's still a long way off … you have to stay tuned … also invest and create the conditions …. Some research also takes its own time; a bit more stamina and more long-term predictability are things one would wish for. (Interview 4, large company)

The EEG (FiTs) law is simply necessary because the sector still cannot support itself. Money still has to be invested in R&D to reduce costs, to enhance efficiency, and, when that is done, one can forgo any kind of governmental support and be competitive then. If this [reduction of Feed -in Tariffs], happens so fast now, however, it is a hard cut. (Interview 10, SME)

Of course, we are directly dependent on the Feed -in Tariffs of the EEG. As long as an attractive return and capital service are possible for the system operator, we'll have a basis for business in Germany. (Interview 7, SME)

There were also warnings about not repeating the same mistakes made in the wind sector in reducing Feed-in Tariffs too early.

I still know this from the wind sector, where, meanwhile, they have had to support it again. But, there, ten years ago, people thought 'Now the time has come for wind energy, now they needn't do research any longer, they have their market now with the EEG law', and then all research activities were cut back in Europe. (Interview 4, large company)

A tiny minority agreed that the time had come to decrease the Feed-in Tariffs, but not as drastically as planned.

There is definitely some element of truth in it, when they say the time of constant incentives must finally be over, but Feed-in Tariffs shouldn't be reduced as sharply as actually planned. … What is happening now, is a step that is actually needed. (Interview 9, large company)

We would have liked less reduction…but the EEG law is the way it is now. (Interview 8, Cutting edge collaborative)

There were repeated complaints that the incentivised sector had also fostered free-riders who simply took advantage of the opportunities and the incentives in the market at this stage.

Free-Rider-Effects

Incentives were seen by some as attracting free-riders rather than generating real growth.

> *Photovoltaics have spread a lot of pioneering spirit, and a spirit of change and, along with it, also, a certain gold-rush mentality. Many just thought, 'Hey, you can make money with photovoltaics, and then, of course, everybody wants a piece of the cake for themselves. We are reaping what we have sown in a sense. (Interview 11, SME)*

> *I think that now that the market has grown so big there's also a fear that there are certain free-rider effects and all this is also overlaid by real policy concerns. (Interview 4, large company)*

What Solutions Did Respondents Suggest?

The key strategy put forward to address the migration of production to China/Asia was faster innovation—"Vorsprung durch Technik". More than three quarters of the survey respondents were optimistic that the photovoltaic sector would strengthen its competitiveness through R&D (See Fig. 6.11).

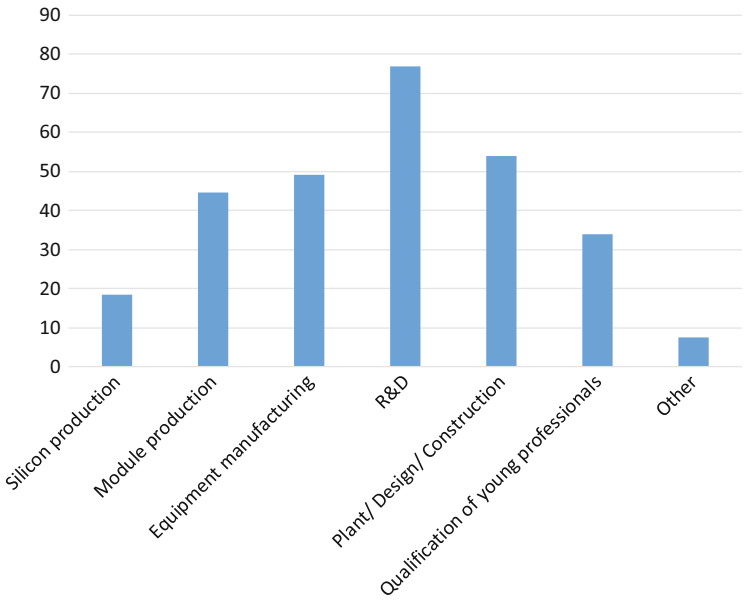

Fig. 6.11 In your opinion, in which areas will the Central German photovoltaic sector strengthen its competitiveness? Survey responses

A further boost to competitive labour costs was expected through the use of automated technologies, shorter development cycles and marketable production costs.

It is extremely important to retain the production site in Germany from the point of view of our strengths . . . that is "technischer Vorsprung"/faster innovation. (Interview 3, SME)

I hope that the German (PV) industry will be innovative (enough) to retain particular production capacities. This presupposes that we can come up with the necessary automated technologies to compensate for labour costs. (Interview 1, SME)

We are well-positioned, particularly when it comes to innovation and faster technical advances . . . but one should never rest . . . especially in good times . . . one must anticipate problems and always think a step ahead. (Interview 4, large company)

Money spent on research is still too little. Given the technological demands, we need much more R&D . . . this must be accelerated . . . otherwise we will not be able to respond to international competition. (Interview 8, SME)

In R&D . . . in technology we simply must always be one step ahead, always produce the better quality products, and this, up to now, we've succeeded in . . . thinking in development cycles of at most two years, because there is simply no more time, by then competition has acquired the technology. (Interview 11, SME)

Our competitiveness clearly depends on whether we succeed in producing photovoltaic products at marketable costs in Germany. (Interview 11, SME)

Clearly there were a range of concerns and perceptions about policy and its impact on different players at different stages. The quotes above reflect the climate of opinion amongst stakeholders in the German cluster, in particular amongst SMEs, who were possibly the most vulnerable to cost-cutting initiatives, yet most important for the move to competition by innovation.

Could this threatening situation have been avoided or mitigated? Does a closer look at crucial interfaces reveal more about the causes of the problems in the German cluster? We look at R&D interfaces to see how viable 'competition by innovation' was likely to be. A look at the communication and coordination interfaces between industry, government and University players provided interesting insights into the flows of information and action between players in identifying and addressing threats, barriers and opportunities more generally.

Barriers at the Interface Between Companies and Universities

All the strategic initiatives managers raised in interviews pointed in the direction of innovation—Vorsprung durch Technik—making the interface with Universities and other R&D institutions a critical one. Was there a functional interface, with easy access to knowledge, information, skills and specialist expertise? Were there opportunities for cooperation and collaboration for companies? Were there sufficient incentives in key areas, and acceptable procedures and contractual arrangements? The interview and survey respondents were revealing.

Although almost two thirds of survey respondents perceived the formal and informal exchange of useful knowledge and information between companies and Universities/R&D institutions as "Very good"/"Good", 22% still rated it as "Poor"/"Bad" (See Fig. 6.12).

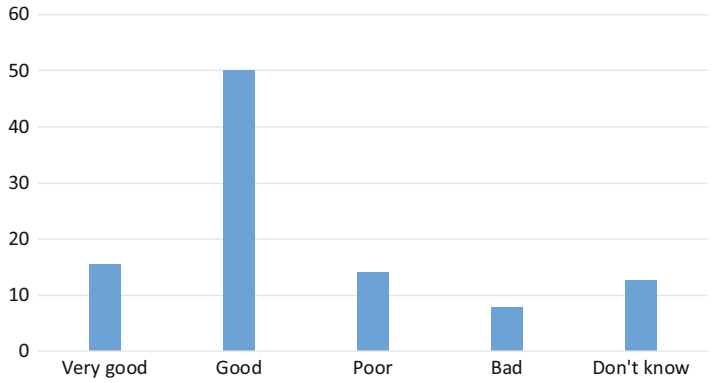

Fig. 6.12 How would you assess the formal and informal exchange of useful knowledge and information between companies and Universities/R&D institutions? Survey responses

Although respondents confirmed that there were excellent research infrastructure and network initiatives in the cluster (See Figs. 6.3, 6.4 and 6.5; Table 6.1), there were also reports about significant barriers, because R&D Institutes had started to develop and licence products themselves. This had often led to a situation of competition rather than cooperation between R&D Institutions and companies.

Competition Rather than Cooperation

> *Of course we cooperate with all R&D Institutes … But it has become more difficult in recent years, … in particular with non-university Institutes, … namely, because of a change in attitude that can be noted … from the basic idea of developing products jointly with industry for industry, they are increasingly moving in the direction of developing products themselves and licensing them to industry then, because they can make more money that way … This has the big disadvantage that one enters into a situation of competition and into a conflict of interest between development Institutes and industry which, in some cases, has actually made us decide not to carry out, or to stop development projects, because we were simply afraid that the partner would use the know how afterwards for their own commercial exploitation. From my point of view, this is in a clear contradiction of the socio-political mandate of R&D Institutes who are supposed to be conducting research FOR industry and not developing and marketing a product themselves. (Interview 11, SME)*

IPR Problems

> *Often it starts becoming difficult in projects then when it comes to (commercial) exploitation of the results … Then often the issue of exclusiveness or some such thing comes up. (Interview 6, large company)*

In addition, the aims and focus of research and the working style of industry and academia were often very different, making productive collaboration harder.

Different Working Styles in Industry and Academia

I mean … research work that is done by public research institutes can definitely be optimised, … that is to say, collaboration with industry could definitely be improved. Concretely speaking, one could imagine better contracts, I would say, a more efficient style of work. The work style of institutes and industry are different indeed. (Interview 1, SME)

Differing Research Orientation in Industry and Academia

Also in terms of research orientation, I mean the kind of research that is propagated or conducted at universities—that could surely be focused more on industry. (Interview 1, SME)

From this and other clusters, it was evident that companies often required support in complex, cross-disciplinary research areas, that were often practice based. For Universities, there were strong incentives to focus on narrower specialisms for publication.

Lack of Relevant Training for Professionals

Another critical issue in this competitive and emerging sector was the lack of timely and appropriate course offerings. The resulting lack of well-trained professionals was seen as a further barrier to development. More than a third of survey respondents thought that the competitiveness of the sector could be supported by better training of young professionals (See Fig. 6.11), with 40% indicating that they felt this was unlikely to improve in the near future. These concerns were also repeatedly expressed in the interviews.

It must be said, above all, that young professionals are a problem … academic young professionals in the technical field are thin on the ground. If nothing is going to happen there, the situation will not improve. (Interview 1, SME)

The problem is recruiting qualified personnel. It means that one has to promote the theme of engineering and create good conditions for students. That will show benefits over the long term, of course, they don't fall from heaven overnight. Personnel is a really important issue and something government could do more about. (Interview 4, large company)

Our education system must be optimised. In the long run, we will not be able to fight competition, if people are not smart or can be made smart. It's a catastrophe that we afford federalism … and the universities and schools are getting worse all the time. (Interview 8, SME)

… but, above all, in Saxony, where there are so many players roaming the field … coordination is really absent. Coordination of universities … There you'll find stiff competition instead of collaboration and coordination of different activities. The same also applies to non-university institutes. (Interview 11, SME)

Barriers at the Interface with Policymakers

Innovation was seen as a way out of the dilemma stakeholders perceived themselves to be caught in. However, in a very rapidly evolving market, companies need regular opportunities for dialogue with policymakers to (a) raise concerns about emerging issues and (b) to help inform policy that will mitigate risk, and maximise opportunities to create value.

In practice, interviewee and survey feedback reveals

(a) a lack of consultation between policymakers and companies on the ground.

> *These very fast changes and especially the latest amendment . . . that have been discussed among politicians . . .. The way politics work there has been very little opportunity for influence from the sector possible and very little consideration of economic policy. (Interview 4, large company)*
>
> *Certain research takes its time . . . It would help if people listened a bit more. (Interview 4, large company)*
>
> *What can one expect from politics? . . . The big electricity providers . . . regard us as disrupting their business, and the nuclear energy lobby has been able to make their case and is doing that again. . . . That's a well-rehearsed argument, and we've got to make our case against it ourselves. (Interview 8, cutting edge collaborative of players)*
>
> *There you speak to a brick wall . . . and it is clearly a certain brown coal lobby that is behind it. (Interview 11, SME)*

(b) a lack of communication and coordination between players in general, with some 60% of survey respondents rating the formal and informal exchange of useful knowledge and information as "Poor"/"Bad" (Fig. 6.13)

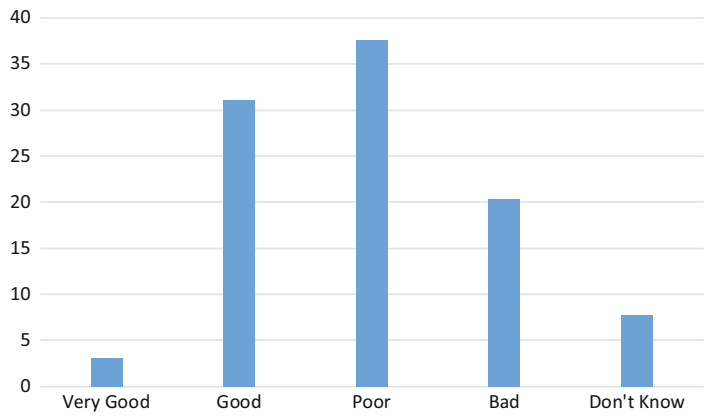

Fig. 6.13 How would you assess the formal and informal exchange of useful knowledge and information between companies and policy organisations? Survey responses

A further critical issue was the lack of funding for renewable research in general, and for SMEs and Universities in particular. The mismatch between rhetoric and reality is an ever-present theme, facilitated by the lack of communication at key interfaces, and the lack of representation of key players.

Policy on Funding Insufficient for Renewables Research by SMEs and Universities

When asked what could support a better development of their company/organisation, more than a quarter of survey respondents emphasised that better access to R&D, in particular supporting collaboration with Universities/R&D Institutes, would make a difference (Fig. 6.14).

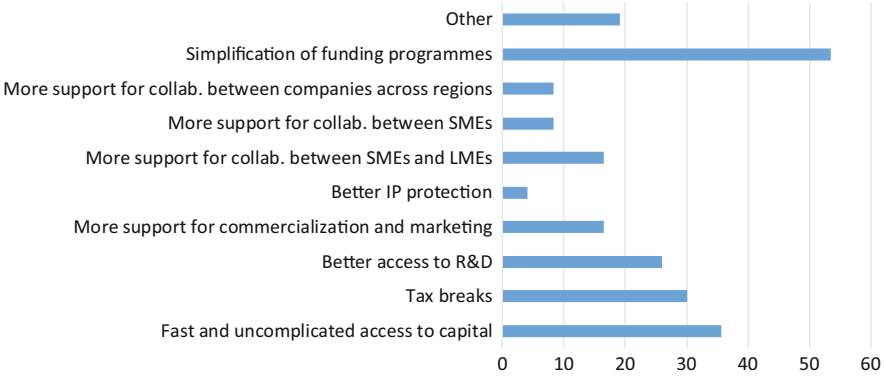

Fig. 6.14 How could a better development of your company/organization be supported? Survey responses

And when later asked if economic development organisations supported innovation of SMEs sufficiently, more than 35% said "No". When asked in general about formal and informal exchange more than 40% thought it was "Poor"/"Bad" (Fig. 6.15).

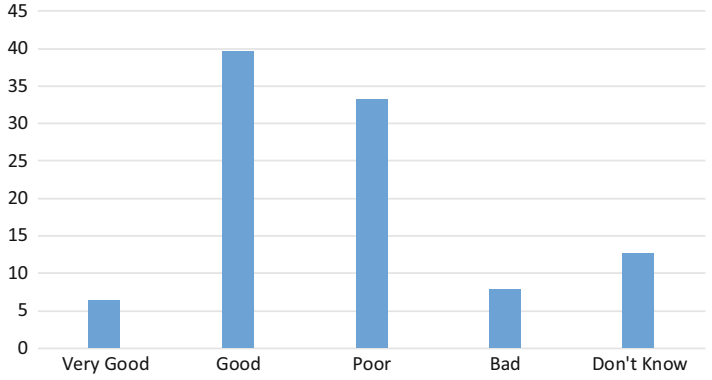

Fig. 6.15 How would you assess the formal and informal exchange of useful knowledge and information between companies and economic development organisations? Survey responses

This weak link was also expressed in the interviews.

To become competitive it is necessary that solid framework conditions are created for the public research landscape . . . and if one compares it (to) . . . the relative amount that goes into classical nuclear energy (research), is still much more than what is invested in renewable energies. (Interview 4, large company)

If one wants to promote network building, then one must enable small companies to carry out research . . . And all the framework conditions that support this . . . I would regard as very important. That is to say, the ability of companies to do research must be strengthened. (Interview 8, cutting edge collaborative of players)

For us it is really important that the political framework conditions are right and that R&D is funded in an appropriate manner. That would be sufficient in the first instance, to be competitive. (Interview 10, SME)

Because R&D has a lasting effect, of course. But that's where the shoe pinches and that's where we must start. So more R&D in companies and anything that helps in this respect. That's where we have to improve. ..(Interview 8, cutting edge collaborative of players)

We are presently developing a solar exchanger which definitely is going to be a bit difficult again . . . That is heavy going and difficult for small companies in any case, but above all in terms of coping financially. (Interview 2, SME)

What is still a bit the Cinderella of the story is funding possibilities for start-ups. In this respect, the Americans, for example, are ahead of us. (Interview 6, large company)

. . . a solid research landscape in the background that generates the basic knowledge from which the whole sector would profit, that's where they are very economical. (Interview 4, large company)

One respondent pointed to the lack of expertise and understanding of this new industry by policymakers themselves. Similar concerns were also echoed in other clusters, where even basic expertise and installation was a concern.

Lack of Expertise to Support Policy Decisions

It's particularly bad in Saxony in my opinion. In the state chancellery, unfortunately, there is still too little expertise. (Interview 11, SME)

Short-Term Political Thinking

In politics, sometimes already, there are signs: 'Now it's good enough. Now we can turn to other issues, and they lose touch. (Interview 4, large company)

Interviewees were also dissatisfied with the perceived lack of political will to promote the photovoltaic sector, which had serious consequences in terms of attracting inward investment and (young) professionals.

Lack of Political Commitment to Promoting the Industry

> *What saddens me personally, even almost makes me angry, is that Saxony is still not taking full advantage of it . . . to commit themselves to the sector and to market themselves as a lighthouse in Europe, as a centre for the photovoltaic industry and research . . . Saxony deserves to be recognised and promoted as an important location (for PV). However, it is not perceived as such. Externally, many people do not know the strengths of Saxony in this field, and that, of course, leads to disadvantages in terms of inward investment, because if large industrial companies are considering if they should locate somewhere, then the idea to locate in Saxony is only as a second or third place. The same applies also to young professionals, students. (Interview 11, SME)*

> *What would help Germany as a location for business and investment, particularly Central Germany, would be a clear commitment . . . politically . . . But that does not really exist at the federal level. (Interview 11, SME)*

> *As far as politics are concerned, one has got to keep in touch . . . It is still a young sector. Talking about photovoltaics, of course, is not as cool as talking about the new Porsche or the new BMW, which have just come onto the market. (Interview 8, cutting edge collaborative players)*

This issue of long-term commitment and promotion by government is one which is pervasive across clusters, particularly in relation to the fortunes of SMEs—ever vulnerable to unanticipated changes (such as early FiT reductions, or unanticipated changes in other financing or subsidies). The survey results in all the clusters consistently place continuity of long term government planning and support for renewables policies at or near the top of their list of concerns.

6.3 Discussion: Barriers and Recurring Problem Scenarios

The German photovoltaic case is a prime example of a rapidly-grown cluster driven by the legislation on Feed-in Tariffs and special funding programmes (in the Neue Bundesländer), where pre-existing regional factors played a key role in helping the cluster to develop and thrive (e.g. the tradition of mechanical engineering; the chemistry and semi-conductor industry; a strong R&D culture in the region).

This promising early development was perceived by managers on the ground as being under external threat from increasing competition from China, and under internal threat from an untimely reduction in FiTs that disproportionately penalised the most vulnerable players such as SMEs.

From the point of view of policymakers, however, the time was right to make the market more efficient by lowering the Feed-in Tariffs. Falling prices and excessive

promotion were already leading to free-rider effects. Excessive promotion was also creating a burden on the whole economy, especially on energy-intensive companies. Policymakers' views were in line with the EEG law. In accordance with this, a decrease in Feed-in Tariffs was intended to exert cost pressures, with the hope that technologies would become more efficient and less costly. The idea behind this is that by gradually reducing the tariffs, the industry would increasingly be driven by market dynamics (BMU 2014).

In other words—government still seemed wedded to a strategy for competitiveness based on cost reduction, while companies felt that competitive advantage could only be achieved in this context through better and faster innovation, which required more, rather than less investment.

Companies on the ground, and particularly research-intensive SMEs, felt they were at a crossroads, without the support to compete in new ways, and without evidence of real long-term political commitment to supporting the industry.

On the one hand, there was the option to compete with cheap products/panels from China by manufacturing more cost-effectively—something seen as impossible within German cost structures.

On the other hand, there was the perceived potential for competitive advantage through innovation, which would require more, rather than less funding—something at odds with the move by government to reduce FiTs more rapidly, undermining the very companies best placed to foster innovation.

In addition to this 'dialogue of the deaf' with policymakers, there were also barriers to innovation at the interface with Universities, including:

- problems collaborating with R&D Institutes in terms of competition and IPR
- a shortage of qualified professionals as Universities were not responding to market needs with relevant training and professional development
- there was not enough (long-term) funding for innovation

The clear threats to the cluster were compounded by the lack of meaningful dialogue and coordination of knowledge and resources to shared aims—rather stakeholders appeared to work at cross-purposes. Interviewee feedback shows clearly that SMEs in particular had limited opportunities for dialogue, and where they did, their influence was limited. Moreover, the wheels of research, training and professional development were not attuned to the speed of change in the markets, or the modus operandi and requirements of regional renewable businesses.

Could the cluster have learnt from other clusters transitioning from a cost-based strategy to an innovation-based one, as in the oil and gas case outlined in Part I, Chapter 3?

Could policymakers have optimised the interfaces with other actors, to support more collaborative value creation and innovation?

Researchers on cluster competitiveness increasingly underline the central importance of creating better communication and coproduction networks between players, if clusters are to create value where they come together, both in terms of innovation, and in the development of cluster policies as highlighted by Morosini's

review of the literature in 2004. These are cross-cutting issues discussed in more detail in Part III.

Recurring Problem Scenarios

The global market provides both challenges and opportunities in ways that recur across sectors as well as clusters.

Challenges and Opportunities from the Perspective of a Highly Industrialised Country

If manufacturers of a world-leading cluster export their cutting-edge technology and production processes to a low labour cost country, and start producing there more efficiently (as in the German case in China), they will benefit from first-mover advantage conquering and building up a new market. They will also benefit from exporting high-quality price-cutting products to high labour cost countries where the demand for the product is sharply increasing. However, stakeholders in their domestic cluster will not be able to compete on cost and benefit from mass production to cover their initial investment costs. There might also be an unfair element in competition if the soaring demand has been incentivised by FITs (as in the German example). In this case, the final electricity client (See Figs. 6.8 and 6.9) indirectly supports the new emerging exporting market. The challenge is now to re-think the value chains and find a new focus. In photovoltaic value chains this could be focusing on innovation and/or focussing on offering complete solutions to the final client.

Challenges and Opportunities from the Perspective of a Low Labour Cost Country

There is the opportunity to build up a new industrial cluster with all its positive implications such as the creation of employment, infrastructure and GDP growth. The cluster will also benefit from a cost advantage exporting to high labour cost countries and, in a photovoltaic/renewable energy market, might also benefit indirectly from FITs granted elsewhere (as in Germany).

In the wider dynamics of global markets, national policy on Feed-in Tariffs can generate both benefits and risks.

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Chapter 7
The Canadian Case: The Free Play of Market Forces on an Uneven Playing Field

Abstract The field study in Alberta gives a fascinating snapshot of an early stage renewable energy cluster competing against incumbent fossil fuel companies in a liberalised electricity market. The outcomes of the study are discussed, highlighting the barriers from the perspective of different actors in an early-stage renewable energy cluster, where there are tensions between different energy players in the market. The chapter suggests why, despite the huge potential in the region, and the wealth of entrepreneurs and industry experience, the sector has had limited success in achieving the aims of the cluster to create employment, increase GDP and achieve environmental goals.

7.1 Background

Alberta is one of the ten provinces that, together with three territories, make up the federal state. It is in the West of Canada, and is one of the most prosperous and wealthy parts of the world, endowed with a rich and varied set of renewable and non-renewable resources and with a per capita GDP that exceeded even that of Norway and Switzerland.[1]

Non renewables include crude oil, oil sands, gas, coal and uranium, and in the north and north east parts of the province there are vast oil sands. In fact, Alberta has the third largest proven oil reserves in the world,[2] as well as an abundant supply of natural gas (Ministry of Natural Resources 2014)[3] and very extensive coal deposits.[4] In terms of renewable energy resources there is abundant wind, sun and hydro potential. Most of these renewable energy resources are located in the southern part of Alberta, primarily by the Rocky Mountains (See Fig. 7.1).

[1]Source: The Conference Board of Canada: Income per Capita.

[2]Source: Alberta Energy: Oil Sands, Facts and Statistics.

[3]Canada is the fifth-largest natural gas producer in the world. In 2013, for example, it exported 97% of its crude oil and 57% of its natural gas to the United States. Source: U.S. Energy Information Administration (EIA) (2015).

[4]According to Alberta's Energy Ministry "Alberta's coal contains more than twice the energy of all the province's other non-renewable energy resources" (Source: Alberta Energy: Coal).

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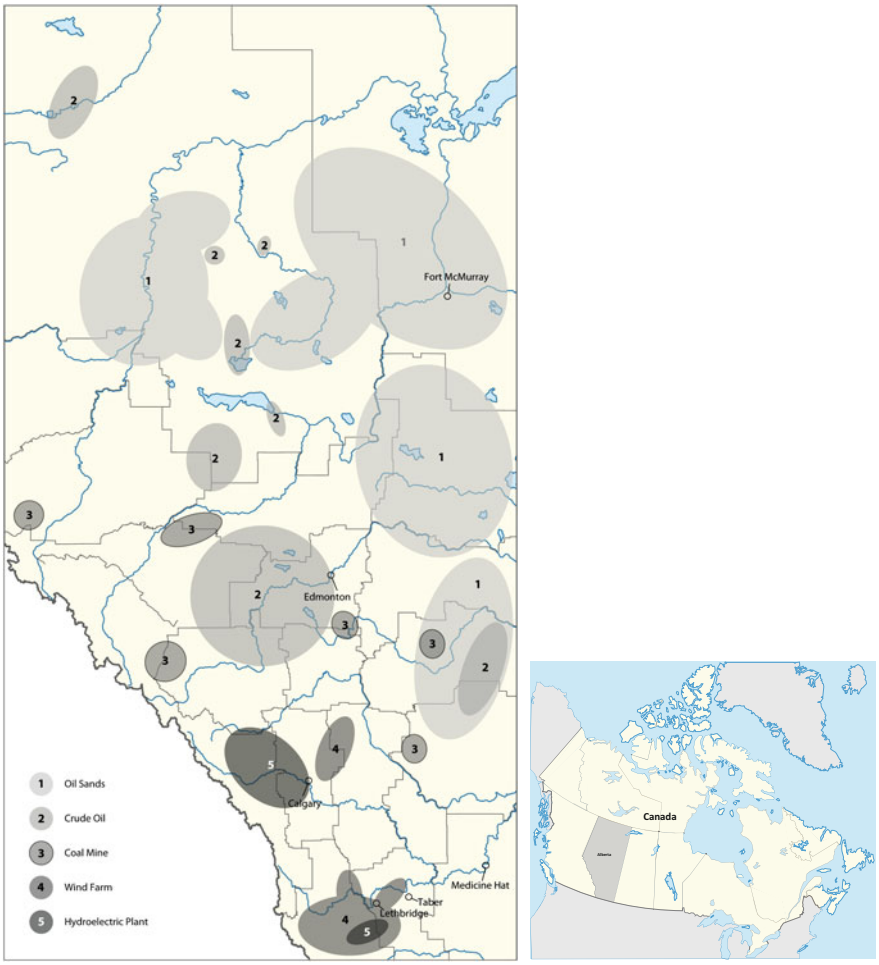

Fig. 7.1 Energy sources in Alberta. Created by Roman Siegert using data from multiple sources. Original maps of Alberta (*left*) and Canada (*right*) sourced from Wikipedia, and reproduced under a Creative Commons Share Alike 3.0 licence. Available on: https://de.wikipedia.org/wiki/Vorlage:Positionskarte_Kanada_Alberta#/media/File:Canada_Alberta_location_map.svg (Alberta) and https://de.wikipedia.org/wiki/Vorlage:Positionskarte_Kanada_Alberta#/media/File:Canada_location_map.svg (Canada)

The wind sector is seen as a growing market. Recent reports rank Alberta third in Canada, with an installed wind energy capacity of 1471 MW, where wind farms are able to produce enough to power over 625,000 average sized homes (CANWEA 2015). Alberta also has one of Canada's greatest solar energy resources, however this resource remains largely untapped. Electricity generation capacity has grown faster in Alberta than the national average (National Energy Board 2013). Coal mines are being phased out and there is potential for wind and sun to increase their share of this market.

Use of Renewable and Conventional Resources

Despite the abundant renewable energy potential and the early stage of the development of wind in Alberta, the province still has a strong reliance on non-renewable energy. In terms of electricity generation, it relies heavily on coal and gas. In 2013, for example, 65% of electricity was generated from coal and 29% from gas. Renewable energy only accounted for 6%, (3% hydro and 3% wind), as shown in Fig. 7.2. Altogether, Alberta accounted for 12% of total Canadian electricity generation in 2013. (German Chamber of Industry and Commerce, AHK Kanada 2015, p. 26.)

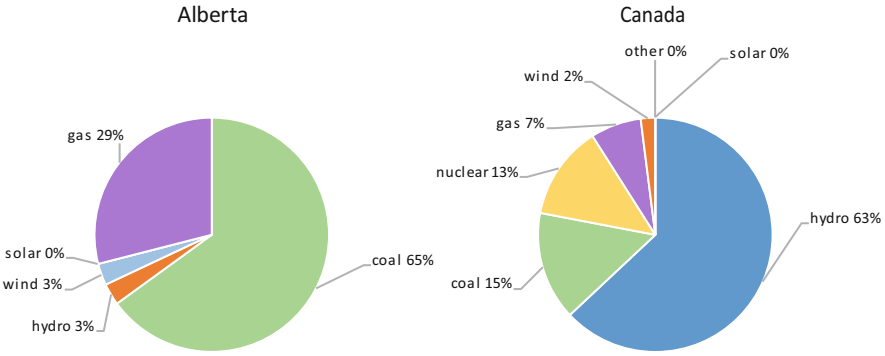

Fig 7.2 Share of energy resources in electricity generation in 2013 (German Canadaian Chamber of Industry and Commerce, AHK Kanada 2015, p. 26). The diagrams were created by the German Chamber of Industry and Commerce, AHK Kanada, based on Statistics 2014. Reproduced with kind permission of the German Chamber of Industry and Commerce

In comparison, across Canada, the main source of energy is hydro (63%)[5] followed by coal (15%) and gas (7%), while only 2% was generated by wind in 2013. The source of electricity generated also varies significantly across regions.

Although more than 60% of electricity generated comes from renewable resources in Canada, the 40% derived from fossil fuels still make Canada one of the world's largest greenhouse gas (GHG) emitters, with its hotspot in Alberta.[6] There is therefore an urgent need to harness more renewable energy to meet the growing electricity demand in the region, and to reduce the impact of GHG emissions from the electricity sector.

[5]Canada ranks third in hydropower worldwide according to the International Hydropower Association website (iha 2014 "Canada—Canada Statistics").

[6]Canada is one of the world's largest GHG emitters, ranking on number seven. See Atlas of Pollution (2009). In order to avoid paying a fine of 13.6 billion dollars for its enormous GHG emissions, Canada formally renounced Kyoto Protocol in December 2011. (Handelsblatt 12.12.2011).

Cluster Development Initiatives

Some cluster development and networking initiatives are important to mention, such as the Sustainable and Renewable Energy (SURE) cluster started by the city of Calgary in 2008 as part of a 10-year strategic vision for the city. This has the aim of making Calgary a global centre for energy, including renewables, and works together with the Calgary Economic Development agency and a large number of local companies to connect peers, potential partners, funders and customers.[7]

A further focus of clustering and networking activity is the Southern Alberta Alternative Energy Partnership (SAAEP). This consists of three sponsor organisations (Alberta SouthWest Regional Alliance, Economic Development Lethbridge and SouthGrow Regional Initiative), and represents a collaboration of 38 communities. It brought forward the Green Growth Plan in 2006 to promote renewable energy and identify barriers associated with its development. This project builds on collaborative working with multiple stakeholders to gather information.[8]

It is also important to note that in Canada, the wind and solar energy industry covers the complete supply chain from raw materials to component manufacturers, and system integrators to developers, retailers and distributors across the country (Invest in Canada 2013).

Market Characteristics

The Canadian energy landscape is very diverse, reflecting the availability of different renewable energy resources and the implementation of different policies across the provinces. As energy policies in areas such as electricity generation and supply, are shaped at the level of the provinces/territories,[9] the structure of their electricity markets differ greatly, ranging from completely liberalised in Alberta and partly liberalised in Ontario through to completely regulated in British Columbia, Saskatchewan and Quebec. Alberta is the only region in Canada with a completely liberalised electricity market.

Some credit this with supporting some of the new developments, in wind for example.

> *Well, strangely enough, I actually think that electricity deregulation that took place years ago was a big boost . . . I think in a way it was an advantage for some people . . ., especially in the wind sector. It allowed people to become small wind energy producers and sell electricity to the grid. That was a policy that at the very least helped the wind sector and I'm not too sure that it always gets the acknowledgement. (Interview B/12, SME)*

[7]More information is Available on: the Calgary Economic Development website.

[8]Further information is Available on: Southern Alberta Alternative Energy Partnership (SAAEP) "Green Growth Plan".

[9]Based on the Constitution Act of 1867. See Ritter (2009), p. 2.

Others, however, felt it merely exposed them to unrealistic levels of competition from established industries which had benefited from subsidies over the years. The following quote captures the point of view of the manager of a small renewables company seeking to compete in this market without subsidies.

> *We need to have subsidies for (renewables) programs, and I know the first thing that government says is 'As a business, you shouldn't have to operate with subsidies', and I couldn't' agree more, so get rid of them. That would be my opinion—IF you got rid of the oil and gas subsidies and put us on a level playing field. (Interview B20, SME)*

Companies investing in renewable energies in Alberta are thus exposed to the free play of market forces—there are no incentives such as Feed-in Tariffs or quota systems to help the infant industry to develop.

When asked what things made a difference and got things happening in the sector in Alberta almost 80% ticked "entrepreneurial spirit" and high levels of resources (Fig. 7.3). This was similar in some ways to the Californian cluster, and in sharp contrast to most other clusters.

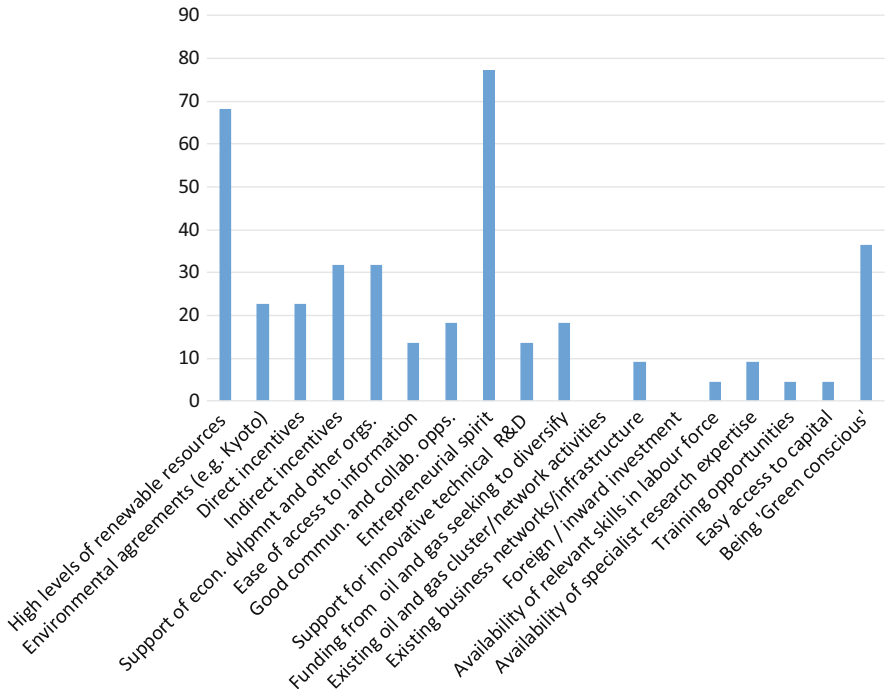

Fig. 7.3 What things do you think really make a difference and got things happening in this sector in Alberta?

The variation across regions in terms of market structure and incentivisation models has created competition between the provinces/territories in terms of attracting investment to the renewable energy sectors (e.g. Ontario and British Columbia and Nova Scotia have introduced Feed-in Tariffs).

The combination of competition between regions with different energy policies, together with the competition from oil, gas and coal producers, is widely seen as a challenging environment for the renewables sector in Alberta.(German Chamber of Industry and Commerce 2015).

In summary, the renewable clusters in Alberta started with a cognate set of advantages in place

- abundant renewable resources (sun, wind)
- some clustering and networking initiatives
- access to a complete manufacturing supply chain across Canada
- oil and gas and hydro engineering expertise
- culture of supporting big engineering projects
- excellent labour pool (e.g. well-trained engineers)
- oil and gas projects with universities

There were also a set of potential barriers to development, however.

- competition between provinces/territories (different incentives and regulations)
- competition between energy sectors (e.g. oil and gas, coal and renewables)
- competition with industries already directly and indirectly subsidised
- lack of communication, coordination and representation of SMEs at the policy table.

The Case Study

The study here was carried out between November 2010 and March 2012, with interviews between November 2010 and February 2012, and a survey between 7th February and 7th March 2012, based on the results of the coded interviews. The distribution of participating companies by size is shown in Fig. 7.4.

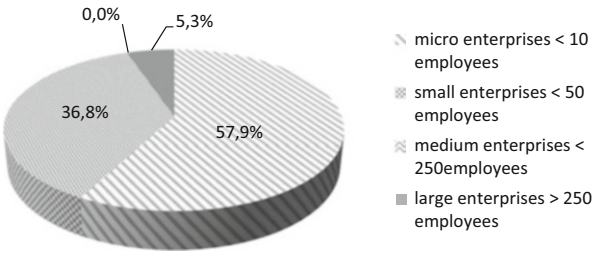

Fig. 7.4 Distribution of companies taking part in the survey. The definition of the size of an enterprise by staff number is based on Article 2 of the EU recommendation 2003/361. According to this, the staff headcount is the main criterion for size, however further criteria such as turnover or balance sheet total also play an important role. In the survey and the interviews, we only asked respondents for the staff number of their company

At this point, the solar cluster was seen by survey respondents as being at a very early stage with no growth as yet. The wind sector was also seen as being at an early stage, but with some evidence of growth. Both sectors were expected to contribute no more than 10% of gross energy consumption by 2020. The Canadian context, the timing of the study, between 2010 and 2012, and the make-up of the cluster have a bearing on the perceptions expressed in interviews and in the surveys analysed here.

7.2 Stakeholder Perceptions of Barriers

A key issue for many was the fairness of the competition in this liberalised electricity market. Stakeholders perceived the operation of the market very differently however.

An Uneven Playing Field for Renewable Companies

Companies on the ground saw themselves as competing on a very uneven playing field in many regards. Governmental representatives, however, tended to perceive all the actors as being on a level playing field in a liberalised market.

> *So the provincial and federal government doesn't provide direct subsidies or any kind of incentive to bring renewable energy in. So unlike ON (Ontario) and other provinces, I guess now NB (New Brunswick) or NS (Nova Scotia) that has a new program, BC (British Columbia) has offered some things as well to renewable companies, AB (Alberta) just doesn't provide any direct incentive and so it's a level playing field. So any renewable company that comes in is taking the lowest energy price or the grid price for their energy. So it's not so much as barrier as it is to have to understand that there's no special treatment in the province just because they're renewable technology. They still have to compete with coal and natural gas and all that stuff. (Interview B/15, EconDevOrg, Assoc, ChCommerce)*

> *As a division as a whole, we don't really distinguish between renewables and non-renewables. We look at electricity as a whole. . . . but most of the legislation and work tries to be technology neutral. I guess one of the main things when it comes to alternatives and renewables is that the government of Alberta does not have a fuel preference. . . . We leave that to private investors in the province to decide what type of generation to build, when to build it and where to build it. We leave that to the market, [we try to be] technology neutral. Now there's actually been some really great success with that to date as far as our competitive market, fostering and encouraging alternatives and renewables. Specifically, I would say the greatest triumphs have been with cogeneration technology in the province as well as wind generation. We've seen quite a substantial increase in both those technologies since we restructured our electricity market. Restructured or deregulated I guess. (Interview B/8, government)*

> *. . . the deregulated market . . . anyone who wants to build a project, can build a project. Unlike other jurisdictions where the government puts out a request for a proposal and chooses a proposal, and the government decides when a project is built. Alberta is different in that it's the private investors who decide that. . . . And along that is the real time price . . . the price fluctuates which can be a benefit to developers because they're not locked into a contract. . . . there is no need for government to intervene in the market . . . the success in*

Alberta we've had is on the fact that we have a level playing field for all investors. . . . there is no need to really look at specific programs to encourage that. . . . You see how much of that is alternatives and renewables. You see, that kind of interest in the market and the record of the investments over the last few years, so there is not a compelling need in Alberta to look into a specific program because the market has been doing way better than any centrally planned program. (Interview B/8, government).

This was also very in keeping with Albertans' perception of themselves as an independent and entrepreneurial business culture. As one manager put it

A lot of people here are fairly entrepreneurial, so people don't necessarily look to government for any specific funding or that sort of thing. (Interview B/12, SME).

Many small and medium-sized companies, on the other hand, had a quite negative view of the liberalised market because they felt that powerful players were strongly influencing the so-called "free play of market forces". They felt overwhelmingly that they were doing business on an uneven playing field where policies were made in favour of fossil fuel industries also in receipt of subsidies and other sources of funding. They also felt that their needs were very different, but less well represented (Fig. 7.5).

This inequity was also strongly expressed in interviews and survey comments.

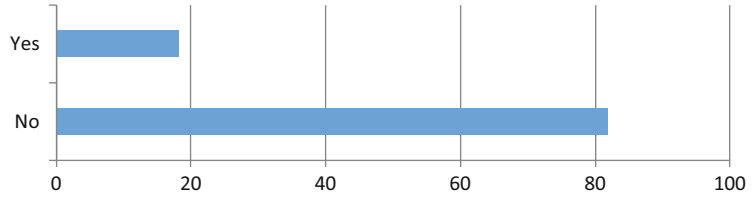

Fig. 7.5 Do you believe there is a level playing field for renewables?

Well the biggest barrier in Alberta is the fact that the provincial government subsidizes the fossil fuels industry but they don't do the same or offer similar support for renewables. In fact there is no support for renewables at all. There's no government incentives, no tax incentives, there's nothing. So the biggest barrier is the fact that it's not a level playing field. (Interview B/18, SME)

Conventional energy is hugely subsidized directly and indirectly. I want a fair playing field. (Survey respondent)

Inequitable energy development incentives (Survey respondent)

Only if subsidies long enjoyed by the oil and gas industry are also made available to the renewables industry will there ever be a sense that renewables are welcome and a level playing field will follow once renewables have had a chance to prosper and grow and contribute to the energy mix in a meaningful way. (Survey respondent)

$1 billion for CCS (Carbon Capture Storage), 1.4 billion in subsidies from federal and provincial government for oil and gas exploration etc.; billions for transmission lines that serve large coal plants in Northern Alberta. (Survey respondent)

In the renewable energy market place there is no basis for equality because of the (funds) given to oil and gas exploration development, (conventional) R&D. . . . If 1% of the oil and

gas expenditures on research were reallocated to renewable, this would be a completely different story. (Interview B/20, SME)

Alberta policies focus solely on coal, oil and gas. . . . [If I had a chance to implement policy for renewable energy] I would eliminate subsidies to fossil fuels. So that the playing field between fossil fuels and renewable energy would be equalized. Because right now fossil fuels receive huge subsidies in a number of areas such as ridiculously low oil royalties, tax holidays, I mean the oil sands were only developed because of tax holidays. (Interview B/6, SME)

I think the biggest problem is that the oil companies give the governing parties campaign funds and so it is a way for the governing parties to stay in power because they receive huge amounts of money. So we are not living in a democracy anymore, we are living in a corporate controlled government. (Interview B/6, SME)

[SMEs] need additional support, because they need a level playing field to be able to compete with the bigger producers. (Interview B/7, SME)

Probably I would call [the oil and gas industry's influence on renewable energy development] something equivalent to a big mountain blocking the sunshine, If that makes sense. It's really been a challenge because we are competing for resources in terms of how well we make power, we compete in terms of the ()space, we compete in terms of focus of public policy on the industry, and oil and gas has been eaten up a lot of time of policymakers. I would actually say, to a certain degree, we have relatively high levels both in oil and gas, oil costs and gas production costs that can kind of tip the scale. As of now it's just been a lot of the focus and eaten up a lot of the resources that could be put in other industries. You have to understand the fact that 85% of our primary, secondary and tertiary industries are oil and gas driven, so I guess you can kind of see why. It certainly has been a barrier, at this point. (Interview B/17, SME)

[The oil and gas industry] pretty well kills [the development of renewable energy in Alberta]. Natural gas is so cheap that it's very, very hard to compete. Our whole province and in fact the economics of Canada is built around the oil sands. Most people don't realize this but the oil sands and the production coming out of it probably in the next 20 years I would say probably 15% of the world's total oil supply will come out of AB. So that has a tremendous economic impetus to it that just overshadows everything else. (Interview B/18, SME)

Oil and gas runs this province . . . they make all the rules . . . all of them. (Survey respondent)

Given the emphasis in the region on the use of market forces rather than subsidies for renewables, SMEs often pointed to the fact that the environmental and health costs from oil, coal and gas were not taken account of, but rather passed on to the community.

What the barrier is, is the economics of the system, because everything is market driven. There is a bit of a bias in the market, there are no externalities like pollution from coal, and this is not taken into account in the market price of energy. So this puts renewable energies that don't pollute at a disadvantage because they are competing against coal that do not have to pay for that extra amount that they are polluting. (Interview B/7, SME)

They basically feel that the market should not account for those externalities, that the market is a market and there is no need to consider that. There are no regulations to

accommodate. In terms of emission standards Alberta is really lacking. (Interview B/7, SME)

I would say the best way to cause renewable energy to flourish in the province is just to penalize the dirty forms of energy. A carbon tax that would cause coal power to be more expensive would change things a lot in Alberta. We rely very heavily on coal and it would shift things away from coal quite nicely. (Interview B/14, SME)

Until the externalities of pollution from hydrocarbon use are appropriately priced, hydrocarbons will retain a price per unit of energy advantage over renewables. (Survey respondent)

Many renewable companies thought that providing more penalties for emissions, and/or Feed-in Tariffs, would help rebalance this (Fig. 7.6).

Asked what factors would make a difference to the future development of the renewables sector, an even higher percentage (77%), were in favour of further

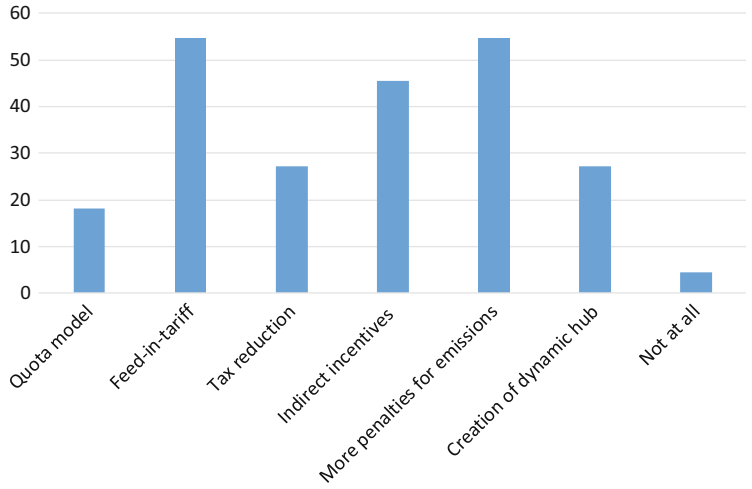

Fig. 7.6 In your opinion, how should the renewable energy sector be incentivised?

disincentives to fossil fuel production, such as emission caps (See Section 7.2.1.5 for more detail).

Different Incentives in Different Regions Was Seen as Creating Unfair Competition

There was also concern about the potential unfairness of competition with other provinces or territories as well, where incentives were available. In the survey 50% of the polled thought that the lack of joined up policy in national and local governments/across jurisdictions was a principal barrier for the renewable energy sector (See Figs. 7.7 and 7.8).

When asked if they thought the sector was disadvantaged when competing with other regions who have incentives like FITs, for example, some two thirds of survey

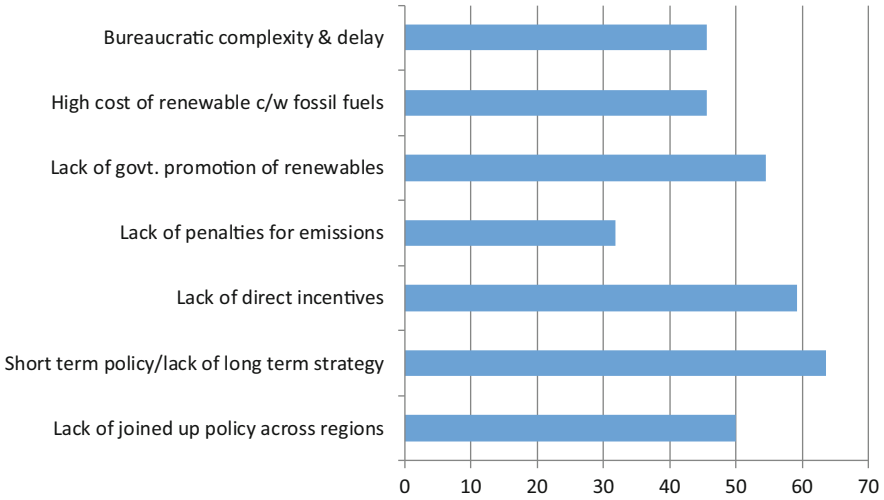

Fig. 7.7 Principal barriers to the sector

respondents said "Yes".

The following comments from interviews further illustrate companies' concern about unfair competition with other provinces or territories.

> *It's a competitive issue. It's hard to bring a company to Alberta even though we have lots of resources. It is a very supportive climate in general and it's a good place to do business. I mean it's very free market friendly, there's an excellent labour pool here, so there's lots of advantages on that front. What it comes down to is. . .the 'buck stops here' question is "What can you give me, in terms of incentives" because that's just how the game's played everywhere else. . . . but as long as they're giving an incentive elsewhere it's hard to attract a company even though there is certainly an argument that they would succeed here. (Interview B/15, EconDevOrg, Assoc, ChCommerce)*

> *As far as incentives, there really aren't any in the province and that's been brought up as an issue because for example Ontario is offering incentives and whoosh, wind projects are moving there. Alberta used to be leading the country in wind investments, for example, they aren't any longer. Projects have gone to Colorado, and Ontario and places that are offering incentives. It just isn't within the Alberta philosophy to do that. (Interview B/10, EconDevOrg, Assoc, ChCommerce).*

> *[barriers for renewable energy development] depending on your jurisdiction, what community you're in, some have stringent bylaws, some are more relaxed. . . .trying to attract investment in renewable energy to Alberta . . . with Ontario having a FIT system and Qué bec and Ontario having domestic content rules . . . made it very challenging to convince manufacturers that they needed to set up in Alberta (Interview B/11, education).*

This also underlined the concerns about lack of penalties for emissions, lack of direct incentives, and the difficulty of competing on cost with other established sources of energy.

Other critical barriers highlighted in the interviews, and in Fig. 7.7, included bureaucracy, and the lack of long term policy, and policy that was coordinated across jurisdictions. (See also Fig. 7.8)

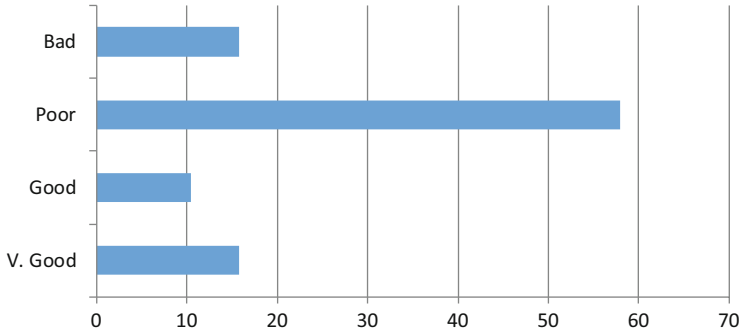

Fig. 7.8 Rating of coordination across jurisdictions

Bureaucracy

This survey question also underlined the recurring issues with bureaucracy as a source of cost and delay. This was recognised in all the clusters, particularly since most businesses in renewables were involved in the assembly of modules or their installation, and also required various permits and certificates to proceed. In such a context, like the construction industry, bureaucracy can be a critical barrier.

Lack of Long Term, Coordinated Policy

Figure 7.7 also highlights a recurrent theme across clusters—the lack of stable, long-term policy, particularly in terms of funding, which acted as a disincentive for both smaller companies, and for investors, given the perception that different governments might change policy. Almost two thirds of respondents cited this as one of the principal barriers.

As previously mentioned, coordination between the different levels of government was identified as a challenge that contributed to this in both interviews, and in the survey (See Figs. 7.7 and 7.8).

> *I think one of the challenges . . . is the levels of government between municipal, provincial and federal, and making sure that everyone is following a similar agenda . . .. The country is a federal country. Democracy dictates that at a municipal and provincial level, sometimes people have different opinions and that's right. And sometimes that doesn't always lead to joined-up policy. (Interview B/9, EconDevOrg, Assoc, ChCommerce)*

There was also a concern about coordination across levels of government, which overlapped with the issues in bureaucracy that were also identified.

Although not scored as highly, there were also a cognate set of SME-specific issues crucial for the development of SME-led innovation. These are a set of issues evident across all the clusters to a greater or lesser extent (Fig. 7.9).

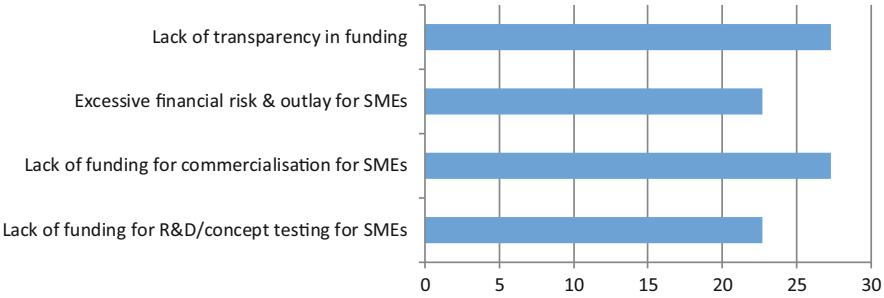

Fig. 7.9 Key barriers specific to SMEs

The specific issues that SMEs saw as barriers to their development were also attributed to the lack of representation and influence at a policy level. While associations were seen as representing some of those needs, the influence of both smaller companies and associations was seen as limited in shaping decision-making. As many of these were oil and gas companies, with very effective lobbies, this was seen as disadvantaging smaller renewable companies in particular.

Lack of Representation and Influence on Policy

It was clear from the responses that many SMEs felt that their needs and concerns were not sufficiently taken account of in the shaping of the policies that configured their operating environment. Yet that was not the perception presented by those making and implementing policy. They typically felt ample opportunities were given to SMEs and other stakeholders.

> *Actually, in Alberta before a policy is made there is extensive, and I emphasize the word extensive, consultation with stakeholders. And of course industry is one of the main players here. And we regularly have these what we call Electricity Coordinating Forums, where everyone can really participate and we do invite them to participate to discuss policies, whether these be policies being made or policies that have been made. Because when you make a policy, after a few years it is time to review. It's open. Broad stakeholder consultation is from what I've seen something that this government has pursued, I guess government wide. (Interview B/8, government)*

> *The organization of the Alberta government that has just been set up is ACTIA . . . it's the Alberta . . ., something. . .Technological Industry Alliance. Anyway, it's focused on sustainable and renewable technology. . . . this is really what I'm saying about extension of the SURE cluster, . . . the mandate of that organization is very much about bringing companies together, not just . . . and talking about what they need to go forward. But also to provide a*

forum where those companies. . .makers of that technology . . . can talk to policymakers as well. (Interview B/9, EconDevOrg, Assoc, ChCommerce)

. . . the SAAEP, which represents over 40 communities and then is in talks to partner with another organization that represents about 30 communities. So, when you have something that represents the whole southern part of the province, which includes 70 or 80 communities and everything agrees on a key message that needs to go up to the province, then elected officials pay attention to that. So, as an alternative energy partnership, we are trying to figure out what we can ask of the province. (Interview B/10, EconDevOrg, Assoc, ChCommerce)

From the point of view of many small and medium-sized companies in Alberta, however, the issue of representation on policy issues was more problematic.

I don't see any current opportunities to influence policy. (Interview B/20, SME)

[We as a business aren't] absolutely [able to influence policy with the provincial government]. . . . we're not big enough to be a player that could influence the government at all. Unfortunately, all those associations are national associations . . . they're all centered in ON (Ontario) or QB (Quebec). So they don't seem to understand our problems in Alberta as an association, so we get like zero support from them to try to influence government in Alberta. Sorry to be so negative, it's just the reality. It's a really uphill slug in Alberta. (Interview B/18, SME)

I don't think there are any golden opportunities for [influencing policy]. It seems to me that if we felt like we wanted to influence policy our membership in CANWEA is probably our best available form for doing that. (Interview B/14, SME)

Communication between companies and policymakers in government was rated as Poor or Bad by around 70% of survey respondents (Fig. 7.10)

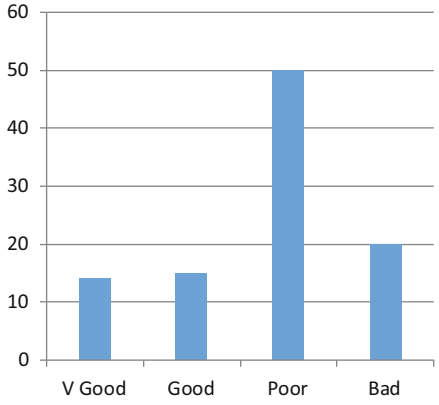

Fig. 7.10 Communication between companies and government

This was seen at times as something of a one way channel for SMEs in particular.

Well, the government only gets you involved when they want something and once they get it they got what they want so they stop communicating with you. I don't know if there's any

better way to do any of that. There has been a number of attempts to establish environmental policy groups . . . I refuse to get involved, I was involved in both . . . they both failed. (Interview B/20, SME)

The feedback of survey respondents on this issue was rather negative. The formal and informal exchange of useful knowledge with policy organisations was considered as Poor/Bad by 70%. Exchange with regional economic development/enterprise organisations was evaluated as Poor/Bad by 40%.

There was a perception, also that a small group of very established companies had significant influence.

There is a small niche group of people that have a lot of communication channel back and forth. . . . but when you scale it up its every man for themselves. (Interview B/17, SME)

And for very specialised micro-companies it seemed to be particularly difficult to find an appropriate forum.

So most of the players are very small, they are one or two men operations at the most . . . it's hard to get them to communicate because their focus is so focused. (Interview B/18, SME)

Policy on Direct and Indirect Incentives

There were still very mixed views of FITs (See Fig. 7.11), given the difficulty of competing without them, and the difficulty of accepting an incentive which appeared

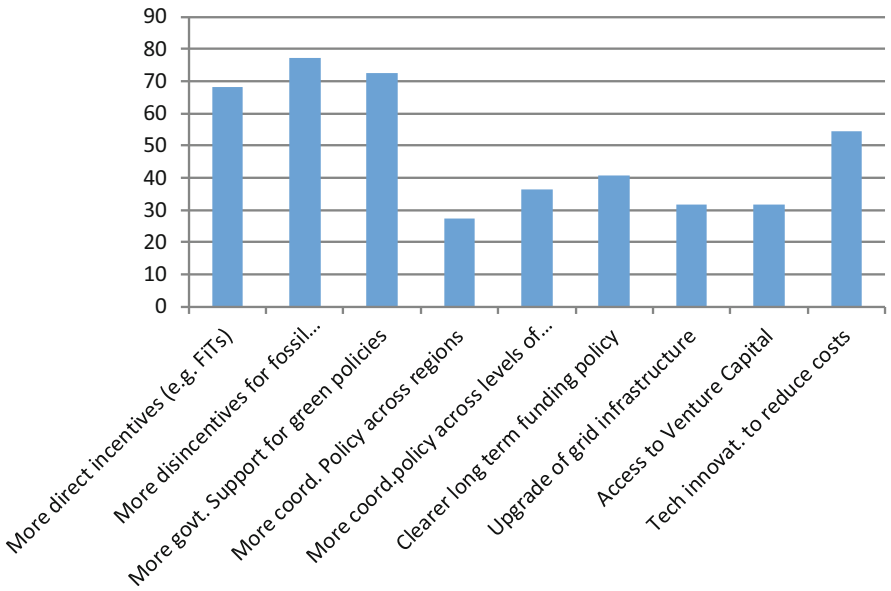

Fig. 7.11 What factors would make a difference in the development of renewable energy in Alberta?

to distort the market, with consequences that had already been felt in Europe. In a separate question asking how the sector should be incentivised, 55% of survey respondents opted for FITs (Fig. 7.6).

Quotes from the interviews reflect the different opinions on this issue.

> *The major barrier in Alberta is the economics. If you look back at the development history of wind energy, you can really see the effect of the wind power energy incentive, which became the eco energy incentive, the effect that that had on wind development. You can see when the incentive was available, it allowed growth of the industry and when this was not available, the industry just stopped. So companies are really reliant on these programs, because without them, it is very difficult to keep a project running. If you want to encourage these projects to get off the ground, there has to be some sort of incentive. This is one of the things that we are struggling with in Alberta, is a government that does not agree. (Interview B/7, SME)*

> *The one policy that has been most effective at bringing in renewables has been the FIT program. We know that it is widely accepted and it is kind of like the gold standard, and it has been effective at bringing in renewable energy as well, as it is the cheapest in the long run. In the end what is cheapest for society is the FIT, and I mean that is based on the principal (that), as each year goes by, they evaluate how much you are paying for your FIT and you decrease it annually. The rates have to reflect improvement in technology. (Interview B/7, SME)*

Others were against the idea

> *There's other ways, and the truth is there are more effective ways of supporting renewable energy, like FITs. I just don't' believe in them. (Interview B14, SME)*

> *I really don't see anything like subsidies or FITs happening in Alberta. (Interview B/15, EconDevOrg, Assoc, ChCommerce)*

Some were sceptical of the longer term benefits

> *I'm not convinced of FITs . . . There's been some positives and negatives I've seen from these programs, and in terms of strictly looking at it in terms of renewables, for renewable energy a FIT would definitely be a good thing in the short term, I'm just wondering in the long term as well because as the tariffs get rammed down. A lot of producers end up having to scale back as quickly. I'm not sure there's really a long-term benefit from them. (Interview B/12, SME)*

And some did not want to pin themselves down.

> *Well, I have no doubt that a FIT would help encourage the development of wind and solar but I'm also aware that a FIT is expensive. So, it's not really for me to decide that question. At the end of the day, a government has a lot of priorities, it has a lot of spending commitments it is a big question. It's not really for me to say whether or not the government should or should not do it. I have little doubt that a FIT would result in more solar and more wind or other sustainable and renewable energy being produced, but whether or not that is desirable as an objective and the cost is not for me to say. (Interview B/9, EconDevOrg, Assoc, ChCommerce)*

Without government support or subsidies for renewables, financing was a barrier for some. Almost three quarters of the survey respondents stated that government support for Green policies would make a difference in the further development of the cluster and almost one third thought that access to venture capital would make a difference. (See Fig. 7.11).

It is hard to get financing and it is hard to make a profit. So this has just driven companies away from Alberta in the renewable energy sector in particular. This would be the major barrier. I would say that the way to overcome that would be to have some sort of government support for renewable. (Interview B/7, SME)

Other challenges, access to finance often for other projects, even if you're going through a commercial bank is challenging, usually for consumers that want to implement, let's say other initiatives that might cost them more for their construction projects. But when you talk to banks, they don't have a knowledge base needed to understand these ideas. (Interview B/17, SME)

While many of the issues discussed related to the interface between companies and policymakers, the interface with universities and other research organisations was also the focus for a number of barriers.

Barriers at the Interface Between Companies and Universities

Lack of Access to Qualified Staff: Unfair Competition

Renewable companies saw themselves as competing for a limited number of qualified staff against the oil and gas sector where salaries were many times higher. This was confirmed by more than three quarters of survey respondents.

A buddy of mine got offered $110/hour by a petroleum company to do quality control engineering and extracting. $110/hour! How do you compete with that? . . . It's shocking. The brain drain, it happens. I lost one of my civil engineers who has the best of intentions going in and an 'I'm going to change the world' mentality and his mistake was getting married and having a kid. Because he had to look at his long-term financial strategy, and guess where you go in Alberta when you want the big bucks quick? You go to oil and gas, which is exactly where he ended up. (Interview B/20, SME)

We don't have a significant amount of oil and gas in the south because it's all moved to the northern part of the province. So of course, those mega developments suck up our labour force big time, so our trades' people, welders, fabricators; those kinds of people are drawn to working up north for much larger salaries than what the rest of us in the real world would get. So there's certainly that labour distribution issue (Interview B/10, EconDevOrg, Assoc, ChCommerce)

Lack of Expert Knowledge and Information

In addition to 40% of survey respondents who thought there was lack of qualified people in renewables, some felt that there was a lack of knowledge and expertise in this new sector as well, as we found in many other clusters. This was not only seen as a barrier to recruitment and expansion, but also as having implications for the quality of policies developed without a real understanding of the issues.

I would think knowledge [is holding back renewable energy development] . . . it's still all a new area. I don't know if I spend $15,000 on solar panels on the roof of my house, if I wake up one morning and think "That's a good idea" I don't know where to put them, how to install them, where to find the components. I don't know for sure how much it should cost and I don't know what my return on investment would be and what the benefit would be. And there just doesn't seem to be any simple way to quantify that for people. (Interview B/10, EconDevOrg, Assoc, ChCommerce)

So you need . . . a combination of fossil fuels, generation of some kind and then some configuration of wind and solar and there's just no one size fits all. We don't know enough about how to put these things in combination, because what works for one person, in one part of the region, might not work as well for another part of the region. Because the wind blows differently, the sun shines differently, the application needs are different. . . . an important issue to address is knowledge and information on how to actually use and implement technology and build it. (Interview B/10, EconDevOrg, Assoc, ChCommerce)

Some people learn how to spell the word solar and announce themselves to the world as leading experts, but there are not a lot of people that do exactly what I do, getting involved in engineering design and development. (Interview B/6, SME)

The biggest issue is that people do not understand the technology and they do not understand power and electricity and they do not know about the economics. They really do not know who is doing what. (Interview B/6, SME)

Universities have the potential to play a role in knowledge transfer and training in support of key regional industry sectors. Although the standard of Universities in Alberta was regarded as world class, collaboration between Universities and industries was still perceived as problematic. Around half of survey respondents assessed the formal and informal exchange of useful knowledge and information between companies and Universities/R&D Institutions as "Poor"/"Bad" (Fig. 7.12).

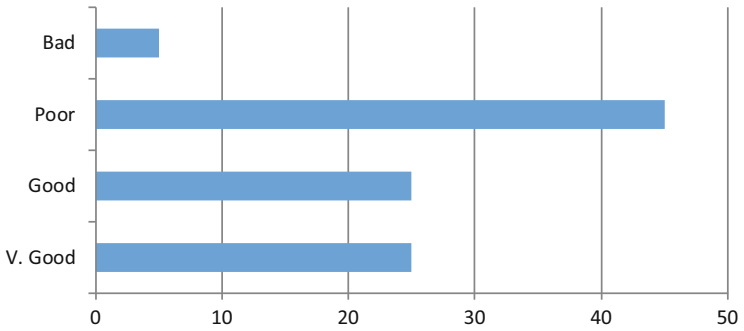

Fig. 7.12 Formal and informal exchange of knowledge and information between Companies and Universities

Access to information for companies about renewables was also raised as an issue . . .

There is really no one overarching kind of provincial place to do this [get information on funding, permits, legal measures etc.] we see our developers going to specific communities.

. . . And you can see where that would be very slow, very laborious, and you just think you're making some headway and the community has an election and the council changes and you're starting all over again. So there really is no one-stop shopping place to find all that. And we see that as a real issue for the province. (Interview B/10, EconDevOrg, Assoc, ChCommerce)

. . . as was the lack of information and knowledge about the industry at the level of government.

I think the thing that really needs to change is the information availability to government and so on. We really need leaders in government, those that are willing to be bold enough to step out of the oil and gas puddles and start looking at Alberta as an energy province again, and not just a carbon energy province. The government has been misguided by so many industries in Alberta. It's absolutely ludicrous. The oil &gas industry convinced the government at some point that carbon sequestration would be the answer.. . . It seems to be another cash cow, playing on fears that we would be left behind if we didn't do something . . . I think what has to happen is the province and the people that live in it have to realize and believe that a fossil fuel economy is temporary. (Interview B/20, SME)

Some suggested that awareness raising amongst citizens could help advancing the agenda of renewables . . .

People here are very aware . . . that the province gains a lot of its jobs and revenue from oil and gas. . . .There could be a little more awareness about what the province has to offer in sustainable and renewable energy, and how everybody can play a role in advancing the agenda through fairly easy means. . . . I think there might be more opportunities for us to proactively educate people. (Interview B/9, EconDevOrg, Assoc, ChCommerce)

. . . perhaps even with an environmental ombudsman being responsible for environmental policy.

I think what needs to change is leadership, in Alberta, particularly, needs to establish an environmental ombudsman—someone responsible for environmental policy. It's not a single chair within cabinet. To have someone there whose sole responsibility and long-term responsibility is to develop and protect social and environmental policy. (Interview B/20, SME)

Collaboration on Research and Training

Interviewees mentioned that, at times, collaboration was difficult both in terms of the lack of training in specialist areas, and the difficulties sometimes encountered in engaging with business.

Another problem I've heard mentioned in the past—and I don't know if it's as strong today as years ago—is that a lot of people feel the local universities aren't really set up to work with businesses. And so, I think there's some businesses that would like to partner with universities and maybe use people at the universities as. . . to work with business, and the impression that I get from the people I've talked to is that there really isn't a mechanism in place that allows the two groups to actually work together so that they can help each other. (Interview B/12, SME)

I got experience with university-industry interactions across Canada and its better in Alberta than in other places. How do I put it—Universities can be a little more standoffish. And because Alberta is very focused, Alberta works hard; Alberta has a very business

oriented mindset, they're comfortable with industry in this province I think. And it's less so in other areas. (Interview B/16, EconDevOrg, Assoc, ChCommerce)

Given the potential for Universities as (a) a source of expertise in innovation and training and (b) as a source of research about the needs of industry and the impact of policy, the limitations perceived by SMEs in particular were significant. This was a recurrent feature of all the clusters, regardless of the stature of the Universities involved.

Barriers at the Interface Between SMES and Larger Companies

The interface between education, industry and government is at the heart of communicating and coordinating aims and resources to common ends in a cluster, particularly in the early stages, and was a recurring theme in the conversations. Again perceptions of the value and effectiveness of networking activities varied across actors. Barriers at the interface between SMEs and larger companies impeded leveraging the huge potential for value creation in the region and surely had implications for economic outcomes.

In the survey, in Fig. 7.13, formal and informal exchange of useful knowledge and information between SMEs was more likely to be regarded as "Good" while that with larger companies, on the right, was more likely to be regarded as "Poor".

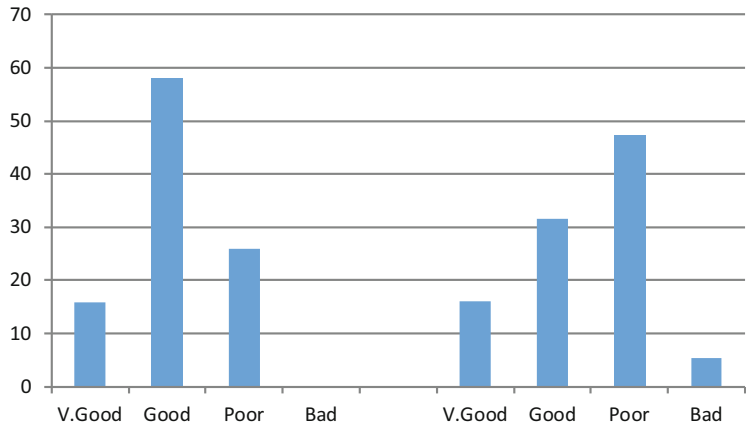

Fig. 7.13 Exchange of knowledge & information (**a**) between SMEs (*left*), (**b**) between SMEs and LMEs (*right*)

SMEs in particular, felt their needs were not well represented and taken account of in general. They made a distinction between consultation and representation in meaningful dialogue with other actors.

> *I find these types of collaboration are all talk and little action. SMEs cannot afford to spend hours in discussions that do not lead to revenue generation for them. Larger companies have the resources to invest in these discussions. (Survey respondent)*

While events had been organised to support this. . .

> *We set up what we call the sustainable and renewable energy sector cluster, or SURE cluster.. . . We've been proactive in bringing those companies together. . . . We've actually had meetings and events where we brought those companies together to network, share practices. It's something, it's a growing area, I think . . . (Interview B/9, EconDevOrg, Assoc, ChCommerce)*

. . . their success was seen as only having a short-term impact, rather than changing the interaction in a lasting way.

> *There's been some networking organization put together for the renewable energy sector and they don't last too long. I'm not sure why, if there's nobody there who has the time or resources to organize it or if one by one the individual attendees move on, but I've noticed that there's not a lot of cohesion in that you have a long lasting group that does that. (Interview B/12, SME).*

> *We've spent so much time as a group to collaborate with institutions, the city, municipalities, to work with these people to come up with strategies and plans to move things forward in a meaningful way. Once it gets in the hands of the decision makers it gets all lost. . . . All these discussions and all these presentations to government, we got no feedback on them. So once we put it out there, we have no idea if it ever gets talked about again. (Interview B/20, SME)*

Although it often came down to personal interaction with key players—something that is hard to legislate for, and requires a long-term relationship, rather than an event.

> *Communication just is always the big issue . . . What we've really found is that we can do all these (mass) things, we can do websites and newsletters, and e-blasts and twitters and tweets and everything else, but honestly, we have found that the things that really work effectively are face-to-face kind of things, because all of these projects are made up of people, and stuff happens when the people click, connect, understand each other and move forward. It just is really interesting how so many effective things come just down to the interpersonal relationships with the people who are in the key positions to move things forward. (Interview B/10, EconDevOrg, Assoc, ChCommerce)*

The Potential for Strategic Alliancing

> *We really need leaders in government. Those that are willing to be bold enough to step out of the oil and gas puddles and start looking at Alberta as an energy province again, and not just a carbon energy province. The government has been misguided by so many industries in Alberta (Interview B/20, SME).*

Economic development agencies often referred to the potential of collaboration with large oil and gas companies as a 'third way', building on their financial capacity, and the various reasons for which they are now seeking to generate or support elements of green energy as part of their portfolio (Fig. 7.14).

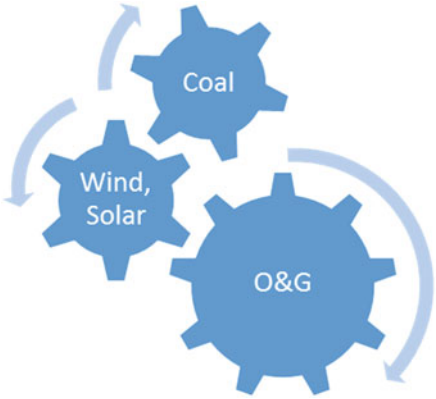

Fig. 7.14 Potential for strategic alliances in a composite energy market

> *Our big energy companies are diversifying their portfolio of production. Probably in anticipation of being able to swap carbon credits or however the heck that complicated system works, but also in terms of public relations and being able to say to their shareholders, "yes, a certain percentage of the power we are generating is derived from green forces, so yes we're staying with the program and moving into the twenty first century." Yes, I think there's certainly an intention and feeling of collaboration rather than competition, because I think we understand in this day in age that both aspects are important, to consumers and to communities. I think why it's not moving along, at least as fast as what we would like to see is, because alternatives and renewables are complicated. You don't just erect a barrack and drill down and put the oil in barrels. It's just way more complicated to plan and implement and utilize wind and solar and bio sources of energy development. And we don't know as much about them as we do about our traditional energy production. (Interview B/10, EconDevOrg, Assoc, ChCommerce).*

To date the potential for this kind of financial support for renewables has been given a rather guarded welcome by some SMEs.

> *[The way the oil & gas industry has influenced renewable energy] is probably two-fold, kind of paradoxical in a sense. The fact that we have a very robust conventional energy sector, oil and gas that is, causes some people to at least have a dismissive attitude towards renewables. Seeing them as small potatoes or not applicable here or even threatening in some cases [or] as competition to our conventional energy industries. But on the other hand, first of all Alberta has a very good wind resource and a decent solar resource and one of the main users of renewable energy is actually oil and gas, . . . So isolated solar and some wind power systems . . . oil and gas industries with their remote . . . power requirements. . . . And also, and more importantly on a megawatts basis there are a handful of oil and gas companies . . . [and] a coal company, have gotten heavily involved in the wind business. So there's some conventional oil and gas or at least fossil fuel industry dollars that are being invested in wind energy in particular. . . . That's nice to see. But there are two sides to that coin. (Interview B/14, SME)*

Companies in the survey could see advantages in the alignment of knowledge and resources towards shared ends. 55 per cent felt large oil and gas companies could support renewable cluster development, and more than three quarters felt that traditional energy providers could actually improve their reputation diversifying in to renewables.

There were the beginnings of win: win arrangements between oil and gas companies seeking to diversify, and smaller renewables companies seeking to develop innovations. These were only just beginning to be explored. Although some interviewees were sceptical and thought this was rather done for PR purposes this would provide a means of focusing on an energy market as a whole, rather than on two competing segments of it.

7.3 Discussion: Barriers and Recurring Problem Scenarios

The field study in Alberta gives a fascinating snapshot of an early stage renewable energy cluster competing against incumbent fossil fuel companies in a liberalised electricity market.[10] It puts the barriers into relief from the perspective of different actors, and suggests why, despite the huge potential in the region, and the wealth of entrepreneurs and industry experience, the sector has had limited success in achieving the aims of the cluster to create employment, increase GDP and achieve environmental goals.

The Perspective of Policymakers

Policymakers (representatives of government, economic development corporations, government support organisations) believed that, with the introduction of a market-based approach, they had created a level playing field for all players (conventional and renewable) in the electricity market. They supposed that the free play of market forces (the so-called "invisible hand") had created a fair marketplace and enabled a viable renewable energy cluster to develop.

The main concern of policymakers was competition from the external environment, i.e. from other provinces/territories and the wider global market where incentives were granted to spur the development of renewable clusters and also to attract investment. In fact, this was already happening. Alberta, the Canadian birthplace of commercial wind energy and, at the beginning, the Canadian market leader in wind energy, had already fallen to the third place for total installed wind energy capacity—behind Ontario and Quebec (CANEWA 2015, 1).

[10]The electricity market—generation, wholesale and retail—was deregulated in Alberta in 2001. See AESO 2015. Transmission and distribution, however, are regulated monopolies, and the Alberta Electric System Operator (AESO), which is regulated by the Alberta Utilities Commission (AUC), is responsible for the access to the grid. See German Chamber of Industry and Commerce 2015, p. 23.

The Perspective of Companies/SMEs in the Early Stage Renewable Cluster

Although companies (and SMEs in particular) did not think a free market approach was bad per se, they did not share the perception of policymakers that this was an even playing field. There were a number of reasons why they felt that competition was unfair, and they were having to compete on a very uneven playing field.

In the first instance, fossil fuel companies were already at a mature stage of development, with an installed base, while renewables companies, at a much earlier stage in development, had to include infrastructure development in their costs.

In addition, fossil fuel companies

- were still benefiting from huge subsidies[11]
- did not have to include the cost of negative externalities in relation to health and the environment
- were able to offer better conditions to the limited pool of trained staff, making it difficult for renewables companies to recruit. This constrained their ability to take on projects, and impacted on work quality.
- were better represented at the decision-making table, and smaller renewables companies were less able to engage with policymakers in shaping policy around their specific needs.

The tensions between the evolving renewable cluster and the well-established fossil fuel energy market had a detrimental impact on the ability of the renewable cluster to leverage the huge renewable potential, and the co-location of centres of scientific and engineering excellence.

Alliancing Different Players in a Single Energy Market

Such an approach would make better use of the cluster strategy, in terms of the potential for identifying strategic alliances between erstwhile competitors, for the benefit of the energy market and the environment, and finally, the region as a whole. This, as one interviewee pointed out, however, requires bold leadership.

Other key barriers in the cluster included :

- lack of a stable long term funding policy for renewables
- the lack of joined up policy across provinces/territories and between levels of government
- excessive bureaucracy

[11]See also IMF report in the Discussion section.

- lack of targeted funding in areas related to innovation, such as concept-testing and commercialisation
- lack of an effective voice in the development and of policy around the needs of SMEs

Recurring Problem Scenarios

The Canadian case is typical of an early stage renewable cluster. Although most of the enablers for development were in place, the professed objective of regional development through employment and innovation was very slow to materialise, despite the resources available.

It highlights the play of forces operating against an emerging renewable energy cluster competing against long-established fossil fuel companies with established networks of influence, and both direct and indirect subsidies. Here the rhetoric of a "free market" at policy level is seen to be at odds with the reality of a very uneven playing field for small renewables companies on the ground.

The case is an example of an early stage cluster where the pieces in place are put together in ways which obstruct rather than enhance the development of the cluster. In part this was also because the legislative, regulatory, financial and administrative infrastructure was not responsive to the particular needs of small renewables companies.

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Chapter 8
The South African Case: Developing and Implementing Incentives to Capture Solar Market Opportunities

Abstract The South African case study provides examples of some of the more extreme barriers encountered in a nascent renewable energy sector that was still under development. This chapter looks at the tensions between efforts to develop the huge potential of solar energy in South Africa, and the difficulty of changing the existing landscape of laws. It focuses on introducing financial incentives such the process of designing and implementing feed-in mechanisms and its related roles and representation of different stakeholders that are affected in this change process. Interview and survey feedback provide a picture of the barriers to cluster development, with a particular focus on the concentration of power and control in the hands of a parastatal organisation monopolising the generation, transmission and the distribution of electricity. The case also discusses barriers that reflect the unique historical and political context, as well as the more generic, cross-cutting barriers that are shared with other clusters.

8.1 Background

> *The industry in South Africa is in its infancy. It's such an early stage that everything as we go we will be learning (Interview 2, EconDevOrg, Assoc, ChCommerce)*

The solar market in South Africa was in an embryonic stage when we carried out the field study, between October 2009 and December 2010, as confirmed by 70% of survey respondents. Agglomerations of companies were emerging in different regions (See Fig. 8.3). Delegations with potential investors were coming on fact-finding tours and foreign investors were already seeking to benefit from first-mover advantage in the fast-growing economy of this newly industrialised and energy-hungry country. South Africa, with its long coast lines, favourable wind conditions and large uninhabited areas, is ideally suited for the development of renewable energy. Solar energy in particular has immense potential, with solar radiation almost as high as in the Sahara (Fig. 8.1).

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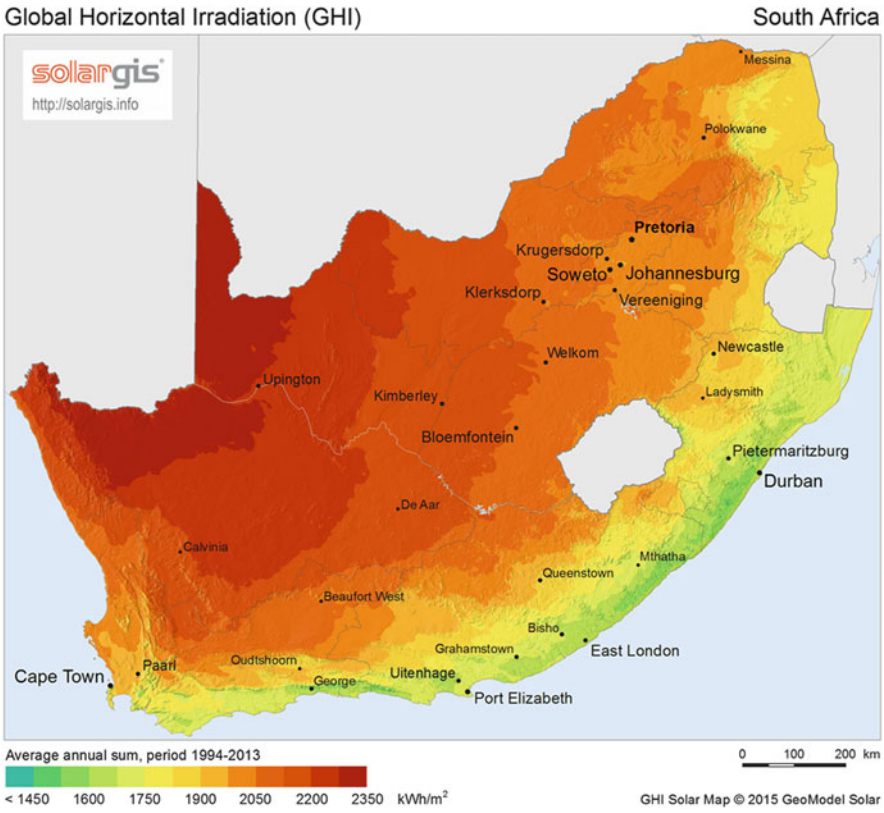

Fig. 8.1 Solar horizontal global radiation in South Africa. GHI Solar Map © 2015 GeoModel Solar [CC BY-SA 3.0 (http://creativecommons.org/licences/by-sa/3.0)], via Wikimedia Commons

Utilising this immense untapped solar potential to generate electricity could not only help mitigate climate change—more than 90% of electricity is generated by coal in South Africa[1]—but could also help solve the serious electricity shortages South Africa has been suffering from with the ever-present risk of blackouts or even the collapse of the Grid service. This constituted a particular threat to social and

[1]Eskom's homepage states that they generate approximately 95% of electricity used in South Africa. Because of coal-based electricity production, South Africa produces 40% of CO_2 emissions of the whole of Africa. (Taz.de 8 Feb2015).

economic infrastructure[2] as well as discouraging potential foreign investors in key industry sectors. More than 83% of the Survey respondents thought that the threat of power cuts/insecure electricity supply had driven activity in this sector in South Africa (See Fig. 8.2).

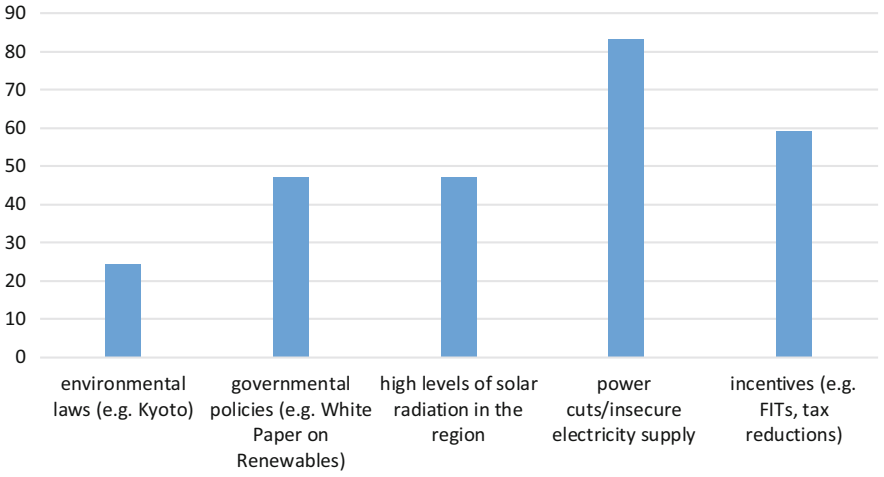

Fig. 8.2 What things do you think really made a difference and got things happening in this sector in your region?

While we were carrying out the study, the economic potential of solar energy at this scale was already attracting foreign investors, and solar companies (local and international) had started clustering around Pretoria, Johannesburg and Cape Town in particular, but sporadically also in Durban, Port Elizabeth, Bloemfontain and Pietermaritzburg, as shown on the map in Fig. 8.3.

We ran qualitative interviews with stakeholders to the stage of saturation in the clustering regions. Then we transcribed and coded them, and, based on the outcomes of the interviews, a survey was carried out from November to December 2010. A standardised questionnaire was circulated with a return rate of 24%.

[2]In January 2008 the national grid came to a near collapse (Bearak and Dugger 2008), with companies installing their own power generators to continue production.

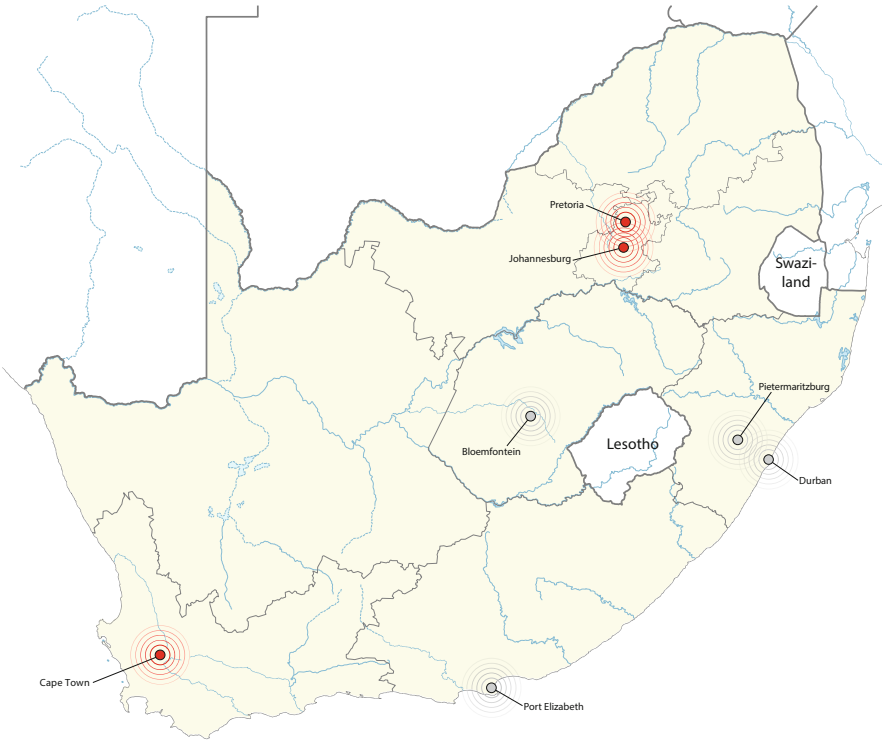

Fig. 8.3 Early stage clustering of solar companies in South Africa. Created by Roman Siegert using study data on a map by NordNordWest and reproduced from Wikipedia under a Creative Commons Licence [CC BY-SA 3.0]. Available on: https://upload.wikimedia.org/wikipedia/commons/3/34/South_Africa_adm_location_map.svg

In all, some 95% of survey respondents were micro and small companies, 3% medium-sized companies and 2% large companies. The distribution of those companies is seen in Fig. 8.4.

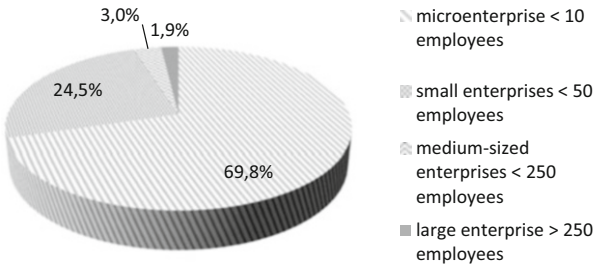

Fig. 8.4 Distribution of companies taking part in the survey. The definition of the size of an enterprise by staff number is based on Article 2 of the EU recommendation 2003/361. According to this, the staff headcount is the main criterion for size, however further criteria such as turnover or balance sheet total also play an important role. In the survey and the interviews, we only asked respondents for the staff number of their company

It is worth noting also, that more than 67% of the companies that gave information on the time they had existed, had been on the market for less than 10 years, reflecting the very early stage of the sector here.

The Electricity Market: Structure and Development of a Feed-In Tariff

The electricity market in South Africa is dominated by Eskom, the national energy enterprise. Eskom generates, transmits and distributes electricity. At the time of our research, this national enterprise generated more than 92% of all electricity consumed in South Africa, with the remaining 8% partly imported (4.5%) and partly generated by independent power plants.

At this point, neither the infrastructure, nor the capacity of the electricity grid were keeping pace with demands of the rapidly-growing South African economy. Power shortages were the inevitable consequence of this. This worrying scenario had been predicted in the White Paper on Energy Policy from the Dept. of Minerals and Energy as far back as 1998 (White Paper 1998), however, Eskom failed to expand the capacity of power stations sufficiently to satisfy the sharply rising demand for electricity until 2013, well after the study was carried out.

To begin to balance the electricity deficit, the Department released a White Paper on Renewable Energy in 2003 promulgating the exploitation of renewables. The declared goal of this Paper was to contribute 10,000 GWh (approximately 4% of the energy mix) to final energy consumption by 2013 (White Paper 2003, ix). The main strategic objectives were (a) "to develop an enabling legislative and regulatory framework to integrate Independent Power Producers into the existing electricity system" (White Paper 2003, xii), and (b) to gradually increase the low cost of coal-based energy generation, so as to improve the viability of renewable energies as an alternative (White Paper 2003, ix).

However, by 2008 only 3% of this goal had been achieved, and no significant construction or installation work had started. This was largely due to the lack of established financing mechanisms and the lack of a legal regime setting up a renewable energy project. The disparity between rhetoric at the level of government and reality at the level of the operational infrastructure was a recurring theme.

To gain momentum and help in achieving the government's target of 10,000 GWh of renewable energy by 2013, the National Energy Regulator of South Africa (NERSA)—a neutral and independent legal entity[3]—launched a renewable energy Feed-in Tariff (REFIT) in 2009. As far as solar energy was concerned, the first phase of the REFIT programme from March 2009, included

[3]According to the National Energy Regulator Act, 2004, NERSA is a "juristic person" with regulatory principles such as neutrality in relation to all market players, and independence from regulated companies and political influence. See NERSA's homepage.

only the technology for concentrating solar power (CPS), and the second phase (from October 2009) incorporated photovoltaic technology—but only for large-scale systems with a capacity greater than 1 MW. Off-grid solutions however were excluded, despite their applicability to the large swathes of rural communities not connected to the national Grid.

In the survey, 40% of respondents thought that off-grid solutions would not only solve a problem in remote regions but also spur the solar market (Fig. 8.5).

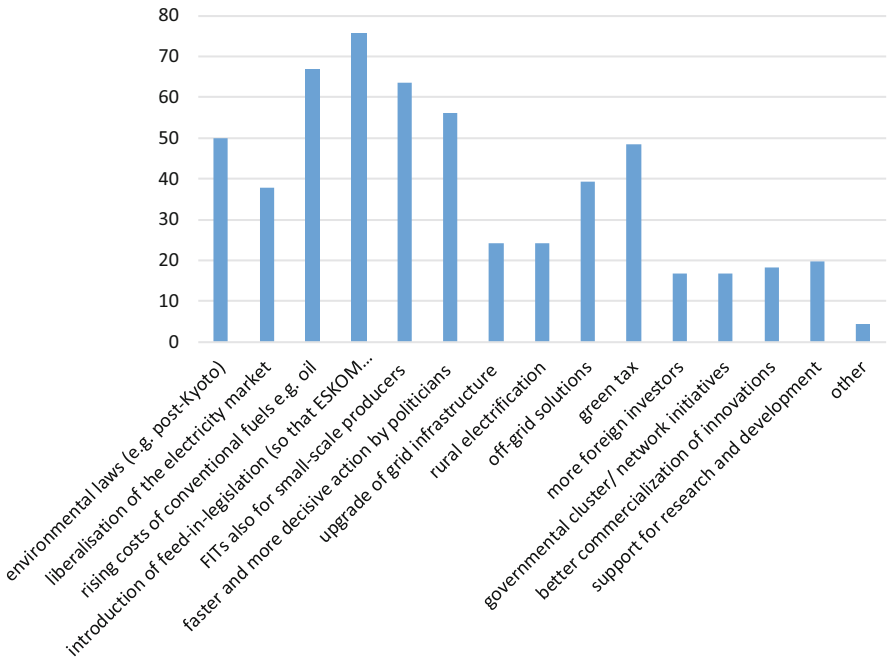

Fig. 8.5 In your opinion, what factors will make a difference in the further development of this sector in your region?

This is in contrast with legislation in other comparable developing counties such as Uruguay and Brazil, for example, where, in addition to a centralised, grid-based model of energy management, legislation also explicitly sought to provide an economic model for small communities across the significant sections of the country where there is little or no access to centralised services.

The REFIT incentivisation framework was in the process of being developed during our research period. The steps an independent power producer (IPP) has to take to start generating and selling energy in theory give a context for understanding the issues interviewees raised:

- Step 1: environmental impact assessment.

  The environmental study is very expensive and typically takes 18 months to complete.

- Step 2: registration as an independent power producer (licence issued by NERSA).

  This allows the power producer to function as a local utility.

- Step 3: power purchase agreement with Eskom as an individual buyer.

  Eskom set up a renewable energy purchasing authority (REPA) as the administrative interface for this step.

- Step 4: Eskom, as the sole authorised utility, buys the renewable energy and also feeds it into the Grid. (See Fig. 8.6)

Rhetoric and reality were still very different however. The only step in this process that had actually been established at the time of the study was the Environmental Impact Assessment. All the other steps were still waiting for a monitoring authority to be established. In reality, the development of the nascent renewable energy feed-in mechanism was still at a very early stage (Fig. 8.6).

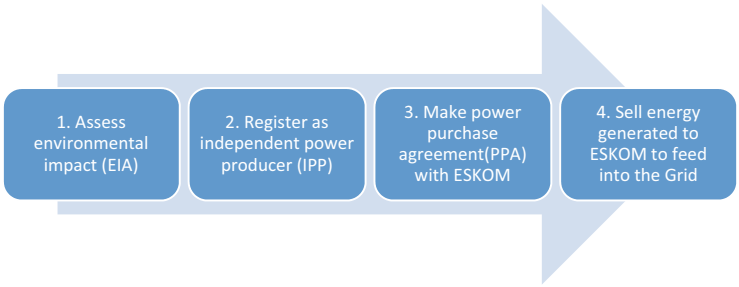

Fig. 8.6 Steps required for an independent producer to generate and sell electricity (ESKOM is the sole authorised buyer, through the purchasing office, REPAL)

There was also a lack of coordination between these different but interdependent processes. The rules for the selection process had not yet been developed by NERSA,[4] and the legal foundation for the procurement process was still missing.

In brief, although a generous Feed-in Tariff had been published (Eberhard 2013; Energypedia), the whole Feed-in Tariff regime had not yet been enshrined in law, meaning there was as yet no legal obligation for Eskom to buy the renewable energy from independent power producers.

In addition, it has been argued that Eskom's multiple roles represented a threat to fair competition. As a government-owned enterprise Eskom not only acted as the sole renewable buyer, but also ran the purchasing office REPAL and fed the electricity into the grid owned by them.[5]

[4]NERSA National Energy Regulator of South Africa. See NERSA's homepage.

[5]An overview of the development of the Feed-in Tariff regime is in Brodky et al. (2009).

Some of the other problems that arose derived from the unintended effects of policy, when implemented in practice. A case in point was the implementation of the Black Economic Empowerment (BEE) Act, and is briefly explained here. The BEE Act[6] is a programme put in place at the end of the apartheid regime, with the aim of counterbalancing the effect of historical discrimination. The BEE was also intended to stimulate growth and help realise the country's full economic potential.

The purpose of the BEE is the generation of equal opportunities in the labour market promoting vocational training, creating ownership, staffing executive positions, and developing public procurement. All companies seeking to participate in public tenders, were required to meet the BEE criteria.

In summary, the South African market had potential given (a) the high levels of solar radiation, (b) the urgent need for energy to avoid rolling black outs and (c) the potential for cross-fertilisation from other clusters such as the automotive industry.

On the other hand, a range of barriers militated against it, including

- an incomplete legal framework (licensing process not clear)
- an incomplete feed-in law (Eskom not legally bound to buy renewable energy)
- Feed-in Tariffs only for large-scale producers
- competition from cheap coal-based electricity
- the difficulty of meeting BEE certificate requirements
- lack of financing
- monopoly market—Eskom's multiple role
- cumbersome bureaucracy
- unstable politics and policies
- unstable currency

8.2 Stakeholder Perceptions of Barriers

The interviews and the survey give feedback on the general problems in this nascent renewable energy cluster, such as the problems and barriers perceived throughout the process. Key barriers included

(a) feed-in mechanisms still under construction
(b) monopoly market structure
(c) a market still in the making
(d) under-representation of companies/SMEs in policy development
(e) SMEs damaged by delayed implementation of incentives
(f) financial barriers
(g) skills shortages
(h) lack of relevant education and training

[6]The BEE was enacted in 2003, and extended by the "Codes of Good Practice" under the name of "Broad-Based Black Empowerment Act" (B-BBEE) in 2007. See Education Africa.

(i) lack of coordination in the nascent cluster
(j) communication/coordination at stakeholder interfaces
(k) bureaucratic hurdles
(l) the BEE certificate

These are discussed in the following section.

Feed-In Mechanisms Still Under Construction

Almost 80% of the Survey respondents regarded Feed-in Tariffs as an appropriate means of incentivising the infant solar energy sector (Fig. 8.7).

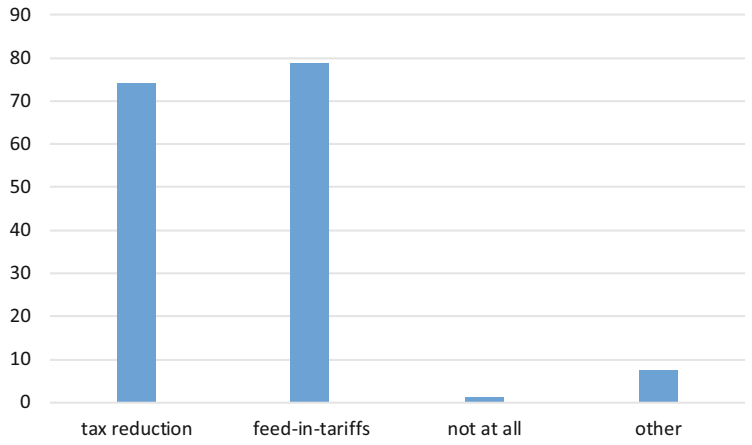

Fig. 8.7 In your opinion, how should the solar energy sector be incentivised?

In practice, however, they criticised the problems they were faced with during the development and implementation of these incentives. The absence of feed-in legislation was one of the principal obstacles to the implementation of FiTs, however there were a number of other impediments.

Feed-In Tariff Without Enforcement in Law

The following quotes from interviews illustrate the problem.

> *And if now eventually the feed-in-tariff is coupled with a feed-in-law, that is to say, the monopolist is obliged to buy the electricity at the set price as quickly as possible, then things could move quite fast there. (Interview 8, SME)*

It has been promoted upfront with a good feed-in tariff ... but in reality there is nothing behind it and nothing has been arranged. And without a power purchase agreement, and Eskom turns it down. (Interview 6, SME)

This criticism was confirmed in the survey. More than three quarters of those polled thought that the introduction of feed-in legislation would make a difference to the further development of the solar sector (See Fig. 8.5), and some 50% estimated that the non-existence of feed-in legislation was one of the principal barriers in the sector (Fig. 8.8).

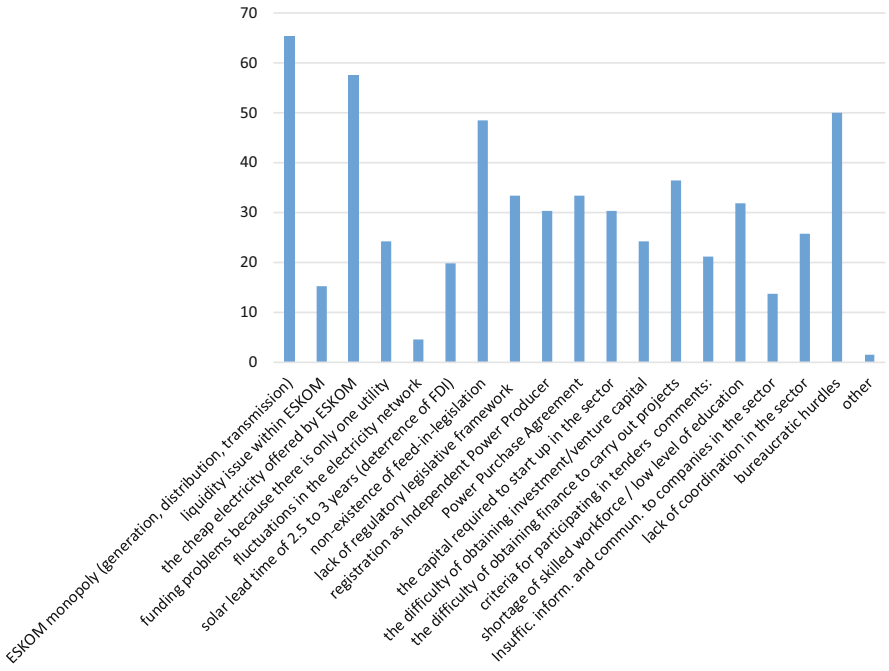

Fig. 8.8 What are the principal barriers in the solar sector in your region?

Lack of Clarity Regarding the Process of Becoming an Independent Power Producer

What is still missing is a regulation for IPP. As yet, nobody has received an IPP ... there are many, many expressions of interest nearly in the range of GWatt by companies who've already registered with NERSA and declared that they would like to become active. As I say, however, there is no procurement procedure yet. What's most important, it has not yet been clarified with whom the Power Purchase Agreement is to be made. Who will be the buyer and who will do the refinancing, and, and, and? (Interview 6, SME)

Lack of Clarity in the Wording of the Power Purchase Agreement

One of the Issues is the power purchase agreement itself that they published. At the moment the risk allocation it's not balanced and it's not what we call bankable. (Interview 4, SME)

Grid Connection Not Regulated

But without a directed REFIT program at the moment people don't know exactly how they are going to be connected to the grid. That's another issue. Who is going to pay the costs of the grid connections? How are you going to pay the costs? The idea there is that Eskom will pay the costs of any strengthening of the grid that's required. But that the private developers will have to meet the costs of getting the power… to the closest substation. I think people find that an acceptable regime … People also want to know what happens if that's going to be late for the grid connection. Obviously you can't get a position where you build a PV plant and you are ready to go and the grid connections are late or haven't been built. (Interview 4, SME)

Similar problems appear in other clusters, such as Scotland, where the delays in the completion of one of the major transmission lines delayed proposed projects, and impacted on the costs and the confidence of those investing.

Grid Connection Not Up to Standard

Well, the Grid is not good here, … there are [deviations in frequency] from 48 to 54 Hertz in the Grid … that is important, as it were, to keep the balance in the Grid. And there is also 180–240 Volts. You can see from this that the cables don't really fit. (Interview 8, SME)

Legal Legacy Problems

It's very tricky at the moment. You see the municipality want to purchase Green energy because they realize… Eskom isn't able to give them electricity. So they want to buy this. … Well, fortunately or unfortunately, we've got a law called the public finance municipal management acts, the PFMA. And we've got a municipal management act. Now these acts were drawn up in 1985 when then there wasn't a thing called renewable energy. So when it comes to purchasing electricity, the PFMA said that you buy the cheapest source. So when the municipality looks at the cost of coal energy … and … at wind energy, they are forced to buy coal. Because the act won't allow them to purchase a more expensive product. So unfortunately there has to be legislation and that has to change before it will empower municipalities and local government to purchase this energy (Interview 10, EconDevOrg, Assoc, ChCommerce)

Feed-In Tariffs Only for Large Scale Producers

The REFIT programme which incorporated large scale photovoltaic systems was strongly criticised. Some two thirds of Survey respondents thought that Feed-in

Tariffs also for small-scale producers would make a difference in the further development of the sector. (See Fig. 8.5)

Of course, . . . what it's going to look like in the end, I also don't know yet either, because it will surely only start off with large-scale plants. It would of course be good if there were Feed-in-Tariffs for small-scale plants too, just as in Germany, ... That would be good. (Interview 7, SME)

The [solar associations] have also pleaded for Feed-in-Tariffs for smaller plants so that everyone can install such a plant or a medium-sized plant on their roof. That was actually announced, but has now been postponed. Above all, because there is no money. That is to say, the Feed-in-Tariffs are paid by the energy company, which is Eskom. And Eskom is actually insolvent. They are still only living on credit. (Interview 8, SME)

Monopoly Market Structure

Inequities in the Balance of Power as a Barrier to Effective Cluster Development

I think if maybe Eskom wasn't monopolising generation, distribution and the transmission of electricity maybe we might have a situation where we probably would have projects. If there were maybe two or three utilities maybe the funding model would be different. (Interview 2, EconDevOrg, Assoc, ChCommerce)

But still there is an obstacle, if there's only one energy enterprise and that one is even partly government owned, there'll be a conflict of interest. And to unravel that knot is relatively difficult. (Interview 8, SME)

Eskom is not necessarily an enterprise which is entirely open to renewables and actively promotes them . . . I don't see Eskom as an enterprise which will move away from its strategy of coal production unless it is politically obliged or politically under pressure to do so. (Interview 6, SME)

There has been the White Paper on Renewables over the last 5 or 6 years. It sets certain objectives about how much of the South African electricity must be generated by renewables by 2012 or 2013... These are very ambitious plans, early adopted early and not followed up for years. This depends on the political structures, but also on our power supply infrastructure. In the case of Eskom we have a monopoly. (Interview 6, SME)

The local government acknowledged it was very naive to give them [ESKOM] the power. Because the idea was . . . it's called an ISO—Independent system operator . . . so that was created within Eskom. And the idea was that Eskom would buy Green Energy and then sell on to the end consumer. But Eskom . . . they haven't, they've got budget, they've got all the funding available to do this but they keep on saying 'No'. They were flooded with applications and they are still processing it and excuse after excuse. And eventually the government has realized that obviously Eskom is protecting their monopoly because why would they engage in Green Energy and lose market share eventually. . . . But Eskom is also playing a bit of a sneaky role because they are investing quite a lot in their own renewable energy center. So they are also trying to develop wind farms and solar farms. So they are looking at that and they are looking at still controlling them so that they keep themselves in

that position of having all that power and being the only supplier. (Interview 10, EconDevOrg, Assoc, ChCommerce)

Stop greedy politicians and captains of industry controlling this market and leave it up to the average citizen to drive through need and not greed and we will grow yet again. (Survey respondent)

ESKOM and government are dragging their heels badly on this market. (Survey respondent)

These comments were also reflected in the results of the survey. Some two thirds of the Survey respondents regarded the Eskom monopoly as the principal barrier to the development of the solar sector. (See Fig. 8.8)

Lack of Competition

Interview and survey feedback addressed the problem of competition in the electricity market. Nearly 60% of all stakeholders surveyed viewed the cheap coal based electricity offered by Eskom as one of the principal barriers in the solar sector.(Fig. 8.8). Almost 38% of the Survey respondents thought the liberalisation of the electricity market would be the answer to the problem. (See Fig. 8.5).

We need more players in the market to bring the price down. (Survey respondent)

Another thing would be . . .if the electricity market was liberalised, in other words, that there were not just one monopoly. That would also be a long-term matter that would help everybody so that more competition was generated and also realistic prices were offered or electricity was offered at realistic prices. (Interview 5, SME)

Obviously renewable energies are an expensive technology when compared to a 20 year old current energy production infrastructure, where they are comparing current energy costs or charges against 20 year old technologies. And the bottom line is, if you were to build new power stations today you would have to regulate the costs of energy. (Interview 9, EconDevOrg, Assoc, ChCommerce)

Eskom regulates the purchase price. So it's not that attractive. So you got a lot of independent investors putting a huge of capital into power generation, but they have to sell it directly to Eskom and Eskom will on-sell that to the public. And Eskom regulates the purchase price. (Interview 9, EconDevOrg, Assoc, ChCommerce)

As a barrier I still see the cheap electricity which the governmental electricity enterprise offers here. They pay about 0.03 EUROs per kilowatt/h, and that is, of course, unbelievably cheap in comparison. (Interview 1, EconDevOrg, Assoc, ChCommerce)

A Market Still in the Making

Establishing Norms

Yes, on principle, the market is still relatively new . . . and the issues are all about structures, and the establishment of technical norms . . . There is a meeting once or twice

a year and a circular ... above all, the issue is all about auditing standards and the funding standards because all texts are audited again according to our own technical inspection association here. And that is their main task. (Interview 7, SME)

Perceived Risks of Investing or Committing to Projects at this Early Stage

... there are a lot of companies that are interested but nobody is really willing to put in major capital because of the uncertainty of the market. We know there is an energy crisis. We know Eskom has an incentive for solar water heating which increased the beginning of this year but at the same time there is uncertainty because of the department of energy of South Africa is looking to change the process and do things their way. (Interview 9, EconDevOrg, Assoc, ChCommerce)

But the market here in South Africa is still too green altogether, too unsorted ... There are almost no reliable numbers about the amount of installations and turnovers. At the moment, it's also very difficult for us to develop a business plan since there are no guide values. One cannot think one, 2 or 3 years ahead. Everything is in continuous development ... So the whole infrastructure still has to be created. It is difficult to predict tendencies or trends. (Interview 7, SME).

Under-Representation of Companies/SMES in Policy Development

The gap between the stated aims of documents such as the White Paper, and what was perceived by industry to be realistically feasible on the ground, speaks to the lack of a viable communication and coordination interface between policymakers and companies. (See Fig. 8.12)

Well, if certain White Papers with certain objectives are written, the industries are not asked for their opinion with regard to their realisation—— otherwise there would not be such objectives like the installation of one million units by 2013. Obviously, the industry could have told them earlier that is not realistic. (Interview 5, SME)

... we have had a White Paper drafted with renewable energy targets with 10,000 GW by 2013 and that's been on the cards for 10 years. And we have done nothing about it. So now that we are 3 years away everybody is panic stations. (Interview 9, EconDevOrg, Assoc, ChCommerce)

The interface between companies and policymakers is highlighted in many clusters, particularly in relation to SMEs, though this seems to apply more broadly to companies in general in this case.

SMES Damaged by Delayed Implementation of Incentives

Well, politically it would help everybody if the aims were pursued more resolutely, that is to say, incentives were not promised long in advance and then it takes 2 years to implement them. These people have experienced in the solar sector where incentives referring to applications for plants in the domestic sector were announced. That led to the fact that some companies that had already been established in the market almost went bankrupt. Of course, all end clients were of the opinion that 'If these subsidies were to be implemented soon anyway, then we'd be able to wait until these subsidies were available, because then we'd get back a large part of our money.' For this reason, the companies suffered from a slump in sales. There it had exactly the opposite effect from what they had actually intended. Therefore, one recommendation would be that they move forward faster, and in a more determined way. (Interview 5, SME)

I don't believe that [the needs of companies] are paid much attention to. (Interview 6, SME)

Likewise more than 56% of those polled believed that faster and more decisive action on behalf of politicians (words must be followed by deeds) would make a difference in the further development of the solar sector (See Fig. 8.5). It not only affects the confidence of investors and companies themselves, but it impacts on SMEs disproportionately, given their cashflow restrictions.

Financial Barriers

. . . what would help even more than higher funding rates is favourable finance . . . what I mean is internationally supported finance of renewable projects. That's something that would help for sure. (Interview 6, SME)

It would, however, be good if the banks were more company friendly. At the moment, this is difficult! (Interview 7, SME)

There are a lot of companies that are interested but nobody is really willing to put in major capital because of the uncertainty of the market. We know there is an energy crisis. We know Eskom has an incentive for solar water heating which increased at the beginning of this year but at the same time there is uncertainty because the department of energy of South Africa is looking to change the process and do things their way. And everyone is a little bit speculative about the success of the initiatives at this stage. . . . A lot of companies started but then the world went into a global financial crisis. And a lot of smaller companies that thought it was a good idea weren't kind of able to load their boat. . . . The Developing Bank of South Africa has got a certain support mechanism [for SMEs] . . . these funds are not necessarily easily available. . . they have a lot of money in order to support this industry. But, at the moment, I don't see anyone tapping into those funds. (Interview 9, EconDevOrg, Assoc, ChCommerce)

Key barriers to research and innovation by SMEs, I would say, are of course, of a financial nature. (Interview 1, EconDevOrg, Assoc, ChCommerce)

The problems of finance were also echoed in the survey. More than 60% of the stakeholders surveyed were of the opinion that better access to venture capital and clear long-term commitment to the future of the sector in terms of funding could improve the support for their organisation (Fig. 8.9).

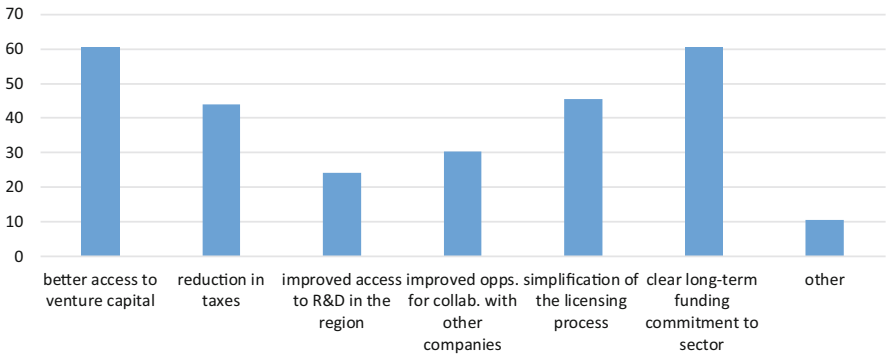

Fig. 8.9 How could the support for your organisation be improved?

More than 70% considered lack of finance as a barrier to innovation in the solar sector (See Fig. 8.10), and some 50% regarded convincing those required to fund and support the solar sector at the level of government as a barrier to innovation (Fig. 8.10).

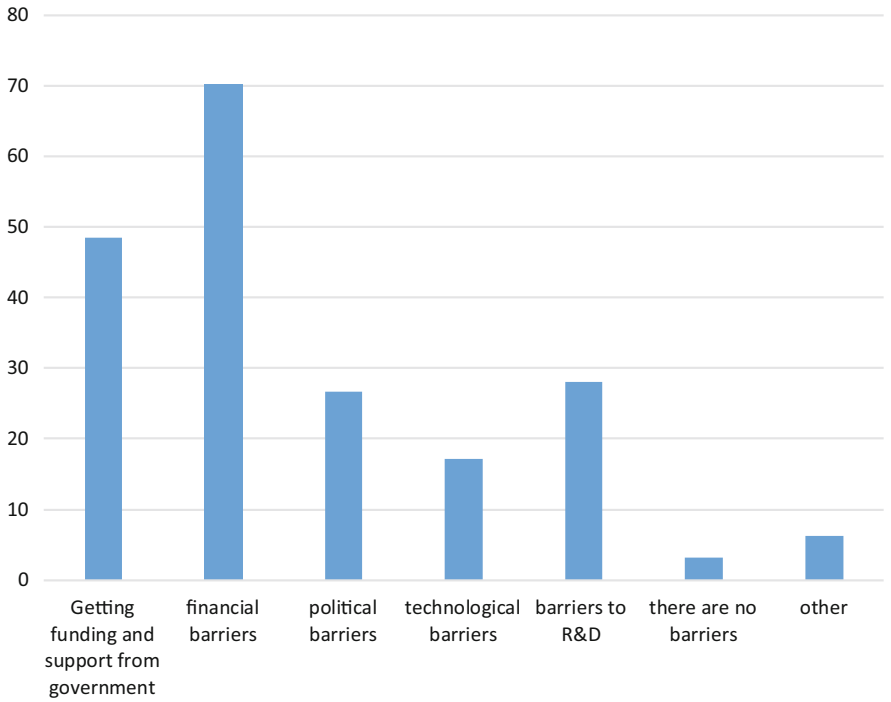

Fig. 8.10 What are the barriers to innovation in the sector?

Skills Shortages

Skills shortages were complained about by some 80% of Survey respondents. This issue also resonates in the interviews.

> *In South Africa the solar industry also faces, a lack of professional skills… an apprenticeship (vocational training) is rather unusual here. The installers don't carry out work of satisfactory quality with quite standard installation. This then results in a negative image … and then it looks as if solar thermal were inappropriate. In the end however, it is just an installation problem. (Interview 3, EconDevOrg, Assoc, ChCommerce)*

The same problem was seen in the Portuguese early cluster.[7]

> *There ought also to be better or more training possibilities for installers … There is no shortage of scientists in South Africa who are qualified in this field, but rather of installers and craftsmen because, ultimately, it is they who must advise the end customer. (Interview 5, SME)*

> *Most of the South African companies are installation businesses. [Solar thermal and photovoltaic products] are then complementary products and may also be on offer together … an electrician integrates a corresponding product into his portfolio, because a client might need it, but, up to now, there are no companies that exclusively concentrate on this. (Interview 5, SME)*

> *Neither the requirements nor the master craftsman … does exist here. When I'm out here on projects and talk to the people about what they did before, they come from many different areas. So it's not necessarily the case that they are all electricians who have then, at some point decided on photovoltaics. (Interview 6, SME)*

Lack of Relevant Education and Training

> *Where there is a great deficit … is in education. That is definitely a field with 30–40% backlog in demand, that is, there is not the knowledge of how something works. (Interview 8, SME)*

> *We are hoping that the industry body is going to be able to develop some sort of incubator to ensure that all new members are brought up to speed with government regulations. Just to basically tell them the rules of the game … to up-skill the members. (Interview 9, EconDevOrg, Assoc, ChCommerce)*

> *Curricula too academic (survey respondent)*

> *[Collaboration between companies, University/R&D Institutions and policymakers could be improved] by developing better internship programs. (Survey respondent)*

> *From time to time, training courses are offered by different providers, but with regard to the thoroughness of training and information they are not necessarily to be assessed positively. Well, the surface is scratched a lot, but in reality they are more sales events than true training courses. (Interview 6, SME)*

[7] See Chap. 5.

Lack of Coordination in a Nascent Cluster

More than a quarter of survey respondents thought that lack of coordination in the sector was a serious barrier in the solar sector. (See Fig. 8.8) This view was confirmed by the following comments.

> *A principal barrier is lack of coordination in the sector and between Government departments. (Survey respondent)*
>
> *We must succeed in adopting a more holistic approach, and for that, I believe, at the moment what's missing is a top level coordinator is lacking who would be accepted by all. (Interview, 5, SME)*
>
> *What is further badly needed is greatly improved and intensified coordination between all relevant government departments as well as the private sector (including NGOs, business and knowledgeable individuals) (Survey respondent)*
>
> *But at the moment the frustration is that there doesn't seem to be anybody standing above all the different interested parties and pulling it all together and coordinating it. (Interview 4, SME)*
>
> *The problem simply is, if you want to establish something like an IPP, that is an Independent Power Producer and Power Purchase Agreement, you'll need a control authority that monitors this. And all this does not exist yet. And such things take time. Such things would have to be built up first, before they are implemented. (Interview 8, SME)*
>
> *... there is no single point of contact or an association you can go and speak to. There are many people trying to think but there is no collective working group. And I think that's also causing a bit of a problem because you hear of people doing this and this and this but you don't know who to contact and you don't know where to go for that assistance. So it actually hampers projects a bit. (Interview 10, EconDevOrg, Assoc, ChCommerce)*

Communication/Cooperation at Stakeholder Interfaces

The majority of survey respondents assessed communication between stakeholders as Poor or Bad (Fig. 8.11), as also indicated earlier. It seems to be a feature of very early stage clusters that interfaces between stakeholders are particularly limited, and often unrepresentative, except in clusters which are diversifying from an existing base in another mature sector (as for example California or Germany).

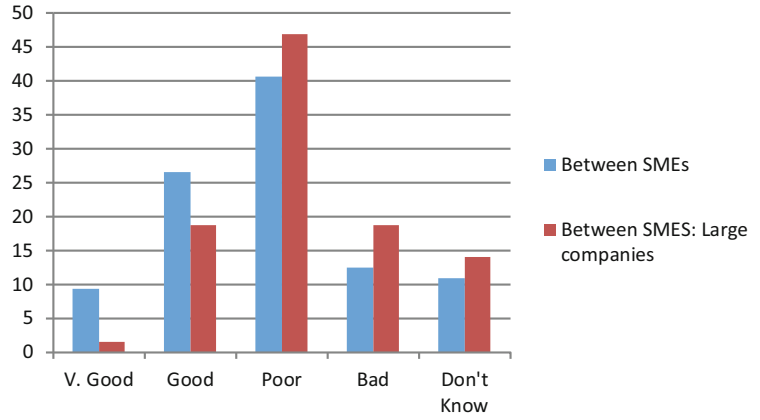

Fig. 8.11 How would you assess the formal and informal exchange of knowledge?

This is not surprising, given that such interfaces take time and incentives to develop, and often only when the lack of exchange causes a crisis. (The UK: Australian study outlined in Chap. 3 is a case in point.) Often the cluster starts from a small group of players with a historical and/or economic interdependency in a zone that is being developed precisely because it lacks an established business infrastructure. The Portuguese cluster in Chap. 5 is another example, as is the automotive cluster in Camaçari in Brazil (Jaegersberg and Ure 2005; Ure and Jaegersberg 2005).

The survey feedback is very clear about the difficulties at interfaces with some other actors. Nearly 70% of Survey respondents assessed the formal and informal exchange between companies and policy organisations as Poor or Bad, and some 70% thought that formal and informal exchange between companies and regional development/enterprise organisations was Poor or Bad (Fig. 8.12).

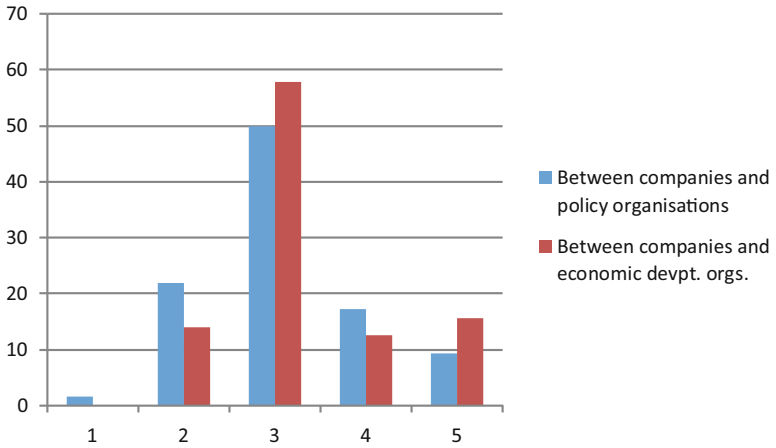

Fig. 8.12 How would you assess the formal and informal exchange of knowledge?

A further 70% estimated that the formal and informal exchange of information between companies and Universities/R&D Institutions was Poor or even Bad (Fig. 8.13).

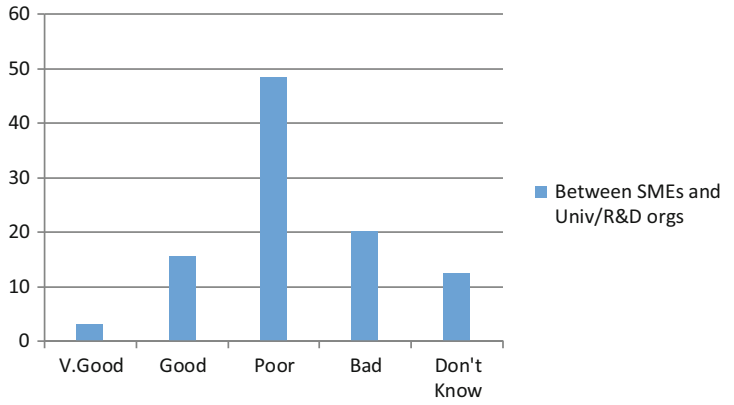

Fig. 8.13 How would you assess the formal and informal exchange of knowledge?

Some 30% also cited this lack of collaboration with universities as a barrier to innovation. (See Fig. 8.11)

Lack of Communication/Coordination Between Companies and Policymakers

Start open communication. Policymakers should act and implement their plans (practice what they dream)—more funding to RE (less for nuclear) to R&D with private sector support -regular strategic meetings between parties, funded by policy/other. (Survey respondent)

Policy focus is not on embedded or distributed generation but on large scale centralised. That needs to change—level playing field. (Survey respondent)

Communication/Collaboration Problems Between Companies and University/R&D Institutes

Universities should move beyond the "ivory tower" so that the economic benefits are more widely shared (Fig. 8.14)

Barriers are evident. Namely, knowledge transfer from Universities and research institutions to new companies is relatively slow and cumbersome. Networking of the players or

network clusters doesn't really function well. The different stakeholders are active rather in their own area of interest, and the character of joint projects, where one then promotes cooperation, is given a rather lower priority. The University will then research a bit in their focal area but integrate the industrial application or commercialization less. This, however, is needed urgently to transform the knowledge gained into new products. There, certainly, things can improve. (Interview 3, EconDevOrg, Assoc, ChCommerce)

Collaboration Between University and Company Raises IPR Problems

Well, if I now have a new development, or a new product and I want to have it tested I'll be able to give it to them [Universities] and they will test it for me. Alternatively, it can be turned into a study project. The students will write, as it were, a dissertation. There is a little disadvantage for companies though, I must add . . . The University doesn't have to bind itself in terms of a confidentiality clause. They publish the results then, and that is sometimes not desired . . . There is a barrier . . . a field test . . . there is the danger of copying . . . it can happen relatively fast. (Interview 8, SME)

With Universities we always have a concern because of publications and the splitting of information. Nevertheless, we have already worked with five Universities however. (Interview 8, SME)

An Attractive Funding Model for Companies: A Stake in the Company in Exchange for Support

There are public institutions here in South Africa [supporting projects], for example, the IDC, that is the Industrial Development Committee. That's a governmental organisation. Then there is WesGro here in Western Cape. They are very keen on supporting projects. The problem is they always want to immediately become shareholders. . . . And that, of course, the majority does not want. . . . The problem is the nature of the collaboration doesn't suit us. Well, I don't want 51 % of my company to belong to someone else. . . . No, that doesn't fit us. (Interview 8, SME)

Bureaucratic Hurdles

Half of the Survey respondents thought that bureaucratic hurdles were the principal barrier in the solar market (See Fig. 8.8), and more than 45% believed that a simplification of the licensing process in terms of bureaucracy would help their organisation (See Fig. 8.9). Bureaucratic barriers were also addressed by interviewees.

If we were to build a [photovoltaics] megawatt plant—but the catch in this is "if we were to build"—that is, the requirements for building a plant are so bureaucratic and as yet unregulated, so that, up to now, nobody has been able to build one, and before 2011, nobody will be able to do so either. (Interview 8, SME)

[there is] a funding programme ... by Eskom ... nobody is really happy with the concept because it is only for certain systems...The systems must be tested, and only those that have been tested will be funded ... [This test period] is a really major administrative burden, and when that's behind you, then the plant can be installed. (Interview 7, SME)

BEE Certificate

The BEE Certificate Was Perceived as an Impediment in the Context of Procurement Processes

When there is a tendering procedure, it is not the price but the BE-level certificate that comes in first place, and if you haven't reached a certain level there by a certain stage in the tendering processes, the offer will not even be looked at, it will be discarded, independently of the price you've handed in. (Interview 8, SME)

A Barrier for Professionals from Abroad

[in a company] one must have a BBB [average of blacks] meanwhile ... To come to South Africa for work as a foreigner, you'll meet with many hurdles, and you'll have to prove that the jobs cannot be done by qualified South Africans. (Interview 6, SME)

8.3 Discussion: Barriers and Recurring Problem Scenarios

The South African case study is a good example of an early stage cluster in a nascent renewable energy sector. It provides insights into the issues in the process of both designing and implementing feed-in mechanisms in a monopoly electricity market and its related roles and representation of different stakeholders that are affected in this change process.

The figure below outlines the basic barriers the new South African cluster was facing at a company, cluster and energy market level when the field study was carried out (Fig. 8.14).

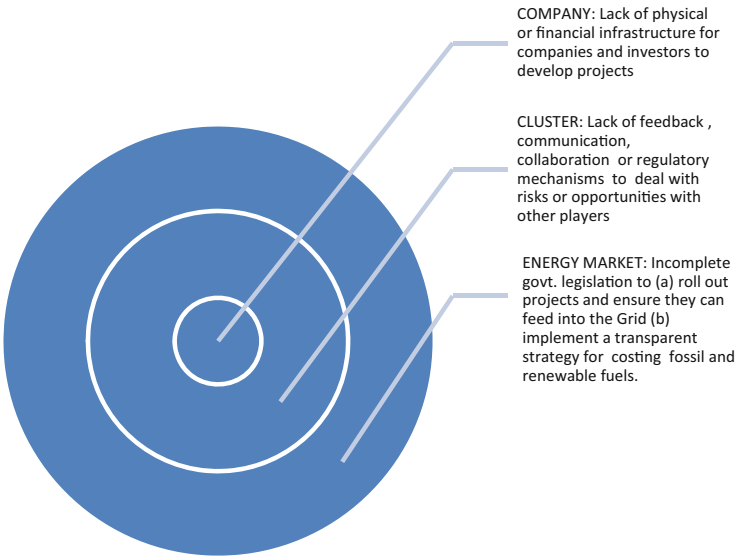

Fig. 8.14 South Africa. A new cluster in an incompletely regulated market

Barriers hampering the design process of feed-in mechanisms were articulated in stakeholder feedback. Some comments reflect the specific South African historical context, while others reflect the recurring issues we also encountered in all the other early stage cluster studies we looked at.

South African Historical Context

Barriers associated with the specific context of the South African market included a) the monopoly electricity market structure and b) the BEE certificate.

The Monopoly Electricity Market Structure

This complex electricity market, with Eskom as the dominant player monopolising the generation, transmission and distribution of electricity, was viewed as a significant barrier to the development of a viable renewable energy market. Although NERSA, the National Energy Regulator of South Africa, had approved a REFIT policy in 2009 with a tariff generally regarded as generous by developers (Eberhard 2013), the basic structure of the REFIT programme was seen by most stakeholders as poorly designed, and not fit for purpose. They criticised the dual role allocated to Eskom as the sole authorised buyer, and also as the administrator of the purchasing

office REPAL, which was seen as giving them too much power in the market and as a potential source for conflicts of interest.

Unravelling these close economic and political entwinements was viewed as a difficult, but necessary precondition for any incentive programme to be effective. Interview and Survey respondents were strongly in favor of the liberalisation of the electricity market for this reason. It was NERSA's role as a neutral and independent entity both to ensure the market was fair and open and to prevent significant conflicts of interest.

In view of these entwinements, it is understandable that interviewees interpreted Eskom's delay in processing applications as a delaying tactic. Some presumed that Eskom was protecting their monopoly as they were investing in their own renewable energy centre. Others thought that the motive for the delay was Eskom's difficult financial situation. They said that Eskom was practically insolvent and only lived on loans and hence was not able to pay the tariffs.

The disparity between policy and practice in areas such as energy pricing also caused concern among stakeholders. While the White Paper policy recommended gradual increases in the (exceptionally low) price of electricity produced from coal (White Paper 2003) to increase the viability of renewable energy on the market, Eskom appeared to be regulating the purchase price of electricity by a very different set of criteria. This made it harder for renewable energy to compete. Naturally, its price was more expensive, since renewable energy in the early stages required significant investment in expensive technology, while coal-based production was already in its mature stage where the investment costs had already paid off.

More Questions than Answers

The lack of clarity about the reasons for all these anomalies raised more questions than answers for interviewees and impacted negatively on their willingness to invest, and to commit to projects.

Would Eskom buy electricity they generated (since there was no legal assurance yet in place)?

Would Eskom give independent power producers access to their Grid if they invested in independent generation projects?

Why did NERSA, the energy regulator assign this dual role (that of administering the purchasing office REPAL and that of the sole authorised buyer[8]) to Eskom in the REFIT incentivisation mechanism?

The BEE Certificate

Another barrier which was deeply rooted in the historical context was seen in the need to comply with the BEE certificate in a market with a shortage of skills. The BEE certificate was originally implemented as a growth strategy and to generate

[8]See Fig. 8.6.

equal opportunities in the labour market. Stakeholders complained that it functioned rather more as a blocker than an enabler. If in a procurement process greater priority was given to the score of the BEE certificate rather than quality, price and speed, then this was seen as potentially distorting competition/the development of the market, and creating further barriers for potential investors where companies had problems finding staff with the requisite skills.

Recurring Barriers

Further major barriers pointed out by stakeholders constraining the infant market fell under the group of recurring issues we also identified in all other early stage clusters. Among them were

- the under-representation of companies/SMEs in policy development
- the uncertainty/insecurity of the market where political, operational and administrative changes led to unforeseen delays and costs
- skills shortages together with a lack of education and training
- the lack of coordination and communication between all stakeholders (strategic and operational)
- and bureaucratic hurdles.

Under-Representation of Companies/SMEs

The feedback highlights the risks of investing in cluster development without adequate representation of players on the ground, and particularly the small and medium-sized companies who are most likely to contribute to regional employment, yet most likely to be vulnerable to poor legislation and operational and market delays or failures.

Interviewees gave a number of examples of the extent to which under-representation could undermine outcomes.

Example 1. Had policymakers listened to companies/SMEs, the unrealistic goal that was set in the White Paper on Renewable Energy (contribution of 10,000 GWh to final energy consumption within in 10 years) would not have been defined, and a setback could have been avoided.

Example 2. Had NERSA listened to solar associations representing the smaller players, small-scale and off-grid producers would probably have been included in the REFIT incentivisation regime. However, only large-scale producers were included, thus excluding small local companies such as installers from the the development of the solar sector, and missing an employment opportunity for the region.

Recurring Problem Scenario

The uneven representation of large and small players contributed to the delays in fully leveraging the potential of high levels of solar radiation and high levels of market demand in the region at this stage. For early stage clusters where the formal and informal mechanisms for collaboration are not fully formed, this is a recurring risk scenario.

The case illustrates the extent to which a monopoly market structure, with an established central player adopting more than one role, can constitute a serious barrier to the evolution of the electricity market, as we also saw in the Portuguese Case.

This is part of the wider point that there needs to be involvement and commitment of all the stakeholders for a cluster to thrive and benefit the region. Setting up mechanisms for supporting the reconfiguration of roles and resources towards shared goals is a necessary part of the infrastructure which is often missing. Many new clusters cannot count on the invisible architecture of pre-existing business culture and communication networks. Where networks and alliances exist, they may benefit some more than others, or even at the expense of others.

Even where there are optimal conditions in terms of natural resources, and in terms of market demand, the failure to create mechanisms for engaging all the stakeholders in the process of policy development and implementation can create unnecessary risks, as demonstrated particularly by the problems associated with the development and implementation of the REFIT incentivisation mechanism.

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Part III
Discussion of Cross-Cutting Barriers

Ure and Jaegersberg

Chapter 9
Recurring Barriers: Cross Cluster Analysis

Abstract This chapter provides an advance organiser for the cross-cutting analysis of recurring barriers across clusters. It underlines their impact on economic outcomes in clusters and companies, as well as the implications for realising the cluster vision. The chapter highlights the need for an understanding of these recurring scenarios to be more accessible to managers, if the cluster vision is to be realised as a benefit for regions. It underlines the importance of creating the less tangible architecture that facilitates knowledge spillovers, collaboration and strategic alliances, and supporting SMEs that can generate employment and innovation. The chapter highlights the implications for policy, for professional development and for research.

9.1 Introduction to the Cross-Cutting Analysis

The anticipation of clustering as an opportunity for knowledge spillovers and co-production has inspired huge investments to create value for regions, typically adopting Porter's macro-economic model (Porter 1990), but paying rather less attention to the messier dynamics of interaction between local actors on the ground as a driver of performance (Audretsch and Feldman 2004; Cortright 2006).

What else shapes the way different stake-holding communities cooperate or compete on the ground? How do different configurations impact on the competitiveness of the cluster as a whole? Who benefits and who loses under different conditions and configurations? What are the recurring barriers at different stages? How can they be addressed?

Studies across eleven countries—based on hundreds of interviews and thousands of surveys—showed surprisingly consistent evidence of recurring issues across very different clusters, particularly at the interfaces between SMEs and other stakeholders (Fig. 9.1).

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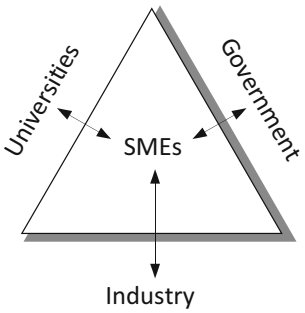

Fig. 9.1 Key interfaces where value can be created in clusters

These cluster studies were initially conceptualised as independent case studies, using surveys to validate and extend on the outcomes of qualitative interviews—rather than as a pre-determined set of questions.

The interviews gave us a very detailed understanding of the genesis and the impact of these issues on companies in particular, and often also suggested how these could be addressed or mitigated.

As the country studies progressed however, we were able to focus in more detail on the emerging issues, and the later surveys in the more recent studies ask more detailed questions, on which we also draw. This section looks at the most cross-cutting barriers in the development of the sector as a whole, then looks at the data on key barriers at the critical interfaces—(1) with policymakers, shaping the landscape in which companies operate, (2) with universities in research, training and innovation, and (3) with other companies in the cluster. Finally, we look at the implications for cluster development, and a summary of the data on what respondents felt would make a difference in resolving them.

9.2 Cluster Dynamics Through Different Lenses

In extended networked organisations, such as clusters, supply chains, and even markets, understanding how distributed actors (technical and human) communicate, coordinate or can leverage disparate resources to advantage (individual or collective) is an increasingly important topic in economics, sociology and informatics. It is arguably the central theme of most social institutions—from football, to politics, conflict and global business. It is therefore surprising that there is so little support for policymakers dealing with the tensions and inequities that shape outcomes for different actors, for the cluster and for the region.[1]

[1]With the exception of books such as Sun Tzu's 'The Way of the Warrior', or Machiavelli's 'The Prince' for example.

This can be looked at through a range of different lenses, each with a particular focus. The adoption of Porter's Diamond model (Porter 1990) has framed the field for most managers, and is the basis of most manuals on best practice in cluster development. Yet, as Morosini (2004), and also Atkinson and Audretsch (2008) have pointed out, there is a need for more research and support to address the more local barriers in practice on the ground, and the associated dynamics and tensions which impact on outcomes (Edwards et al. 2007).

Economists and Nobel prizewinners Joseph Stiglitz (2001, 2012) and Jean Tirole (2014) have both looked at the impact of inequity and lack of regulation on access to/distribution of information among market players, and the impact of this on the effectiveness of economies, businesses and society. They look at the mechanisms through which incumbent actors can leverage the infrastructure to create monopolies for example, distorting the free play of market forces, with technology often exacerbating or scaling these effects.

As technology connects clusters of communities and mobile devices at increasing scale, whole branches of network science and informatics have developed to map the impact of different sociotechnical configurations on the flow of information and resources. Burt (1992) for example looked at gaps in networks and the role of these in the brokerage of information and knowledge across communities. Granovetter (2005), Callon (1998) and MacKenzie (2006, 2014) are among a growing range of researchers we draw on, who look at the implications of social structures and relationships for economic ones.

An understanding of the alignment (or misalignment) of social and technical actors in large scale collaborations is increasingly important for designing or managing these at scale, in eBusiness, eScience and eHealth, as well as in extended enterprises, global supply chains or clusters. Social scientists such as Pete Edwards and Geoffrey Bowker's workshop paper in 2007 provide good starting point for looking in more detail at the dynamics and tensions in large scale infrastructure. This is part of a growing body of research in this area, which we draw on in different chapters.

Researchers in defence systems—early adopters of technology to support distributed working—were also early to see the need to look at how social and technical actors and networks could be aligned to best advantage. Joslyn and Rocha (2000) were early proponents of this approach, also drawing on the biology of social insects and of the immune system to understand the mechanisms through which autonomous and distributed actors shape the behaviour of systems as a whole.

Other social scientists such as Callon (1998), MacKenzie (2006, 2014), Granovetter (2005) and MacKenzie et al. (2006) look at the social shaping mechanisms in multi-actor systems such as markets, financial trading and other sociotechnical systems. They look at how the models and mechanisms through which they are transacted are constructed, enacted, controlled and maintained by disparate actors, often to the advantage of particular communities.

The sociological lens of actor-network theory in particular (Callon and Latour 2005; Bijker and Law 1992) has provided a lens to examine this, particularly where new technology has provided new 'infrastructural uplands'[2] to exploit. It has also helped unravel the dynamics underpinning the frequent failure of large scale investments in technical and digital infrastructure at scale (Seddon 2008; Bloch et al. 2012; Eason 2007; Royal Academy of Engineering Report 2004).

There is thus a growing awareness, across disciplines, that understanding complex large scale infrastructure has to be considered as the interplay of forces between disparate communities of actors, and that understanding or managing the behaviour of such systems requires an understanding of the messier interactions at the micro and meso levels which so significantly shape macroeconomic outcomes.

9.3 Creating the Connections and the Conditions

The barriers highlighted in the study required changes in the organisational and inter-organisational infrastructure to make them fit for purpose, rather than additional technical or financial resource.

They were issues that could and should easily have been elucidated and addressed as part of a feedback loop. Ongoing collaborative action research[3] with stakeholders can provide feedback about the impact of policy on the ground, and help stimulate engagement with the emerging risks, requirements and opportunities on the ground.[4]

The nature and impact of the threats to cluster development, competitiveness and innovation suggests that just as Hammer and Champy highlighted the need to re-engineer the corporation in 1993, perhaps there is a need to re-engineer the communication and coordination infrastructure of clusters to better achieve their intended objectives.

The analysis of hundreds of interviews and thousands of survey responses highlighted recurring problems at key stages of cluster development, and at key interfaces between actors in government, business and academia. The most significant of these are listed here (See Fig. 9.4) and explored in detail in the following sections.[5] Those we interviewed and survey in this and other sectors have suggested

[2] Star and Ruhleder (1996) use this term in a very rich sociological overview of infrastructure as a fundamentally constructed, relational concept, rather than as a static framework.

[3] See Sect. 4.5.

[4] One of the reasons for this may reflect the lack of incentives for universities to actively pursue this approach—practice-based research and cross-disciplinary research is hard to publish, and high ranking journals typically prefer to publish narrowly focused, theory-based research within the realm of individual disciplines.

[5] As some of these issues fall under more than one theme they are cross referenced.

a range of strategies to better align and harness the needs and resources of the different stakeholders to create shared value for the cluster and the region.

Some of these have already been piloted and shared between clusters, and some are already used in other sectors. Most are about better configurations of existing resources—in ways that create value by design, rather than creating cost and risk by default. Some are about what one manager in Scotland succinctly described as "willing the means as well as the ends"—matching rhetoric with concrete actions on the ground to provide the conditions for the development of the sector.

9.4 Looking at Barriers Across Clusters

Before focusing in on particular areas, (such as innovation) or particular stakeholder perspectives, the interviews and surveys asked general questions about barriers to the development of (a) the sector and (b) the barriers to the respondent's organisation.

The surveys were designed to validate the themes arising from the analysis of the interviews, but still allow scope for new issues in comment boxes and text boxes for example. In mapping the themes we have graphed those that were cited very frequently or very highly. Those which were only cited by 1 or 2 clusters have been omitted, to avoid excessive size and complexity. The themes have been presented as cognate or related groupings, and to some extent, the following chapters follow this pattern (See Figs. 9.2 and 9.3).

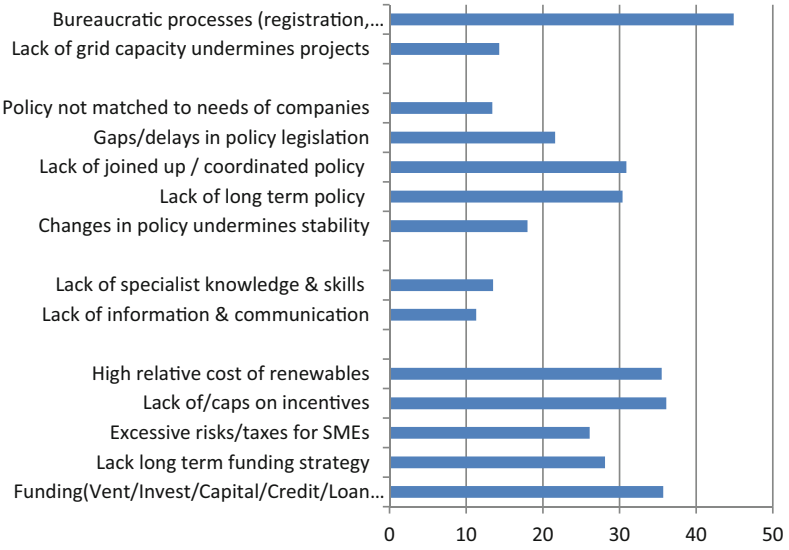

Fig. 9.2 Barriers to the renewables sector in general

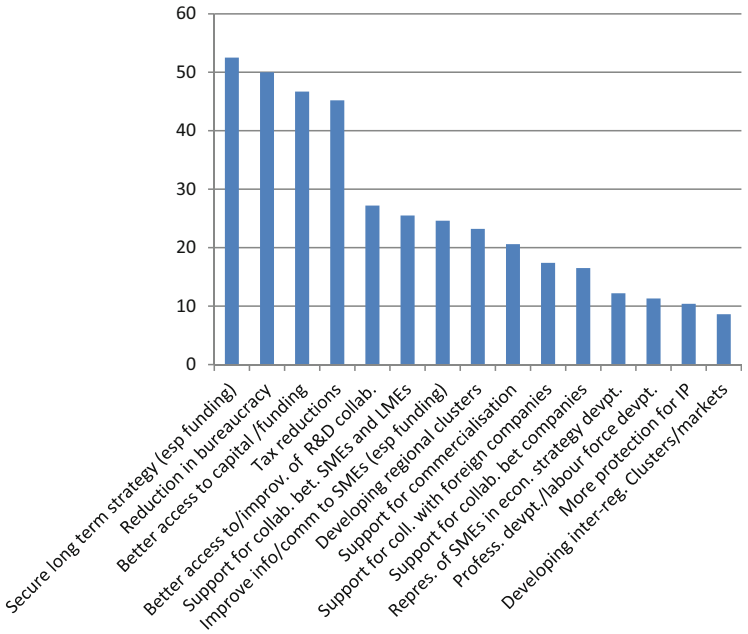

Fig. 9.3 Asked what would help address the barriers for companies, many of the same issues were evident, however there were a number of very specific issues that came to the fore, such as support for concept testing and commercialisation

While communicating these issues was one of the barriers, resolving them was often about re-configuring, coordinating, aligning and targeting existing resources to better advantage rather than finding new ones - something that was evident form earlier cross cluster projects in both the energy sector and the automotive supply chain (Jaegersberg et al. 2007, 2010; Ure et al. 2007).

Looking at the key barriers across clusters in Fig. 9.4 shows the cross-cutting nature of the issues, and the variation across clusters. The issues tended to form cognate sets that have been used as the basis for the focus of the discussion that follows.[6]

[6]It is worth noting that this is a project which has grown, cluster by cluster, as it became apparent that there were real cross-cutting issues with implications for cluster policy. The very first study in this sector, in Italy, was large scale, and exploratory, and some of the more specific questions that were included in later studies are not part of this dataset. In a number of the cross-cutting analyses, therefore, Italy is not included.

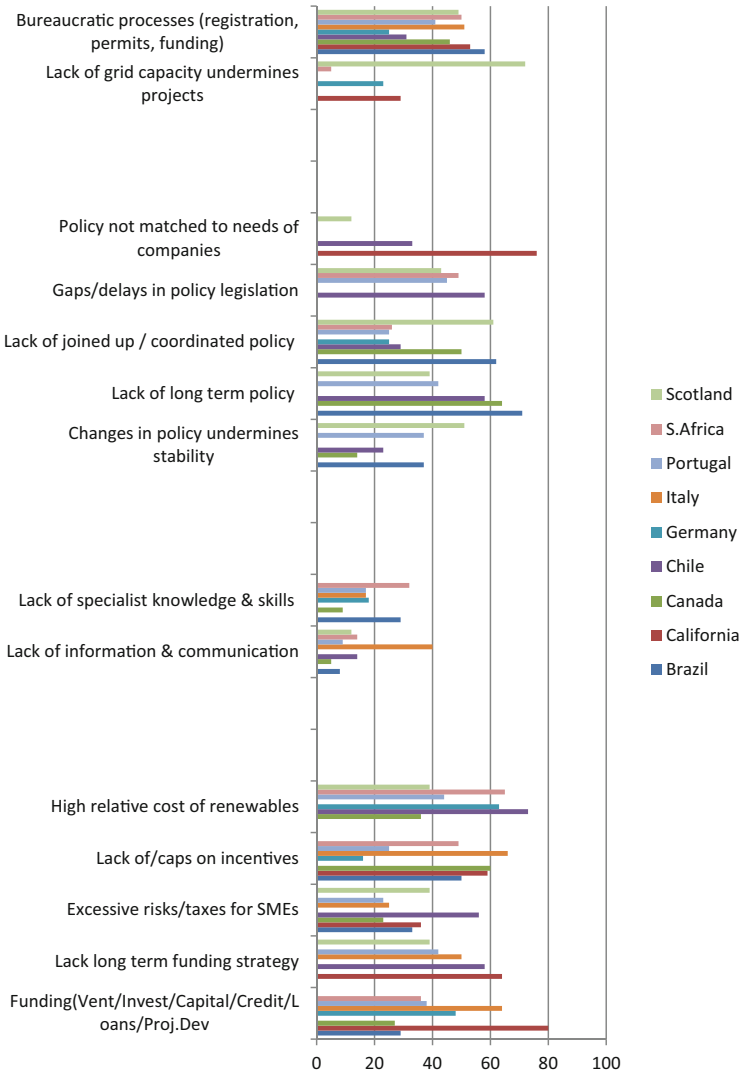

Fig. 9.4 Distribution of barriers across clusters

At the bottom of the bar chart is a cluster of highly cited funding-related issues that recurred across the clusters from the need for targeted funding for aspects of innovation, through to the lack of a stable, long-term funding strategy. These issues are discussed in Chap. 11 (Policy Barriers), together with the policy-related issues—such as lack of joined up and coordinated policy—and some of the policy implementation issues such as bureaucracy. Chapter 11 also looks at policy on subsidies and incentives, where different economic models and policies led to very

different approaches. It also highlights the perception of many SMEs that they were competing on a very uneven playing field, and operating in a landscape largely shaped by others.

9.5 Structure of the Discussion Section

Chapter 10 looks at the perceived barriers at the interface with Universities and research organisations—from lack of support for innovation, concept development, commercialisation and specialist training—through to the tensions in the aims and modus operandi of universities and businesses.

Chapter 11 discusses the policy barriers, from the match to perceived needs, to the involvement of different groups in its development, and the issues with implementation in practice. The lack of feedback from particular groups is discussed in more detail here.

Chapter 12 deals with communication and collaboration issues—the 'social glue' which Porter (1998) refers to in relation to the potential of clusters to create value. This is an aspect which has moved increasingly centre stage, as it became apparent that mere co-location, in itself, was not necessarily sufficient for the kinds of interaction that might create benefits for clusters. It has also become apparent that the arrangements between actors in a cluster can in fact be actively prejudicial for the economic performance of the cluster. We ask where communication and collaboration was a barrier, what the impact of this was, and what could or should be done about it.

What has been lacking, however, as Morosini pointed out in his review of the literature in 2004, is something in more depth in this area that might provide a basis for both understanding and acting to optimise value-creating arrangements, and minimise the risks attendant on others.

This book is intended to provide different insights into such arrangements—through both in depth case studies and through this cross-cutting perspective of these issues across different clusters.

Chapter 13 concludes with an overview of a range of barriers which result from lack of equitable arrangements for feedback and change, yet which present significant risks for the competitiveness of companies, clusters and regions. It explores some of the underlying reasons for the perceived lack of a match to the needs of small and medium-sized companies on the ground, and how this could be reconfigured to better create value within the cluster, including the potential to learn from other clusters and other sectors rather than re-inventing the wheel.

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Chapter 10
Barriers at the Interface Between Companies and Universities

Abstract The interface between Universities and SMEs was perceived by many as creating barriers rather than creating value in the key areas where clusters are expected to generate shared value. It includes surprising evidence of the difficulties faced by companies in collaboration with academic organisations with very different aims, goals and modus operandi, and highlights the pressing need for more practice-based, collaborative and cross-disciplinary research to meet the real demands of a sector in urgent need of answers. In terms of innovation—the area where Universities typically claim to contribute to the economy, significant difficulties in aligning the different needs of both parties was seen, combined with a lack of targeted funding for research-active SMEs testing new concepts or seeking to commercialise these. This section also highlights a cross-cutting concern about the lack of appropriate skills and professional development in the sector as a real constraint to companies and the development of the cluster. The chapter points to the need for policymakers to create the conditions at this critical interface, for clusters to create value.

10.1 Research and Development Barriers

The interface between Universities and SMEs was perceived by many as creating barriers rather than creating value in the key areas where clusters are expected to generate shared value—from research and the development of innovation through to research on challenges in the field as the basis for policy and professional development.

Lack of Effective Research Collaboration with Universities

This chapter looks first at the barriers to collaborative research and development so crucial for innovation, where Universities should play a key role. The second section looks at the lack of training and expertise which companies also highlighted, and where Universities were again criticised (Fig. 10.1).

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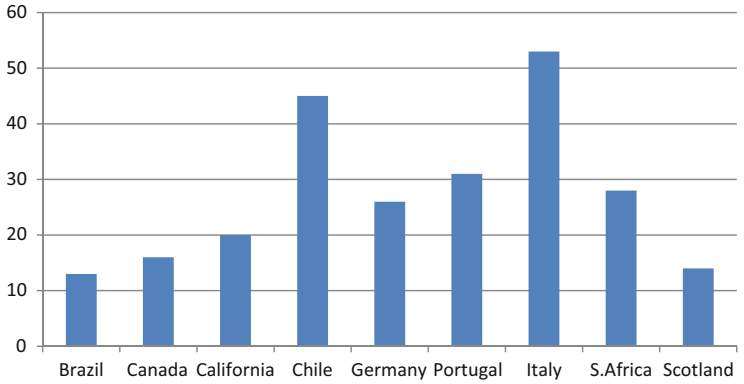

Fig. 10.1 Perceived lack of effective collaboration between companies and universities

In a sector where companies are designing and installing renewable solutions that are new, they need to be able to access answers quickly. As competition with cheap imported products from Asia/China grows, the need for innovative research on both materials and applications is also increasingly important.

The perception that access to this kind of research and expertise was difficult suggested to some that there was a lack of feedback and awareness of the problem at a senior level, a lack of overall coordination of cluster policies, or even a lack of political will to go beyond the rhetoric and create the conditions that can help renewables develop.

Why Was Collaboration on R&D Perceived as so Difficult?

Universities were consistently described by interviewees and survey respondents as having different (and even competing) aims and modus operandi that acted as a barrier to innovation, for SMEs in particular. At times, even University staff acknowledged this as a problem.

Lack of Shared Aims and Incentives

While this perception is less surprising in the context of new clusters, where communication and coordination infrastructure is still in the process of coalescing, it is also evident in mature clusters, albeit to a lesser extent. In other words—this is a cost-effective lever for improvement in any cluster.

It was evident that Universities and businesses had aims, incentives and ways of working that were not well aligned, hindering innovation and knowledge transfer across the cluster.

CANADA	I would think knowledge [is holding back renewable energy development] . . . it's still all a new area. I don't know if I spend $15,000 on solar panels on the roof of my house, if I wake up one morning and think that's a good idea, I don't know where to put them, how to install them. Where to find the components. I don't know for sure how much it should cost and I don't know what my return on investment would be and what the benefit would be. And there just doesn't seem to be any simple way to quantify that for people (EconDev.Assoc.ChCommerce)
S. AFRICA	Knowledge transfer from Universities and research institutions to new companies is relatively painstaking. Networking of the players or network clusters doesn't really function well. The different stakeholders are active more in their own area of interest and the character of joint projects where collaboration is promoted is of lesser importance. The University will then research a bit in their focus area but integrate the industrial application or commercialization less. However this is needed immediately to transform the knowledge gained into new products. There, certainly, things can improve (SME)
CANADA	Another problem I've heard mentioned in the past, and I don't know if it's as strong today as years ago, is that a lot of people feel the local universities aren't really set up to work with businesses. And so, I think there's some businesses that would like to partner with universities and maybe use people at the universities as . . .. to work with business. And the impression that I get from the people I've talked to is that there really isn't a mechanism in place that allows the two groups to actually work together so that they can help each other (SME)
CALIFORNIA	The University of XX has recently become the host for what is known as the XX Collaborative. The idea is that it'll act as sort of a bridge between academic researchers, the public, and industry and policymakers . . .. and then we are supposed to also be looking in terms of the economics of commercialization and other things like this. And what really jumped out is there is a really big gap between what research is and what companies are thinking and policymakers are funding. And the coordination is very poor (Univ. Energy Professor, California)

The questions challenging companies were often practical, and required a working understanding of more than one field. The inability to engage in addressing pressing research questions, particularly applied cross-disciplinary ones, is clearly a barrier that constrains development.

Universities lacked incentives to invest in practice-based, cross-disciplinary research of the kind most needed by companies in the design and implementation of projects in a new sector and in new contexts. Their research funding is determined by the number and ranking of published research to a great extent, and most top-ranked business journals tend to publish research that is subject specific (often narrowly so) and based on theory rather than practice.[1] Such journals often take up to 2 years to publication. In a fast moving sector, this means research cannot inform policy and practice in a timely way.

Companies on the other hand, require commercial confidentiality if their research is to provide competitive advantage, and speed is of the essence. It is perhaps not surprising that such collaborations are difficult to sustain, even where funding is available. Added to this is the fact that there was a relative shortage of researchers at university with specialised experience in many of the countries (Fig. 10.2).

[1] See Willmott (2011).

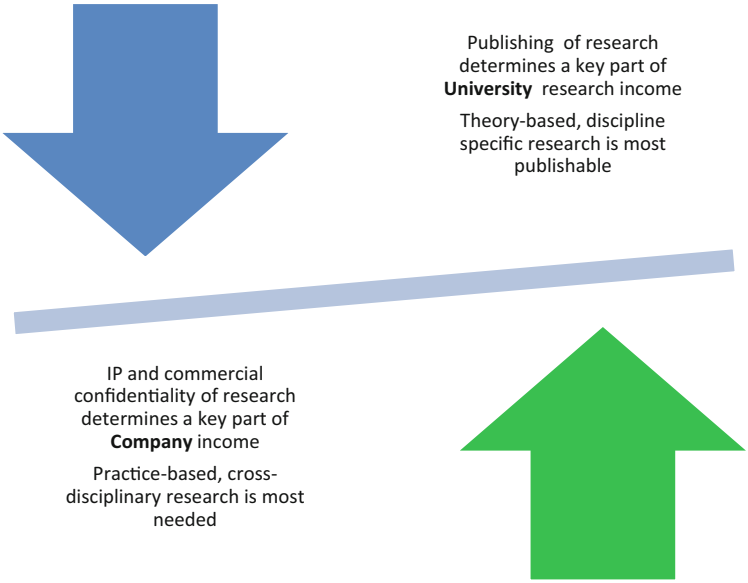

Fig. 10.2 The aims of universities and companies were not well aligned

Lack of Engagement with SMEs

Small companies felt particularly sidelined in terms of R&D support from Universities. Given that a significant part of the income of research-active SMEs comes from patented innovation that contributes to cluster competitiveness, this is a significant issue, particularly in solar energy.[2]

SCOTLAND	The current funding structure for Universities does not allow them to really help SMEs. They are more focused on their own funding and survival. SMEs are a necessary evil to them. Universities are creating unfair advantage over some SMEs. They have access to funding, spend it poorly and do not help SMEs on their journey. Universities wish to share knowledge with all. SMEs need some competitive advantage. . . .What is the incentive for them to train their competitors? Some projects that are undertaken may have academic value but do not meet commercial value adding requirements. For SMEs it's a waste of time (Survey respondent)
S. AFRICA	Actual projects which see collaboration between smaller companies and Universities would help (Survey respondent)
CHILE	Universities don't carry out research projects in partnership with small companies . . . there are only partnerships with large companies (SME)
GERMANY	If one wants to promote network building, then one must enable small companies to carry out research . . . And all the framework conditions that support this . . . I would regard as very important. That is to say, the ability of companies to do research must be strengthened (Business Association)

[2]This may reflect the fact that wind was being developed before solar in many clusters, so was given priority. It may also reflect the fact that wind was often developed by larger companies, and many of the solar companies installing panels, for example, were very small.

It is evident from respondents that although innovation is seen as increasingly important in competition with countries such as China with low labour costs, it is not generally seen as effectively supported in practice by government, funders or by Universities at key stages. The strategic alignment of aims and activities of the key actors is perceived as absent or flawed, even in mature and successful clusters.

This was particularly true at critical stages, such as concept development and commercialisation with Universities. Funding targeted at SMEs specifically involved in renewables is also seen as lacking at these stages, and as is a policy of targeted long-term funding for renewables research by SMEs in collaboration with Universities. There were exceptions in one or two of the mature clusters such as Germany, however, where some companies had very positive experiences.

GERMANY	The readiness of research institutions to cooperate is definitely praiseworthy. Universities, we work with, it all works fine (SME)
	We've had quite excellent experiences here in Saxony. We are in contact with different Fraunhofer research Institutes. We are in contact with Technical Universities and other Universities. There we have very good contacts (SME)
	The basic conditions are excellent in Saxony, and it is always up to you yourself if you use them or not. . . we are very well networked, have all sorts of relationships and have running research projects in Saxony (SME)

This was particularly an issue for smaller companies without access to expensive private research laboratories, or the in-house services available to many larger companies. As a result, the potential of both SMEs and clusters to innovate was compromised. Given the raison d'être of clusters as opportunities for the creation of shared value, this represents a striking finding.[3,4]

Businesses were often in need of more practice-based research to address the issues that arose in the emerging challenges of a new, trans-disciplinary sector.[5] The lack of expertise in this area in many Universities was also a limiting factor.

10.2 Barriers to Innovation

There were a number of cross-cutting barriers to innovation shown here in Fig. 10.3.

[3]Access to facilities such as those now being offered to SMEs by organisations such as NREL in California were rarer at this point in time.

[4]In Australia, this has led to a proposed change in the funding of Universities, in an attempt to encourage greater focus on both collaboration with companies on innovation, and more tangible evidence of research impact, rather than purely publication. See http://www.smh.com.au/federal-politics/political-news/academic-publications-to-become-less-important-when-funding-university-research-20151112-gkxkgl.html. Accessed 16/11/2015.

[5]This is not a critique of pure research, in key areas of such as engineering and chemistry that can clearly contribute to competitive advantage.

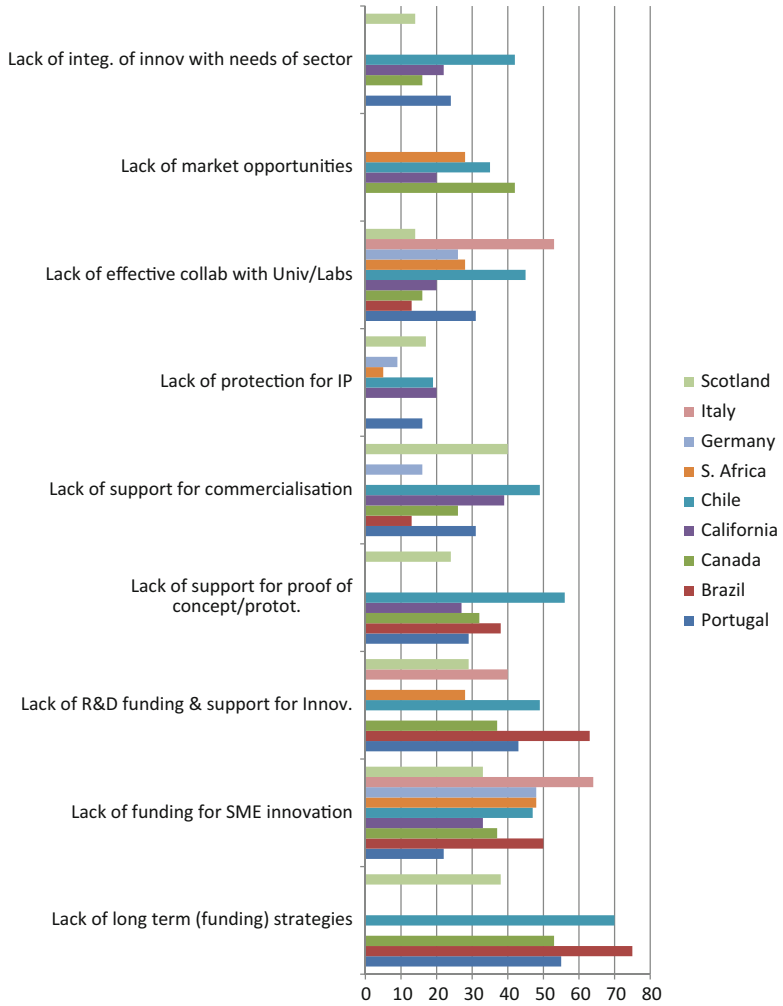

Fig. 10.3 Perceived barriers to innovation

Lack of a Long-term Funding Strategy for R&D

The lack of a long-term funding strategy—with the security and the stability it brings to project planning, and to investors—was seen as crucial for the sector as a whole in all the clusters, and for innovation in particular. This is a recurring issue also documented and addressed in the oil and gas sector at a time of growing global competition, where SMEs were the most affected.

The financial impact of sudden changes in government policy on funding were a pervasive source of concern—changes in the timescale for planned reduction of FiTS, for example led to changes to costings in consortia projects, often with the loss of research-active SMEs and their potential to contribute to innovation and employment in the region.

Given the role of SMEs in innovation, and the potential for their success to benefit the region as well as the cluster, one might have expected more attention to the funding of SMEs, and to the stages where they typically have difficulties, such as commercialisation. Yet the feedback here, as in other areas, highlights the lack of funding for SMEs, and for small projects—such as offgrid projects, and in the context of microgeneration. Smaller companies felt disadvantaged on multiple fronts.

Lack of Funding at Key Stages Such as Concept Testing and Marketing

Lack of Support for Concept Testing and for Commercialisation

This issue was raised across clusters, both in terms of the difficulties of collaborating with Universities themselves, and also in terms of the availability of funding to support this. In fact, where feedback from University staff was filtered, it is clear they were also aware of a funding gap in this area.

Lack of Alignment with the Needs of Business

While research institutes were funded by government, there was a perception that this was not always aligned with the needs of research-active businesses seeking support in areas such as concept testing and commercialisation in particular.

This mirrored almost exactly the issues that impacted on innovation in an early study of the oil and gas chain in two clusters, in terms of lack of funding for marketing of this nature, but also in terms of representation and SME-friendly policies (Ure et al. 2007; Jaegersberg et al. 2007).[6] In a number of such ways, the renewables sector could have learnt from the lessons of oil and gas clusters and avoided or mitigated some of the risks at an earlier stage.

[6]As one SME manager pointed out in our initial oil and gas study (Ure et al. 2007; Jaegersberg et al. 2007) even within their own cluster, other companies were unaware that they had developed innovations to address drilling issues, only to find that companies were requisitioning solutions from abroad, quite unaware it had already been solved at home. The use of regional SHARE Fairs was set up as one strategy to address this lack of communication and marketing, and foster regional collaboration and alliancing towards mutually beneficial objectives.

Lack of R&D Funding for SMEs and for Small-Scale Projects

Lack of specific funding for SMEs was frequently raised, particularly in the context of established demand for microgeneration, and for rural off-grid projects. Many managers attributed this to the focus of government on large (utility scale) installations. In countries focusing on wind, such as Brazil, wind projects were sometimes assumed to require the resources of larger companies, and SMEs were to some extent sidelined. Given that SMEs are core to renewables, as well as core to regional employment, and given the established demand for small-scale projects in most of these clusters, the consistency of this finding begs many questions.

CHILE	I think research and innovation requires a big financial commitment, a big commitment of resources, and sometimes very high risks—very high so companies, and particularly SMEs (who have such limited resources and who are much more preoccupied with generating enough resources to carry on producing) are going to have even less of a reason or an interest in developing innovations they don't have the money for. So I think it is there that government should have a means of supporting and subsidising innovation and research at the SME level—so that it is not such a huge effort (EconDev.Assoc. ChCommerce)
	When a bank realises that it is a small company (seeking finance) then this is where there is a flaw in the market. And it is here where the government should support SMEs, guaranteeing their credit, or helping them to get other kinds of funding for those projects which can be built (SME)
PORTUGAL	. . . the banks leave SMEs completely out in the rain, without loans, without financing . . . It cannot be that the European Union, the Central European Bank, lends a lot of money to Portuguese banks and very cheaply, and afterwards nothing gets to SMEs (SME)
	Normally, for some reason, the money ends up in the pockets of large companies, when it comes to research. Because it's distributed through big programmes, and for some reason, it's normally large companies winning projects (EconDevOrg, Assoc, ChCommerce)
BRAZIL	Well, I could add that our strong point in commercialization is this—the commercialization of micro and mini energy. The problem we face is (in securing) more effective government participation in terms of financing, because we sell equipment which seems expensive to Brazilians at the moment, but this is equipment which will pay for itself in 3, 4 or maximum 5 years. And this seems a long timeframe to Brazilians, because it is something new. People know that in Europe they don't think that way. They already see that a 5 year return on investment is not a long-term investment, But for Brazilians it is, and we don't have the financing and the structures for financing this (SME)

Microgeneration, at scale, puts more power in the hands of small investors, as opposed to the larger utilities, and in countries such as Brazil, where large tracts of the country are not connected to the grid, this is a very large market.

In some countries also, such as Brazil, there were insufficient funding schemes to encourage householders to invest in microgeneration, despite the documented scale of this market, and the potential for job creation.

SMEs and start-ups, particularly in solar energy, often felt sidelined to a certain extent in this regard, given the established size of the market for microgeneration and for off-grid solutions in those countries with significant areas not connected to the Grid.

The lack of long-term government funding strategy to incentivise, and research and development was highlighted as a key issue here by around three quarters of survey respondents across clusters.

IP Issues

Although IP (intellectual property) was not one of the most highly cited barriers, it cut across the clusters, where Universities at best fail to take account of these concerns in interactions, and at worst even compete rather than collaborate in this critical aspect of regional innovation.

CALIFORNIA	University XX has been taking the stance for a very long time that they should have the full ownership of all of the IP. And that really hurts the University because it is a killer for start-up companies (Academic Project Manager)
	There have been some issues with IP because they prevented me from getting or publishing materials. . .there is no reason for working together with universities (SME)
GERMANY	. . . often it starts becoming difficult in projects then when it comes to (commercial) exploitation of the results . . . Then often the issue of exclusiveness or some such thing comes up (Large company) They [R&D Institutes] are increasingly moving in the direction of developing products themselves and licensing them to industry then, because they can make more money that way . . . This has the big disadvantage that one enters into a situation of competition and into a conflict of interest between development Institutes and industry which, in some cases, has actually made us decide not to carry out, or to stop development projects, because we were simply afraid that the partner would use the know how afterwards for their own commercial exploitation. From my point of view, this is in a clear contradiction of the socio-political mandate of R&D Institutes who are supposed to be conducting research FOR industry and not developing and marketing a product themselves (Medium-sized enterprise)
S. AFRICA	Well, if I have a new development, or a new product now, and I want to have it tested I'll be able to give it to them [Universities] and they will test it for me. . . .//. . ..There is a little disadvantage for companies though, I must add . . . The University doesn't have to bind itself in terms of a confidentiality clause. It publishes the results then, and that is sometimes not desired . . . There is a barrier . . . a field test . . . the danger of copying . . . appears relatively fast (SME)
ITALY	One of the main barriers is the lack of research collaboration with Universities specialized in this [photovoltaic] sector (SME)
	Research and development are difficult to do in Italy—even if it is important. Have you ever seen a contract of R&D collaboration with a University? It would be less complicated with NASA (SME)

It became clear that the issues with IP were part of a wider disconnect between Universities and companies, in terms of aims, interests and modus operandi, and one which was a barrier to innovation by SMEs (as opposed to spin—outs from Universities to SMEs.

This is something that also appears in other large scale national studies. The Hargreaves (2015) study of hundreds of SMEs in the UK, for example, underlines the increasing importance of IP issues as a barrier to research-active SMEs in a range of different industries.

They point out that "30% of small firms with IP in the UK, for example, are reliant on those rights for at least 75% of their turnover" and that "Small businesses have invested significant amounts in developing and trying to protect their IP rights. A significant percentage of members describe their investment as being poor value for money. This leads to a risk of small businesses being discouraged from investing in the IP they need, and could act as a block on innovation."

Far from being allies in innovation, at worst, SMEs sometimes felt they were in competition with Universities. At best, they felt their aims and modus operandi were poorly-aligned with those of most Universities.

Lack of Cross-Disciplinary and Practice-Based Research

Companies often expressed a need for answers to real world questions that requiring the coordination of knowledge and information from disparate fields to answer emerging questions related to the design and installation of renewable technology in varying contexts. This was seen as different from the kind of research most Universities were involved in or interested in carrying out.

It is worth noting here also that the lack of practice-based research on the ground means that policy and professional development are not informed sufficiently early to address emerging needs in a timely and effective way. If the feedback loop[7] from the ground is slow or even absent, policymakers are slow to respond to emerging issues impacting on competition and innovation. Similarly, the training and professional development provided by Universities will fail to address the real needs of companies.

[7]The Donella Meadows Institute website on systems thinking provides some very clear and compelling examples of the impact of delays in feedback loops on such systems. See http://www.donellameadows.org/archives/leverage-points-places-to-intervene-in-a-system/. Accessed 6 November 2016.

CANADA	Because the wind blows differently, the sun shines differently, the application needs are different. . . . an important issue to address is knowledge and information on how to actually use and implement technology and build it (EconDev. Assoc.ChCommerce)
SCOTLAND	Stop Universities and research organisations doing their own thing and insist that they consult with industry on problems to be solved and make them accountable for delivering results within timescales (SME)
GERMANY	Also in terms of research orientation, I mean the kind of research that is propagated or conducted at universities—that could surely be focused more on industry (SME)

There was also a perception that lack of knowledge and understanding of the sector among policymakers was an issue, with implications for the research and the professional development on offer from Universities.

> *At the (round) table should be sat the people who know about the technical issues, and the commercial issues together with the government people—sadly this has not yet happened. And the truth is we have spent a long time trying to talk some people in the government. (SME, Germany)*

There was also a clear view of the interface between Universities and SMEs as complex and bureaucratic.

> *Research and development are difficult to do in Italy—even if it is important. Have you ever seen a contract of R&D collaboration with a University? It would be less complicated with NASA. (SME, Italy)*

There were exceptions however.

> *I've got experience with university-industry interactions across Canada and it's better in Alberta than in other places. How do I put it—universities can be a little more standoffish. Because Alberta is very focused-Alberta works hard-Alberta has a very business oriented mindset. They're comfortable with industry in this province I think, and it's less so in other areas. (Economic development corporation, Canada)*

Clearly, research and development is fundamental, however the interview feedback from research-active SMEs suggested this was limited and poorly-targeted in terms of their areas of interest. To better understand and quantify the issues, we used the follow-up survey to try and qualify and quantify this to a greater extent, and identify specific aspects of this that were problematic, and also as a basis for practical recommendations.

Need to Align Innovation with the Needs of the Sector

This issue was only raised in some of the clusters, but makes an important point about the importance of targeting identified needs as a means of optimising value in the cluster. SMEs are typically well-endowed with niche knowledge but limited in funding to exploit it. Developing an innovation which is not a match to the needs of the market, or which is not well marketed threatens the survival of research-active SMEs with limited cash flow, and constrains the ability of the cluster in terms of competitive innovation (Ure and Jaegersberg 2005).

In other sectors, such as oil and gas, this risk has been addressed by bringing stakeholders together in different ways (Share fairs; mentoring; targeted events) to identify the innovations that would be most useful to the cluster and/or promoting them within the cluster when available. Funding is then targeted more effectively for both those developing innovations to meet cluster needs, and those adopting them.

10.3 Lack of Skills and Expertise

Lack of skills and specialist expertise was seen as a significant barrier to development in all the case studies, to a greater or lesser extent. This lack was most evident in early stage clusters in less industrialised rural areas, as might be expected, but was also clearly evident (though less crucially) in more mature clusters, in areas well endowed with well-established Universities, despite the size and mobility of the labour pool (See Fig. 10.4). Interestingly, stakeholders in government often underestimated the extent to which this impacted on companies.[8]

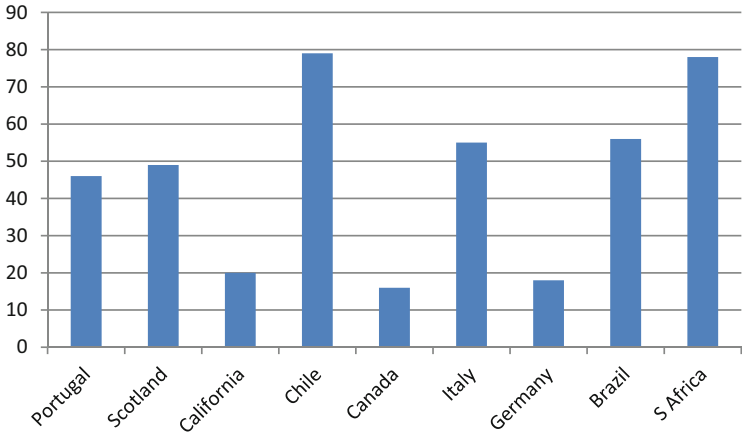

Fig. 10.4 Percentage of respondents who felt the workforce was insufficiently skilled

The interviews point again to a lack of commitment by many Universities to timely identification and provision of skills, education and training at all levels,

[8]This is increasingly borne out in national and international studies. In the UK, for example, large-scale studies such as the Federation of Small Businesses (FSB) Members' Survey in 2013 show that access to skilled staff was cited as the third biggest barrier a business experiences when trying to grow. This is ranked above access to finance, regulation and employment law. A further survey of around 1300 CEOs revealed that UK business leaders highlighted it as the greatest threat to business growth, with around 7 in 10 members offering on-the-job training themselves (Education 53%, Health and social work 52%,Construction 46%, Engineering 46%, Energy, water, environmental 46%).

from professional development through to training and skills in design and installation, and the kind of practice-based action research that might inform the curriculum (and policymakers) more quickly, in this rapidly evolving sector (Jaegersberg et al. 2002; Jaegersberg and Ure 2010).

Most companies in clusters saw shortages of skills, expertise and understanding as a significant barrier to both business development and to good governance of the sector, with a number indicating that the lack of professional development and knowledge dissemination in the sector was one reason why many felt policy was being developed by people who did not really understand the sector.

It is in this context of a new sector with little established knowledge and understanding, where practice-based research with stakeholders in the field by Universities might have proved invaluable in informing the curriculum in ways that met the needs of professionals, and practitioners.

Where are the incentives, however, for Universities to invest in course development? Or the penalties for failing in this key role for the region?

A number of respondents suggest more involvement in collaborative or practice-based training, which could also provide more timely feedback on the needs of an emerging industry to both curriculum developers and policymakers.

> *In many ways, students should work in industry for a year as part of their degree, free or even pay companies to support that experience. Students should have a specific project to deliver. . . (Survey respondent, Scotland)*

The lack of skilled professionals was a surprisingly cross-cutting barrier. Although it was most evident in early stage solar energy clusters,[9] and in rural areas, it was also evident even in mature clusters with access to well established universities, limiting both opportunities for the company, and employment opportunities in the region.

SPAIN	We don't find people with experience in this sector. For that reason we think that it's much better if we do the training for our engineers in this sector (SME)
GERMANY	It must be said, above all, that young professionals are a problem . . . academic young professionals in the technical field are thin on the ground. If nothing is going to happen there, the situation will not improve (SME)
CHILE	There is a lack of human capital, and a lack of money and this impacts on the Universities, the SMEs and the large companies as well—this cuts across them all (EconDevOrg. Assoc. ChCommerce)
PORTUGAL	There is no university qualification in this specific area [solar energy] (SME)
	The first construction courses for photovoltaic systems only appeared recently, but the practical side of these courses is still poor. It's also necessary to offer more photovoltaic training in the fields of energy policies and strategic planning (SME)

(continued)

[9]The solar energy sector was generally seen as requiring a more technical and a more costly development phase, and for this reason, wind was prioritised for development in the first stage of some clusters.

	There's a lack of qualified human resources to develop innovative products (SME)
S. AFRICA	There ought to be also better or more training possibilities for installers . . . There is no shortage of scientists in South Africa who are qualified in this field, but rather of installers and craftsmen because, ultimately, it is them who must consult the final client (SME)
	Where there is a great deficit . . . it's in education. That is definitely a field with 30–40% backlog demand, that is, there is no knowledge about how something works (EconDev.Assoc.ChCommerce)
BRAZIL	People are on their own. We provide training but more is needed (SME)

For colleges and Universities to provide such training requires both an awareness of precisely which courses are needed, based on some kind of research with companies, and some incentive to design and teach it at an accessible price. Even where courses were offered, they were not necessarily matched to the needs of regional companies. As one manager put it.

> *From time to time, training courses are offered by different providers, but with regard to depth of qualification and information they are not necessarily to be assessed positively. Surely, the surface is scratched a lot, but in reality they are more sales events than true training courses. (SME, S. Africa)*

There were respondents who had established such arrangements, but this was still more accessible to larger companies than small ones, in part given the fact they could provide a larger cohort of students, and were more likely to be able to pay for professional development courses.

While some larger companies felt they were developing collaborative relations, most felt that the relevant courses were not yet on offer, and that this was a real constraint.[10]

This gap in knowledge and training was not only seen as impacting on the development of the sector, but also as impacting on the quality of policies developed, by people without a full understanding of the technology and its applications, or the challenges for companies on the ground. Again, this is an area where Universities would have been ideally placed to carry out research and provide professional development and training to enhance public and professional understanding.

Addressing this barrier will require significant changes to the way business and engineering departments at Universities are currently incentivised to support professional development. The status quo drives an emphasis on publication and pure research, rather than professional development and practice-based, cross-disciplinary research.

[10]Since the studies were carried out, some of these regions, have created new courses and research and development hubs in the renewables area.

Unfair Competition for Trained Staff with Oil and Gas Companies

In some regions, such as Canada, renewable companies also saw themselves as competing for a limited number of qualified staff against the oil and gas sector where salaries were many times higher.

> *A buddy of mine got offered $110/hour by a petroleum company to do quality control engineering and extracting. $110/hour! How do you compete with that? It's shocking. The brain drain, it happens. I lost one of my civil engineers who has the best of intentions going in and an 'I'm going to change the world' mentality and his mistake was getting married and having a kid. Because he had to look at his long-term financial strategy, and guess where you go in Alberta when you want the big bucks quick? You go to oil and gas, which is exactly where he ended up. (SME, Canada)*

In addition to the skills needed to design and install these systems, there was also a lack of expertise and understanding of the sector in general.

Lack of Understanding and Expertise Among Policymakers

> *The principal barriers to the development of renewable energies?—First is the lack of technical capacity—which you can see in the different fields . . . The universities don't have it incorporated in their basic curriculum for professional development in the technical careers. At the moment what you see of renewable energy at university is only at the postgraduate level—so this make it difficult when it comes to carrying out renewable energy projects—as there are no local companies specializing in this area. (SME, Chile)*

There was a perception in many clusters that lack of understanding of the technical and the business issues in this area also impacted on policy, and on business investment. And it was as evident a problem in mature clusters such as Germany, as it was in nascent ones like Chile.

Managers pointed for example to the risks where there were competing claims with regards to different kinds of renewable and non-renewable energy. Those depended on the ability of politicians to understand the issues and make informed decisions about policies that had a very different impact on different groups within the cluster. Others highlighted the extent to which deciding to make an investment, or take the decision to develop a project where the information needed to do that was not easily obtained.

At the most basic level there is a need for Universities to generate, disseminate and develop knowledge and expertise if it is to genuinely support research and innovation that will support businesses in a new sector.

Addressing this barrier will require significant changes to the way business and engineering departments at Universities are currently incentivised to support professional development. The status quo drives an emphasis on publication and pure research, rather than professional development and practice-based, cross-disciplinary research.

10.4 Implications: Learning From Other Clusters

The rationale given for clusters is based on the advantages of co-location to foster joint working and the creation of shared value. This is not how it was perceived at the interface between renewables companies and Universities.

The feedback highlighted a need to:

- address the lack of skills and knowledge transfer
- support collaboration with Universities in key areas, such as concept development and marketing
- provide better and more targeted funding for R&D, particularly for SMEs
- address the competing aims of universities and businesses in research, for example by providing incentives for more engagement in collaborative, practice-based, cross-disciplinary research that better meets the needs of industry.

Research with companies on the ground could also provide an essential feedback loop in uncovering the emerging issues in this new sector, allowing timely feedback to those developing policy, as well as the professional development curriculum.

In a new and highly competitive sector, where the answers to key questions are not yet available, the speed and efficiency with which this can be achieved will determine the ability of the sector to compete effectively.

It is noteworthy that since then, some clusters are beginning to focus more on addressing this barrier. The US Dept of Energy's National Renewable Energy laboratory (NREL), for example, is one of nine national laboratories providing vouchers for SMEs to address precisely those challenges to develop and commercialise innovations, with laboratory support, while also giving better feedback to government about the needs of SMEs.[11]

Universities could provide a much more effective role in using student internships as a bridge between regional Universities and the industry networks they serve, collaborating in research and course development with other regions, as the authors have done in the automotive, oil and gas and the renewable energy sectors. (See for example Jaegersberg et al. 2002, 2007; Ure et al. 2007).[12]

The sector could learn directly from the experience of the oil and gas sector, which had to manage a transition from cost-based strategies that decimated SMEs, to innovation strategies which required more SME-friendly policies. The PILOT[13] initiative outlined in Chap. 3 facilitated the partnership between education, government and industry to optimise competitiveness through very effective collaborative working that gives much more of a voice at the executive level to SMEs than

[11] http://www.nrel.gov/news/press/2016/24654. Accessed 1 April 2016.

[12] Aranguren et al. (2014) speak of Universities as potential change agents, drawing on experiences in the Basque region ORKESTA cluster.

[13] https://www.gov.uk/government/groups/pilot.

before (Ure et al. 2007; Jaegersberg et al. 2007). Managing such transitions is an increasing part of the discourse in rapidly evolving global markets.

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Chapter 11
Policy-Related Barriers

Abstract This chapter deals with the recurring barriers relating to policy—at different stages in the cycle—from the initial stage of communication and development, through to implementation, and feedback from those on the ground about impact and new requirements. It points to the importance of establishing regular meaningful dialogue with all the stakeholders if emerging risks (and opportunities) are to be identified and addressed in a timely way, and to the need for Universities to take a more active role in supporting this dialogue. The first section concentrates on the very recurrent funding policy issues and the policies that respondents felt were most effective for the sector, and for companies themselves. The second section concentrates on the extent to which poor implementation of policies can hamper rather than help in practice. Lastly this chapter looks at the barriers to feedback and collaboration between companies and policymakers, highlighting the economic cost of failure to harness what users know about the cluster landscape on the ground and the potential to learn from other sectors that have harnessed this to advantage.

11.1 Barriers at Different Stages in the Policy Development Cycle

Most of the recurring barriers that were described in the case studies, related in some way to how policy was developed or implemented—and we have used a very simplified framework in Fig. 11.1 as something of an advance organiser for discussing the barriers and concerns that were most typically raised. Sect. 11.2, on Policy, looks at the many barriers associated with existing policies. The policy cycle facilitates the understanding of policy-making by breaking the complexity of the process into states (policy, implementation and feedback). In reality, however, as Stone et al. rightly point out "policy making is messy" (Stone 2011).

Section 11.3, on Implementation, looks at the recurring issues associated with putting policy into practice. Section 11.4, on Feedback, highlights the lack of opportunities for some groups to communicate their needs, and help shape policy that adequately meets them. (This is also taken further in Chap. 12, which looks at Communication and Collaboration).

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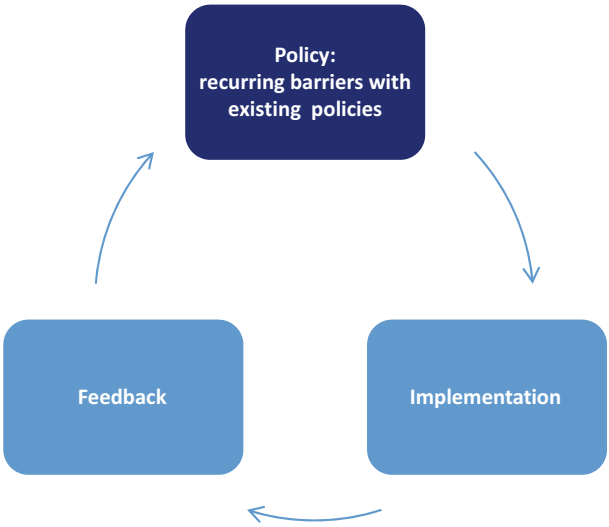

Fig. 11.1 Simplification of the stages in the policy cycle where barriers most frequently arose

The research concentrated on understanding the perceived failings of existing policies to reflect their needs, and the needs of the cluster, in key areas such as innovation, and finally, what changes stakeholders felt would better meet the needs of company, cluster or sector.

If the main aim of policy was to meet the needs of stakeholders, and facilitate progression to long-term economic goals such as energy security, employment, innovation and economic growth—it was perceived by the majority of company managers as woefully inadequate—and often quite unnecessarily so.

The perceived problems here fell into three categories—those related to the existing policies themselves—those related to the process of informing policy development—and the process of implementation, which often had unanticipated effects. At each of these stages, SMEs felt they were insufficiently taken account of, despite being the principal actors in the cluster responsible for generating innovation and regional employment.

11.2 Barriers Related to Existing Policies

We look first at the perceived problems with the policies in place at the time of the interviews and the surveys. Some of the barriers were about the failure of policy to meet specific needs, and some of them were more general such as the lack of coordination of policy, and the lack of long-term stability in funding policy that is required for companies to risk investing limited cash flow in ambitions or long-term projects.

Lack of Joined up Policy

Based on the analysis of the interviews, lack of 'joined up' policy was perceived as a very prominent problem across clusters (See Fig. 11.2).

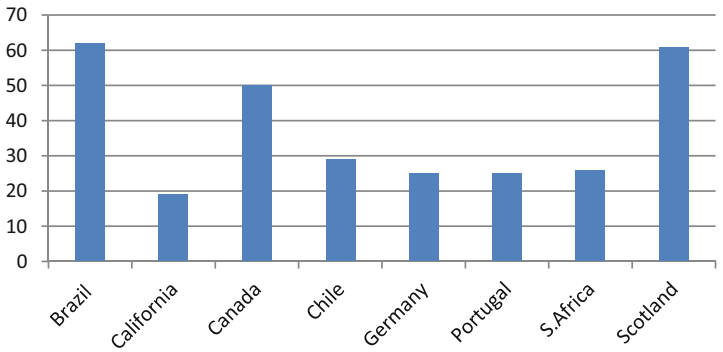

Fig. 11.2 Lack of joined-up policy as a barrier in different clusters (This issue was not included in the Italian survey. The Californian survey respondents focused on joined up policy more specifically in relation to the lack of inter-operability of standards between utilities and between municipalities)

Two key aspects that figured high on the list of barriers across clusters related to legislation. First among these was (a) the lack of joined up policy and legislation itself, and (b) the associated gaps or delays in implementation of policy that could leave project developers (and investors) at risk.

In countries such as Brazil and Canada, where large scale projects required working across multiple regions with different legislative regimes, this was clearly a barrier, and something of a disincentive. In Brazil and Scotland around 60% both rated it as a key concern, reflecting experiences that had stopped developments already approved and well down the planning road. In Canada, the differences in regional policy, (with regard to incentives and subsidies), was an issue which both disrupted competition and hampered trans-regional projects. The lack of coordination between Ministries and other agencies was also seen as resulting in legislation with gaps and inconsistencies highlighted in the quotes from South Africa and Portugal.

This was a very cross-cutting issue—across regions with different policies and incentives, across Ministries with different briefs, and even in terms of the different regulations and standards used in collaborating industry partners involved in installation or connection.

CANADA	(There are) barriers for renewable energy development depending on your jurisdiction, what community you're in, some have stringent bylaws, some are more relaxed. . . .trying to attract investment in renewable energy to Alberta . . . with Ontario having a FIT system and Québec and Ontario having domestic content rules . . . made it very challenging to convince manufacturers that they needed to set up in Alberta. (Interview B/11, education, p. 3)
BRAZIL	The weak point is perhaps the lack of coordination between Ministries, which involve the Ministry for the Environment, the Ministry of Mining and Energy, the Ministry of Planning, the Ministry for City planning . . .the use of renewable energy could be a common cause, and a strategy could exist that would cover all this so as to take it forward (Regional policymaker)
S. AFRICA	A principal barrier is lack of coordination in the sector and between Government departments. (survey respondent) What is further badly needed is greatly improved and intensified coordination between all relevant government departments as well as the private sector (including NGOs, business and knowledgeable individuals). (Survey respondent)
PORTUGAL	The major barrier is the lack of coordination between the legislative bodies, and the associations representing the sector. This lack of communication causes laws with gaps that lead to serious consequences in the future. (EconDevOrg. Assoc. ChCommerce).
CALIFORNIA	The US is fragmented. You have to deal with local authorities, with regional authorities with the state, with the federal government; with the tax authorities . . .everybody is doing it differently. (SME)

Policy research increasingly points to the potential synergies and cost savings possible where policies are integrated with other economic goals, coordinated across Ministries, and focused more on facilitating operation across sectors and regions (Hallsworth 2011). Practice-based research on the ground by Universities would provide critical and timely feedback on the often unanticipated barriers to implementation that are very obvious to practitioners but not necessarily to policymakers.[1] This chimes with the perception of those on the ground that lack of coordination in this area was damaging to the potential of companies in the cluster to plan for the longer term, or to manage projects across regions or sectors.

In early stage clusters, creating the whole legislative and regulatory infrastructure, with all its legal and political ramifications, is complex and hard to synchronise, particularly as it involves working across different Ministries and administrative bodies, and aligning the interests of disparate groups.

The lack of a long-term, coordinated plan to provide the conditions for companies to develop projects effectively, was very evident in complaints about lack of adequate Grid transmission infrastructure where the physical transmission networks were not complete and fully operational, where capacity was insufficient, or where arrangements for connection with a Power Purchase Agreements were not yet in place.

There were issues of barriers to connection, transmission speed or purchase and payment arrangements in some cases, with coordination between different Ministries and the regulatory regimes of different regions often further complicating the

[1]The extent to which policymakers felt they consulted widely was often at odds with the perception of managers.

process of an emerging infrastructure. The South African case in the second section of the book illustrated the impact of the resulting delays and uncertainties on investors and companies on the development of/confidence in the sector at that stage. Again, in Scotland and in Brazil, delays in the development of Grid transmission lines created delays and uncertainties and thus financial risks for companies. Such barriers, combined with the lack of certainty in long-term funding commitments from government, created a very difficult operating environment for companies, and particularly for small companies.

S. AFRICA	People don't know exactly how they are going to be connected to the grid. That's another issue. Who is going to pay the costs of the grid connections? How are you going to pay the costs? The idea there is that Eskom will pay the costs of any straightening of the grid that's required. But that the private developers will have to meet the costs of getting the power the energy of the local side to the closest substation. I think people find that an acceptable regime but they just need to have a bit more priority on where the line is drawn. People also want to know what happens if that's going to be late for the grid connection. Obviously you can't get a position where you build a PV plant and you are ready to go and the grid connections are late or haven't been built. (SME)
SCOTLAND	I think the problem here is that we don't have enough capacity on the grid to take any more. At every conference I go to they are saying that the XXXX (transmission) line is an absolute must to upgrade from the north to the south, and speaking to people in the industry XXXX is already booked. . ..The problem is—even if XXXX happens, all that capacity is already being booked by all these people who are much further ahead of you. In my interpretation of things, this is a real problem, because the wind might be there and appropriate land might be there. What's not there is the grid to support that electricity and move it and take it (Govt. Advisor)
BRAZIL	And another big problem with wind energy in Brazil is the connection, and there are a lot of projects which have good sales potential, and good wind potential ,but they don't have a connection to the grid to start production So there are lots of areas which need to be developed—this area of connection so that projects can start moving forward, otherwise what is going to happen is what already happened in fact and some projects which were auction winners, and were built and ready, but couldn't start production because the transmission was not ready in time. (EconDevOrg. Assoc. ChCommerce)

Such uncertainties might be reduced were renewable energy policies better integrated with economic policy as a whole, rather than as a 'bolt on' arrangement. The lack of overall coordination between Ministries contributed to a lack of complete, timely or coherent policy and processes that impacted on the viability of projects, as well as the potential for an integrated approach. This was more of an issue in new clusters where this was in process, but still cut across clusters as an issue that impacted on the viability of the sector, the confidence of investors and the survival of SMEs in particular, given their vulnerability to unanticipated delays or costs. As one of the respondents pointed out—renewable energy policy should be a strategic and integrated part of economic strategy across Ministries, rather than something bolted on.

Lack of Stable Long-Term Funding Strategy

Sudden changes in policy—such as unscheduled reductions in Feed-in Tariffs—were recurring features of the landscape, often in the wake of elections or political upheavals.

See if you think it's fair... to the rules of the game in the middle of the game. It's not fair when you make a contract at an auction. You work out your costs...not counting these new system changes in the middle of the game. Then this creates insecurity for investors, for the generator and the entrepreneur. Of course the small and medium-sized companies suffer the greatest impact. (SME, Brazil).

Anyone who wants to use a small scale solution. . .well that is what is missing – the financing of that aspect (SME, Uruguay)

The impact of the lack of a secure long-term funding strategy on companies and on investor confidence was profound and damaging (See Fig. 11.3).

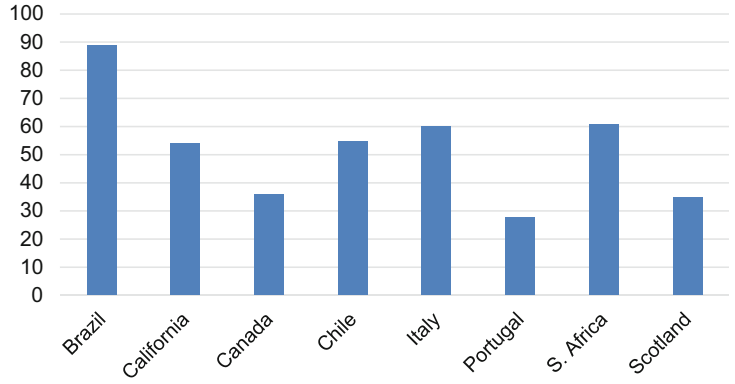

Fig. 11.3 Lack of secure long-term funding strategy was identified as a crucial barrier in all but one cluster

This was one of the highest ranked and most recurrent issues across all clusters (See also Figs. 11.9 and 11.10). In Brazil for example almost 90% identified this as the key barrier that would make most difference to their company if addressed. Asked what would make most difference to companies across clusters, this was the most salient issue across clusters, with the exception of Germany.[2]

While it was clear managers felt the need for policy that was consistent across constituencies, it was also abundantly clear that they wanted policy to be consistent over time as well. The reasons for this are clear, and concerns were sharpened by the many examples of sudden changes in funding policy, in the face of political headwinds, which then undermined planning, costing and investor confidence.

In an OECD study of policy to support cluster development Martin Stanley enjoins governments to "avoid the temptation to make frequent short-term changes to the regulatory framework, or introduce ad hoc taxation that undermines confidence on the part of investors". He points to the evidence of well-publicised

[2]In the case of Germany, at that point in time, none of the survey respondents to the survey identified lack of a long-term strategy as a particular barrier, in what was an open question although the interviews do highlight a concern with the timing of reductions in Feed-in Tariffs as a related issue on its' own.

examples of this in the renewable energy sector (Stanley 2011) which were all too familiar to interviewees from companies in the different country clusters.

Managers of small and medium-sized enterprises often expressed concern in the interviews that government (funding) strategy might change before they were able to market their innovation or achieve a return on their investment in the open market. These were seen as impacting both on the confidence of SMEs and investors, in a sector vulnerable to a change in the political compass, such that projects might never be completed or fully operational, or where the return on investment would be less than initially projected.

Clarity, Commitment and Continuity

Sometimes the damaging issue was the lack of **clarity** for future planning.

> *The thing is, the subsidies from government are only good till September. That means we don't yet know what will happen in September next year. That creates a confusion. Or problems to the market, because none of us knows anything about what's going to happen. (Large company, Spain)*

For companies investing everything in a new and untested innovation, the long-term **commitment** of government was a pre-requisite for the continued commitment of companies and investors to the sector. Sometimes the lack of **continuity** in policy reflected the rapid turnover of politicians in an energy portfolio role, and the difficulty of sustained dialogue and understanding.

> *When the government changes, also the energy plan changes, which is an absurdity. (SME, Italy)When it is not possible to maintain—let's say—a conversational thread with the people in charge, because those people change—then it is not very easy. (SME, Chile)*

The lack of coherent, coordinated and stable long-term policy hampered planning and project development, and undermined confidence in investment, and one of the most damaging factors was the perception that governments were not necessarily committed in the long-term to supporting the development of renewables, and renewable companies, in the critical early stages of development.

Constraints on Access to Funding for SMEs

The focus of funding policy was widely regarded as directed at larger companies, and utility scale projects. Funding for microgeneration, offgrid applications and small projects by small companies was harder to finance, either from government programmes, or from banks. There were also particular concerns about funding for concept testing and commercialisation of innovations. The interviews provided a very detailed picture of the problems that smaller companies felt needed to be addressed in policies.

> *Of course, we are disadvantaged… government always gives preference to the big companies. If someone here is running a small company with 10 or 20 people the support is zero … Everything that's big automatically receives support. Everything that's small automatically does not get support—this is the basic policy. (SME, Portugal)*

Anyone who wants to use a small scale solution. . .well that is what is missing – the financing of that aspect (SME, Uruguay)

This was amply confirmed in the surveys across most of the clusters—particularly those in the early stages such as Chile and South Africa (See Fig. 11.4).

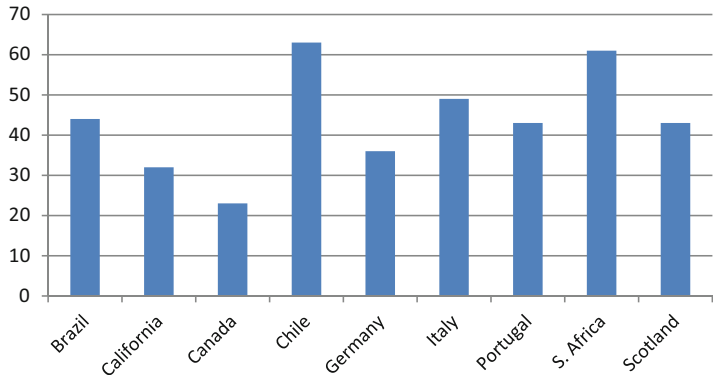

Fig. 11.4 Identified need for better access to funding for small and medium-sized companies

The focus of policy on large projects was a recurring theme, with many asking why more was not done to provide better financing for distributed generation by homeowners, given the size of this market in countries such as Brazil, and South Africa where many communities in vast rural areas are not connected to the Grid.[3] Restricted access to bank loans for SMEs, and lack of financing for home generation was one of the most significant barriers across clusters (See also Fig. 11.9).

SMEs regarded banks as unlikely to consider loans, even where they were in receipt of money from government managed funds ear-marked for this, since smaller companies were regarded as a higher risk, and the market itself was still new and untested.

A lack of knowledge and understanding of the sector was also felt to play a part in this, in addition to the inherent risks of a small company in a new sector, in an uncertain political climate.

[3]Since this study, a number of interesting projects have shown that this sector is coming of age. Pay As You Go (PAYG) financing for distributed generation in homes and rural business in Africa http://www.scientificamerican.com/article/pay-as-you-go-solar-energy/has grown to fill the gap for the many regions that are not connected to the Grid—generating a cluster of related industries for supplying, maintaining and financing this. The Trans Active community energy market http://transactivegrid.net/ now being piloted provides another model for distributed generation by householders, using blockchain technology to manage energy transactions between producers in the community.

This was seen as limiting funding for smaller projects and for research projects, as well as for companies themselves. These quotes from the cluster in Chile give some sense of the experiences we found across the regions.

CHILE	When an SME goes to a bank to ask for financial support for a renewables project. . .. the first thing the bank will do is look at the financial state of this company, and as it is an SME, will probably not want to finance their project. (SME)
	The fact is there is no governmental (financial) support is a real barrier because in Chile there are certain laws to foster the use of alternative forms of renewable energy, but they are not directed at the small user. They are directed at the big electricity generating companies. And the truth is that the ordinary user who wants to install a system like this to help or in a house in the country or in a house in a rural area—the fact is that it is very difficult because of the high initial cost this involves. And small and medium-sized companies like ours don't have the capacity to finance. (SMEl)
	We are presently developing a solar exchanger which definitely is going to be a bit difficult again . . . That is heavy going and difficult for small companies in any case, but above all in terms of coping financially. (SME)
	The great driver for renewable energy here in Chile is the SMEs. . .who occupy a niche in the electricity market to develop their business. And for that reason, it is just there where the government and the authorities must be very careful that the regulations they create there develop and support the SMEs to do this (Renewables Association)

Many felt that funding did not always target the real needs of the business community, and particularly for the small business community in key areas of innovation, such as concept testing, development and marketing of innovations. This is discussed in greater detail in Chap. 10, in the context of barriers at the interface with Universities (See Fig. 11.9). Respondents wanted more financial support for:

- research and development with universities, and especially in key areas such as concept testing; commercialisation of innovations, particularly in Germany, Scotland and Chile
- small scale solutions for householders and small businesses (including financing packages for householders in PV)
- off grid solutions (especially in countries such as Brazil[4] where the market for this was under-exploited)

This is also evident in the responses when asked which policies would make a difference to companies. (See Fig. 11.10). In terms of funding, it is interesting to see the variation in preferred incentivisation mechanisms across the clusters, reflecting a range of economic approaches with both political and historical roots.

Perceptions of Incentivisation

Views of incentives varied across clusters. While SMEs generally felt that they were necessary to develop the market, there was also a perception that incentives were a disruption of the dynamics of the free market. On the other hand, there was

[4]In Brazil, for example, where there are large areas of the country with no access to the grid, half of all survey respondents felt the market for off-grid solutions was being insufficiently supported by government in financial terms.

the perception that the historical and ongoing subsidies to oil and gas producers, and the lack of penalties for health and environmental costs had already made this a very uneven playing field.

While most small company managers felt there should be incentives,[5] the nature of these direct and indirect[6] incentives varied, often reflecting established practice and the regional business culture and history, as well as the strength of different lobbies. Figure 11.5 highlights this variation across clusters.

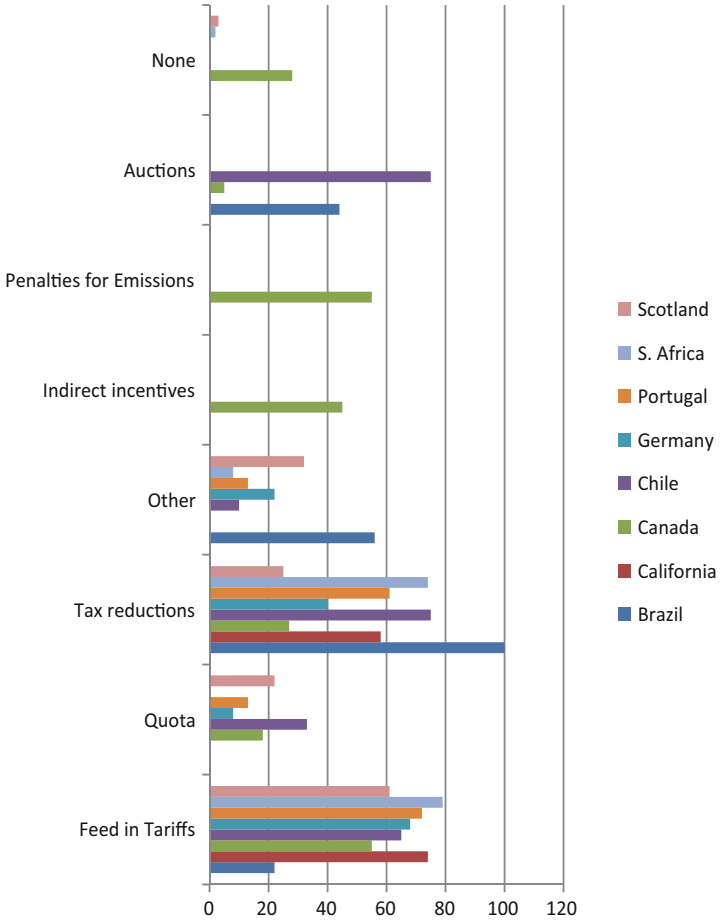

Fig. 11.5 Incentives seen as most appropriate across different clusters

[5]Even in regions such as Canada which was opposed to the use of direct incentives.

[6]This included things such as priority access to funding for research and innovation such that surviving companies were 'match fit'.

Canada contrasted with most other clusters. Slightly more than half felt there should be penalties for emissions by fossil fuel producers as an alternative approach to evening out the playing field. It is also interesting that around half of Canadian respondents also registered a preference for FiTs (See also Fig. 11.6).

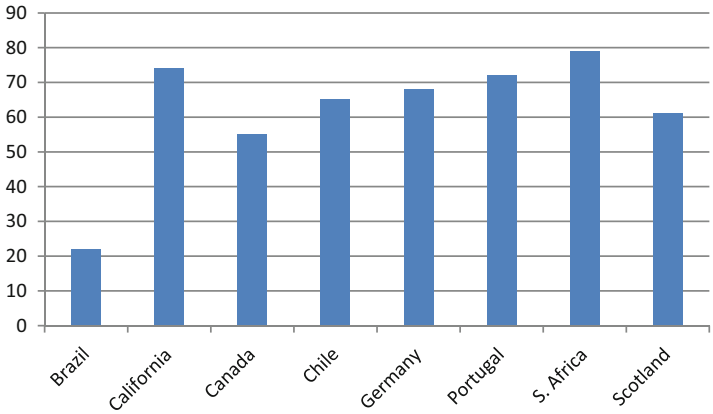

Fig. 11.6 Preference for Feed-in Tariffs

We know from the interviews that smaller companies felt that without FiTs at the outset, competition was not sustainable. Canada was also more active than many in providing indirect support for renewables companies through easier access to research funding, and in piloting strategic alignments between research active renewables SMEs and larger oil and gas companies seeking to diversify.

The role of lobbyism from fossil fuel producers was clearly seen by those in the renewables sector as distorting the fairness of the market, particularly in countries like Canada with a large oil and gas lobby, and the huge potential for exploitation of the tar sands.

Which Incentives?

The most frequently cited incentives were very predictable—Feed-in Tariffs (FiTs) and tax reductions. Latin American countries were also very comfortable with an established and successful legacy of quotas and energy specific auctions which was more prevalent there, and had been effectively used to support hydropower and biomass into the energy market. The most striking outlier here is Canada, where many respondents clearly felt that indirect incentives, such as access to research funding were the best means of rebalancing the playing field.

Across clusters, it is worth noting that tax reductions for SMEs were also seen as necessary, given the perception SMEs were disproportionately burdened by taxes and other financial risks they were poorly equipped to deal with.[7]

Those in the Brazilian cluster stood out as preferring tax reductions rather than FiTs. Different configurations were clearly being explored in this arena, reflecting cultural, historical and business models (See Fig. 11.7)

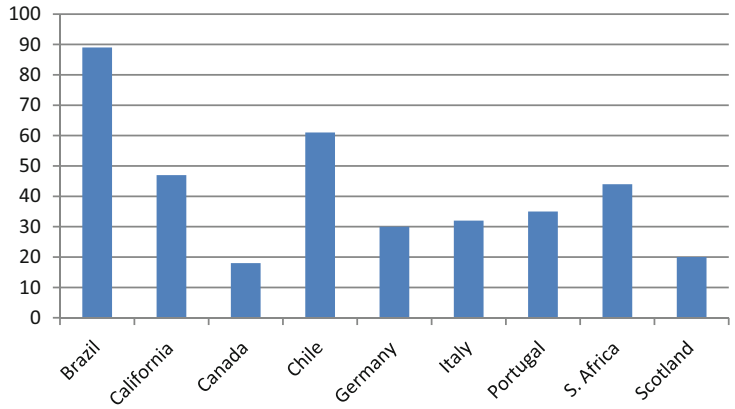

Fig. 11.7 Preference for tax reductions

Even without incentives, there were a number of strategies which could shield SMEs from some of the financial constraints, and could bolster long term confidence in the future of renewables in the market. Tax credits to support innovation (Atkinson 2007) help smaller companies survive, and develop competitive assets for example. Sector specific auctions such as those in Brazil, ensured that renewables were seen as a long term integrated part of the energy matrix. Encouraging collaborative projects by fossil fuel producers, together with research-active renewables companies was another strategy being piloted. Some of these approaches helped offset the risk to SMEs in contexts with limited incentives, and provided confidence in the long term commitment of government to renewables

[7]In the US, innovation economists such as Robert Atkinson provide useful background on some of the economic arguments for reducing the financial disincentives to innovation, and the potential benefits of a long term policy to increase in the Research and Experimentation Tax Credit—to ensure for example, that the US remained an attractive venue for innovation and the employment it creates (See Atkinson 2007).

Unequal Access to Subsidies Across the Energy Sector: The Role of Lobbies

A key concern was the wish by companies for a more even playing field in relation to subsidies for the energy sector as a whole, and anger in some cases at the subsidies (direct and indirect) offered to traditional energy providers in oil and gas, coal and nuclear.

Lobbyism was seen as shaping policy around the needs of oil and gas companies more effectively than those of emerging renewables companies.

> *Well the biggest barrier in Alberta is the fact that the provincial government subsidizes the fossil fuels industry but they don't do the same, or offer similar support for renewables. In fact there is no support for renewables at all. There's no government incentives, no tax incentives, there's nothing. So the biggest barrier is the fact that it's not a level playing field. (SME; Canada)*

What is very clear from the interviews and the survey is the extent to which renewables companies felt that incentives and subsidies for fossil fuel companies unfairly disadvantaged them, with particular concerns that the negative externalities such as costs to health and the environment were not taken account of. Ironically, for policymakers in some regions, avoiding incentives was equated with providing an even playing field where free market forces would drive the market most efficiently.

> *This region [Alberta] just doesn't provide any direct incentive and so it's a level playing field. (EconDev.Assoc.ChCommerce)*

Small and medium-sized companies felt the costings were inequitable because of the way costs were calculated. They pointed out that the cost of pollution from oil, gas and coal companies was not reflected in the price, as well as a lack of quantification of the economic and social benefits in terms of employment and health or environmental costs from pollution.[8] This was added to the fact that oil and gas infrastructure was already installed, while wind and solar had to cost in the infrastructure for a new industry. (See the Canadian case in Chap. 8, and also Sect. 11.4).

The challenge of competing with other energy sources on cost was, not surprisingly, one of the top barriers for all the clusters, particularly in regions where there was no Feed in Tariff for renewables, quota systems or tax breaks.

Which Policies Were Seen as Effective? Which Were Seen as Missing?

Before looking at the processes of policy making and implementation, it may be interesting for the reader to see which actual policies respondents felt:

(a) had been effective in helping develop the sector in the past (Fig. 11.8)

[8]There is also increasing evidence of the potential for employment generated by 'green' innovation in particular Gagliardi et al. (2016).

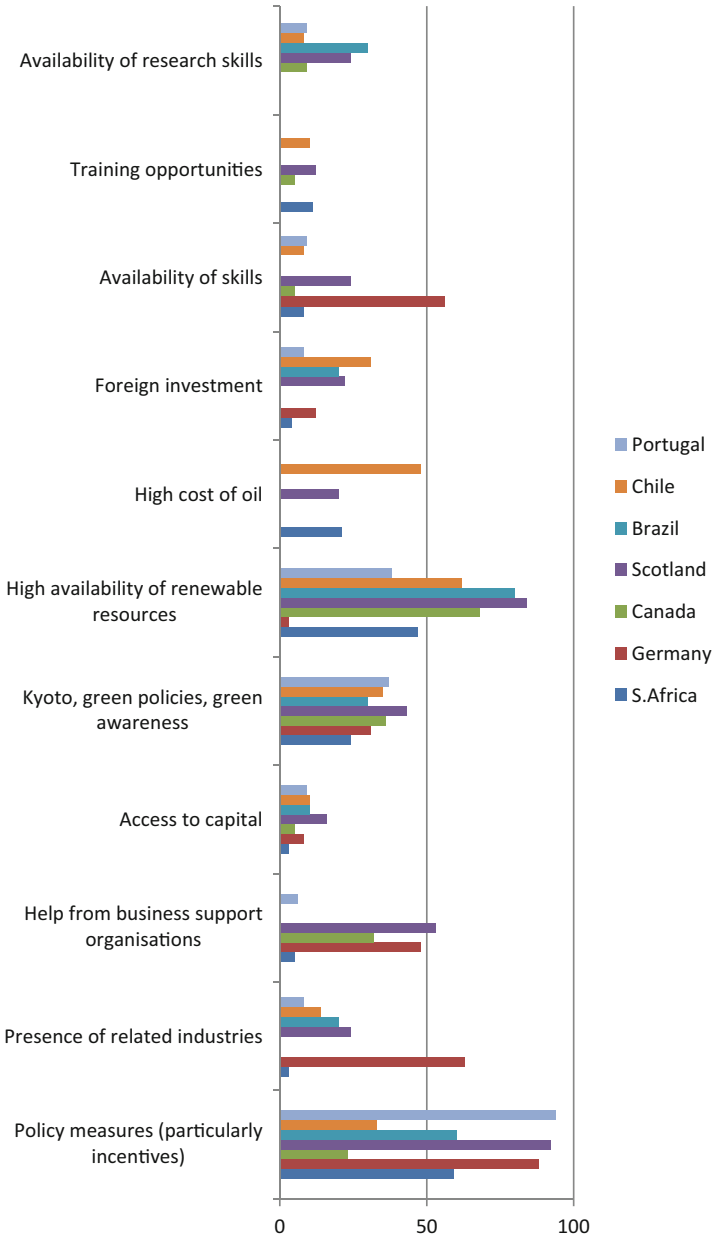

Fig. 11.8 What policies have made a difference in the development of the sector? (This is a subset of the most highly-cited and cross-cutting issues. The many issues only identified in one cluster have been excluded to avoid an over complex chart.) This question was not available in a comparable format from the early surveys for Spain, Italy and Uruguay

(b) would be helpful for the sector in future (Fig. 11.9)

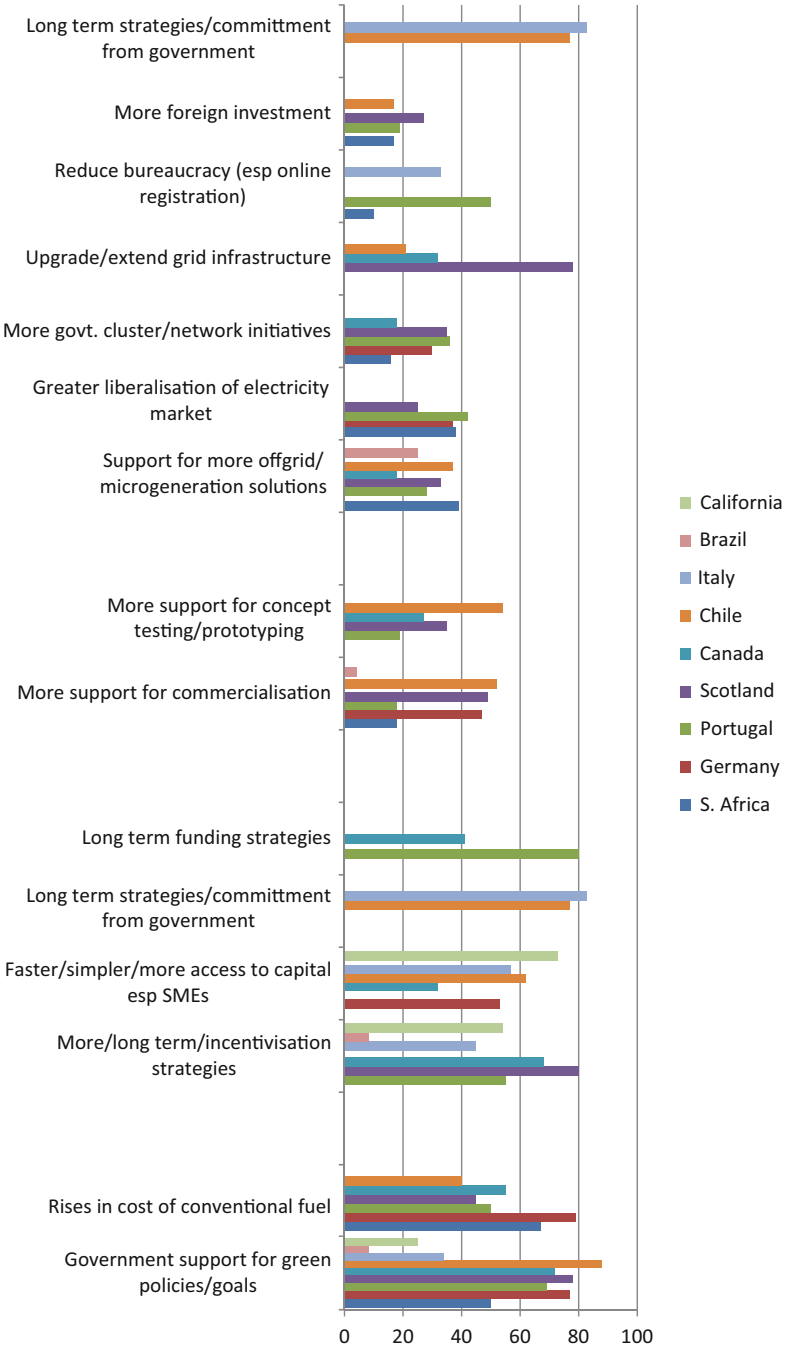

Fig. 11.9 What policies would make a difference to the sector now?

(c) would be helpful for their companies in future (Fig. 11.10)

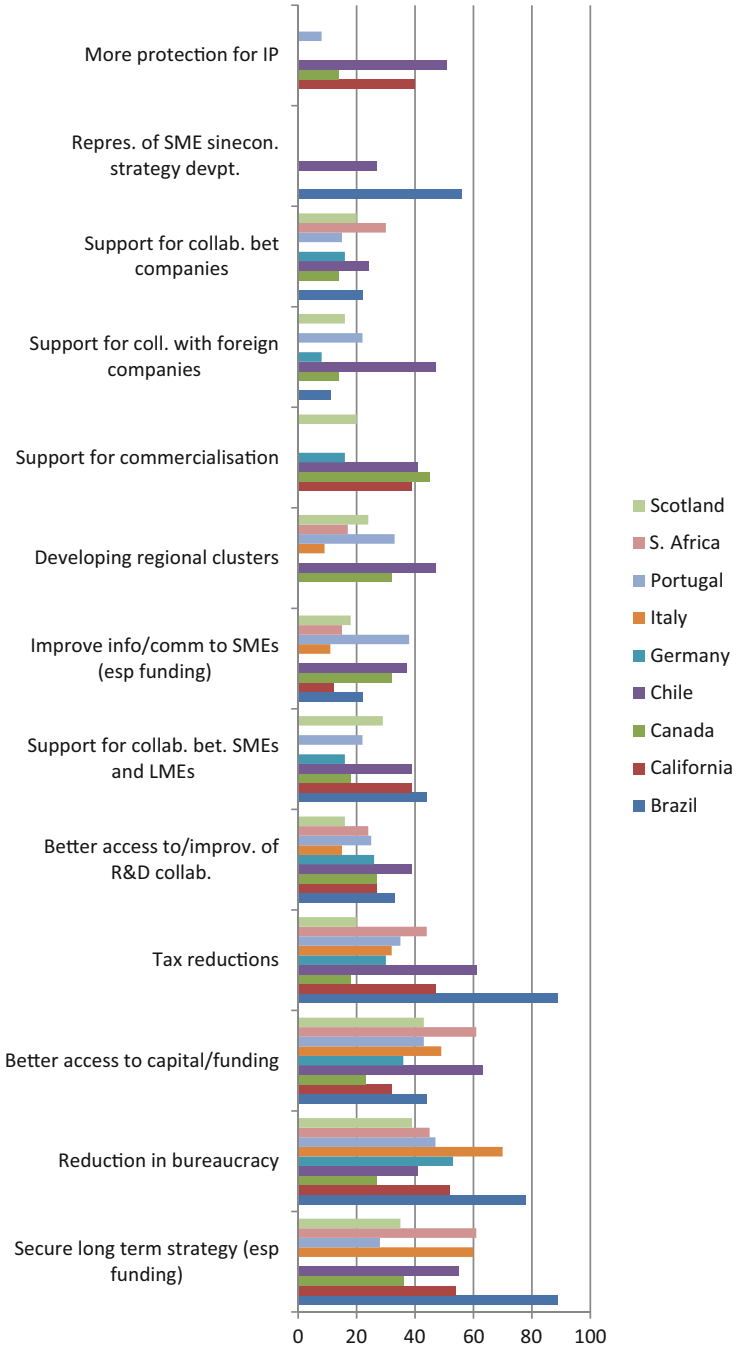

Fig. 11.10 What policies would make a difference to your company?

Note that the issues in the surveys were typically derived from the analysis of the interviews, and were offered as options in the survey, where respondents could tick as many boxes as they chose.

Figure 11.9 shows what the cross-cutting policy requirements for the sector were now perceived to be, and is altogether more interesting. While there are many correspondences between Figs. 11.8 and 11.9, (such as commitment to green policies, and the provision of financial incentives), the policies regarded as crucial for companies were much more closely tied to the operational barriers they faced on the ground, which were less visible to policymakers, and which are discussed in this chapter.

Figure 11.10 shows what policies would make a difference to the companies themselves, is much more interesting. Issues such as reduction of bureaucracy, for example, is hardly mentioned in the list of policies relevant to the sector (Fig. 11.9), however in Fig. 11.10, in relation to the needs of companies, it is as important as funding! Why is this important? It highlights the need for policies that take separate account of the specific and emerging needs of companies on the ground, and small and medium-sized companies in particular, if a cluster is to be successful. Reliance on policies that support the sector, and/or on policies that have been effective in the past may miss significant issues that are undermining the ability of companies in the cluster to survive. For policy to reflect these emerging needs and concerns on the ground there must be a process in place to capture and communicate this in a timely and representative way. From the perspective of the overwhelming majority of small and medium-sized companies—the back bone of clusters—this was not the case.

11.3 Barriers Related to Implementation

This section looks at the many barriers which arose in relation to the actual implementation of policy on the ground (See Fig. 11.11).

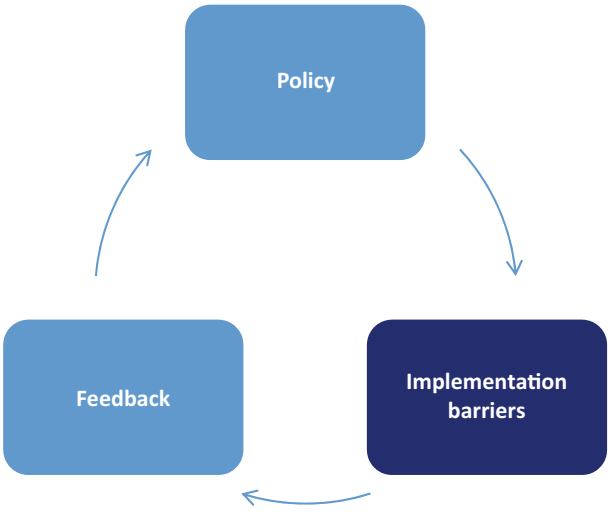

Fig. 11.11 Implementation

As policy is translated into strategy and ultimately processes—many of them administrative, it can also have unanticipated effects. It creates an operating landscape that can allow very different patterns of interaction, and may provide advantages for some players at the expense of others.

The most recent research on policy development highlights the importance of recognising this process, and using feedback and evaluation to optimise this process of transformation to better achieve the intended outcomes. Sometimes this is a process of managed exploration that leverages effective approaches to achieving a particular end—making it easier for the right things to happen than the wrong ones. The UK Policy Profession Board (2013) highlighted this in a report for UK civil servants as part of a move to improve policymaking and implementation.

> *The real world effects policies produce are often complex and unpredictable. In other words, the goals and nature of a policy are often adapted as it is realised in practice. A policy is not just made and then executed; it is made and constantly remade by multiple players throughout the system.*[9] *UK Policy Profession Board (2013)*

The feedback from interviews and surveys highlights this complexity—from the cost and delays occasioned by bureaucratic procedures, or in the late implementation of key legislation, through to the misappropriation of digital networks for managing transactions. Yet there were few effective mechanisms for generating a response to visible issues with the implementation of policy despite the impact on outcomes.

Bureaucratic Administrative Processes: A Barrier to Companies and Clusters

The processes and procedures for the installation of renewable technology are multiple and complex. The speed and ease with which this process can be initiated and completed impacts directly on the ability of companies to complete projects quickly and effectively. This impacts on the economic performance of companies, and of the cluster as a whole. Companies in a cluster can evidently be constrained or advantaged by a range of different legislative, regulatory, administrative, political, organisational and geographical constraints that shape the landscape in which they operate (Garbe et al. 2012).

Bureaucracy was one critical constraint in this (See Figs. 11.10 and 11.12).

[9]They recommended an approach termed system stewardship' (Hallsworth 2011a, b) which consists of four aspects: goals, rules, feedback and response described by the Director General of one global organisation as a matter of "setting and enforcing the rules of the game and providing strategic direction for all the different actors involved".

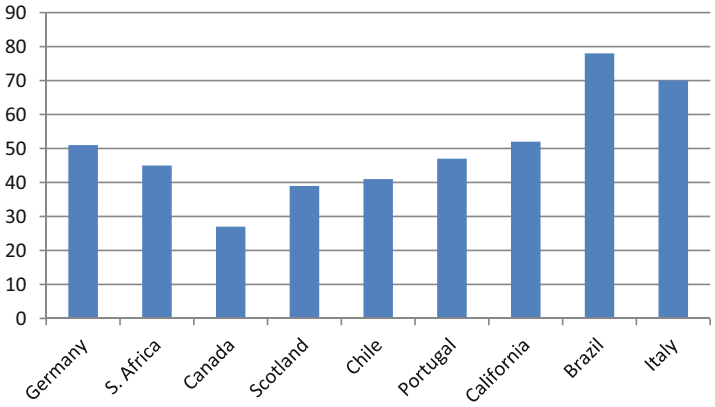

Fig. 11.12 Reducing bureaucracy was seen as one of the changes respondents thought would make a difference

In Brazil, this was particularly high on the wish lists for change. The bureaucracy associated with applications for grants and loans is one that was also both striking, and very consistently raised as a barrier, not only because of the time and resource required, but also because many felt the programmes were not designed with the needs and capacities of SMEs in mind at the strategic level, nor in the design of the application form and process itself.

The administrative bureaucracy and delays associated with registering applications and obtaining permits or funding was one of the most significant cross-cutting barriers across clusters[10] together with the many other procedures involved in assembling modules and installing them. A company assembling and installing a solar module needs to interact efficiently with a wide range of other players (See Fig. 11.13).

[10]The European Union PV Legal project subsequently highlighted these issues (obtaining permits and licences such as grid connection procedures, power purchase agreements) flagging the need for reform to ensure that supply and demand are not artificially hampered by the very systems set up to facilitate them. The project is Available on: http://www.pvlegal.eu/results/status-reports.html Accessed 28 Dec 2015.

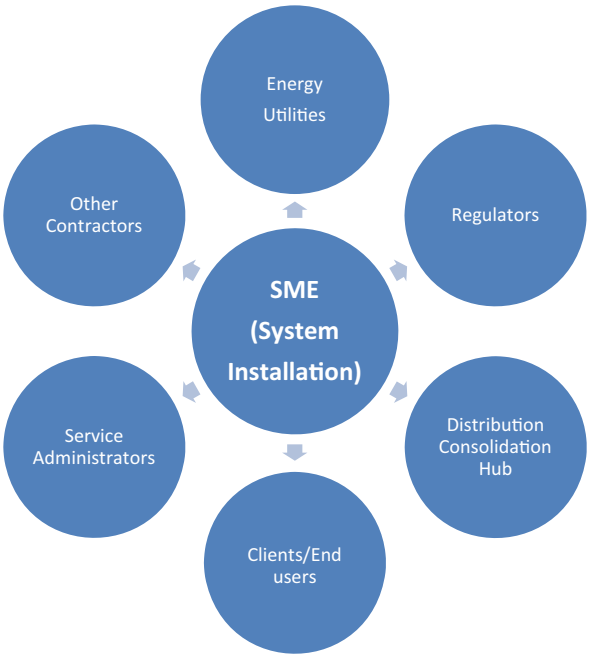

Fig. 11.13 Simplified overview of the range of interactions SMEs need to manage to complete installations

Unlike barriers such as lack of funding, bureaucracy was often created by default, rather than by design, and remained due to the lack of central feedback and coordination of the cluster. Asked in a later question what would make a difference to their organisation, the reduction of bureaucracy was one of the key themes of concern. Bureaucratic procedures disproportionately impacted on SMEs who were most involved in system installations in the downstream supply chain with many crucial interfaces (See also the Portuguese case).

SMEs with tight margins were unable to wait out delays in the implementation of projects, and unwilling to take risks with new projects. In discouraging engagement with the sector, such barriers acted as a brake on the development of the cluster, the sector and the benefits for the region. Italy and Brazil were regions where this was seen as a particular source of problems, although it ranked highly across the board. The time and resource required to go through the administrative processes associated with setting up a project, getting permits and agreeing arrangements or even applying for funding was clearly a significant barrier for most respondents.

ITALY	(The need for) simplifying the authorization procedure, accelerating the mechanism of the procedure to licence and install, is one of the principal barriers to SME innovation. (SME)
PORTUGAL	We always have problems of an administrative and bureaucratic nature because the process of licensing and authorization are always lengthy. (government)
CALIFORNIA	It is an enormous bureaucracy to find government money for your start-up. It is a bureaucratic approval process rather than a market mechanism. Just to get funding is so expensive the legal paperwork in the US is much bigger than anywhere else. For grants they want you to have the right format and you have to do all this budgeting and I do not have the resource to do this. (SME?) The public policy landscape in California alone is very fragmented . . . contributes to delays and confusion in what is available in terms of state government support. (SME)
SPAIN	Because, you know, to sell you have to ask for a connection point. . . . you have to go to the 'ayuntamiento' (town hall) to make your licence for the construction. You have to go to Industria (Ministry of Industry) to check your project, they have to say your project is okay. You have to go to electricity-companies and you have to say: Okay, I'm going to build this over here and I'm going to produce energy and I need to transmit it, to sell it. And then you have to wait for them to say: "Okay, here is your connection point." Too much paper work (SME)

The administrative infrastructure created barriers to project development and innovation rather than supporting it, in the eyes of many, and was in dire need of streamlining and simplification.

While SMEs in all clusters spoke of bureaucracy in relation to authorisation, licensing and funding, the impact was highest in early stage clusters. These were often in rural regeneration areas with little existing business infrastructure. Oversight of this aspect is well within the ambit of regional government and cluster managers, and would generate benefits for the region as a whole if the process for local SMEs was expedited as it now has been in some mature clusters such as Germany.

It is worth noting here also, that the 'friction' experienced by companies on the ground was not restricted to the bureaucratic nature of essential processes, but was also contributed to by the lack of interoperability between standards and regulations for interconnection, for building codes and for Power Purchase Agreements, which made life harder further down the line. The fragmentation of different processes across agencies and Ministries contributed to this. Lack of joined up standards on the ground reflected the lack of integration of policies as well.

Sometimes however, the complexity and lack of transparency in administrative processes masked inequalities in the access and the advantages afforded to some players over others. Bureaucratic complexity can mask unfair competition. This was most evident in emerging clusters, as the earlier cases showed, and it is interesting to see how this has changed as they evolved. Some have now introduced legislation to ensure independent regulation of many of these processes, to minimise competing interests, manage transparency and even out the playing field, such that market forces can have something more like free play, encouraging sector growth, greater competition and greater market efficiency.

Online Administrative Processes that Can Reinforce Inequalities

The Portuguese case provides one of the most interesting examples, in that the IT platform (through which companies accessed permits and certificates to complete sales and start installation of micro generation systems), gave only restricted access to small regional companies.

> *There is a procedure at the beginning of the (Online registration) process here that benefits some and prejudices others. If all companies had equal access, there would be competition based on technologies and sales and not on a question of who has the best access. (SME, Portugal)*

In addition to introducing delays for SMEs, it was widely perceived as allowing players affiliated to the company managing the platform the opportunity to have greater access to the same pool of customers. The way in which the implementation of new social, organisational (or digital) systems can embody, reinforce or change the opportunities for different actors has long been a focus of interest for social scientists, and one that underlines the need for the feedback and engagement of actors on the ground if these are to have the desired effects.

ICT-based services in particular both embody and even extend the opportunities for different players to create value for themselves, sometimes at the expense of others, and particularly when they are complex and bureaucratic, as seen in the Portuguese case. This has been a feature of research in different sectors as services migrate online, with eHealth and eBusiness services being a prime example (Dourish 2001; Callon 2003; Ure and Jaegersberg 2005, 2011; Ure et al. 2009).

The complexity and the selective delays in this system was seen as providing advantages for some players at the expense of others, and blocking the free flow of market forces. As with many of the cases, the landscape created on the ground often generated value for some actors at the expense of others, rather than generating value for the cluster.

Commercial companies are aware of the value of making access to their administrative services to customers as painless, quick and equitable as possible, if they are to survive competition in the market. The administrative services provided by government, and public utilities, generally speaking, have no competition, and few incentives to change.

Gaps and Delays

Clearly, legislative gaps and delays of the kind described were a significant barrier to cluster performance, as well as to the companies operating in them. They were of most concern in very early stage clusters where the legislation still had critical gaps, as in South Africa. Here the concern was less that policy and infrastructure was joined up, but more that it was there at all. In others, such as Chile, this reflected the difficulty of implementing immature policy, and at times, the lack of policy in related areas such as transport or business infrastructure that was also needed in some of the areas where renewable projects were being developed.

S. AFRICA	What is still missing is a regulation for IPP.[11] As yet, nobody has received an IPP . . . there are many, many expressions of interest nearly in the range of GW by companies who've already registered with NERSA and declared that they would like to become active. As I say, however, there is no procurement procedure yet. What's most important—it has not been clarified yet with whom the Power Purchase Agreement will be made. Who will be the buyer, and refinancing, and, and, and . . .? (SME) Certain standards (for construction) are not yet established -what the prices are—how to pay or even that people don't want to permit use of their land for wind turbines (SME)
CHILE	In Chile there is actually legislation regarding an obligation to include a certain percentage of renewable energy, but we find that this legislation is very immature, and there are many problems implementing it. (EconDev.Assoc.ChCommerce).

This is doubly difficult where the cluster has been set up as a focus for development in rural areas which lack these facilities. The initiation of large wind farm and solar projects at scale in the North of Chile threw into relief the importance of transport and other infrastructure in supporting or hindering projects. As one manager put it "you're not just building a wind park!" These difficulties were compounded because of the fragmentation of policies across Ministries.[12]

11.4 Barriers Related to Feedback

An Uneven Playing Field for SMEs in Cluster Policy Development

> *Policy, specifically grants, suck for small companies because we don't have lobbyists, which is the chief and often only way to get attention at the US federal level Survey respondent, California*

A pervasive theme in the interviews on policy is the extent to which SMEs felt that policy took less account of the feedback from SMEs. It often did not reflect their needs, in key areas such as innovation and microgeneration projects in particular. This section looks at this strand of the data (Fig. 11.14).

[11]Independent Power Purchase agreement requiring the energy distributor to buy the energy produced.

[12]A similar problem we met in the automotive sector in Brazil where a high tech modular consortium with just-in-sequence production (JIS) was set up in an underdeveloped agricultural area in the North East with poor transport infrastructure (with second-tier suppliers 2000 km away) and inadequately skilled labour force (Jaegersberg and Ure 2005; Jaegersberg et al. 2002).

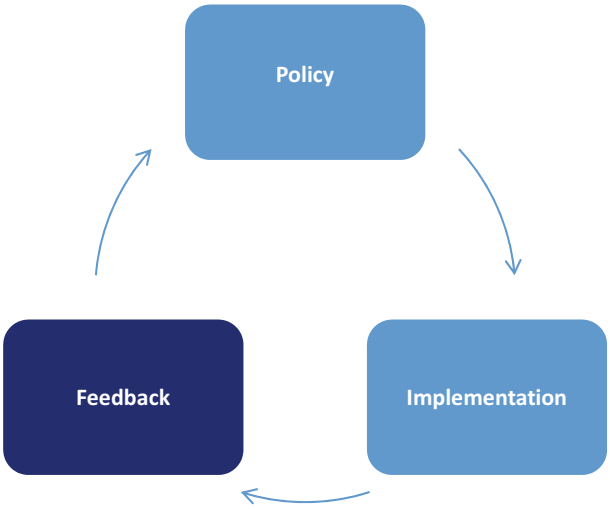

Fig. 11.14 The policy feedback loop

The impact of this on a cluster can be very significant given that SMEs play a central role in innovation, and act as a reservoir of niche knowledge and skills, as well as being the vehicle for many of the intended benefits for the region, such as employment. Policies which fail to take account of the needs of the knowledge of the players who make up most of the cluster fail to leverage an important resource, and risk loss of both the capacity for competitive innovation, and the capacity to create value for the region.

The cost of the very unequal distribution of opportunities for communication, coordination and co-production with policymakers has also been evident in other clusters, as for example in the oil and gas cluster discussed in Chap. 3, where it had a very negative impact on the survival of smaller companies, and the potential of the cluster to innovate, or to generate employment for the region, until this was addressed (Ure et al. 2007; Jaegersberg et al. 2007).

PORTUGAL	Of course, we are disadvantaged . . . government always gives preference to the big companies. If someone here is running a small company with 10 or 20 people the support is zero. Everything that's big automatically receives support. Everything that's small automatically does not get support—this is the basic policy. (Interview B/11, SME) They (policymakers) are not very interested in our arguments . . . with government organisations the experience has been negative, in the sense of difficult, very difficult. There is a lack of dialogue in areas of mutual interest [between SMEs and policymakers] to speak about what people think. (Interview A/6, SME)
CALIFORNIA	Policymakers are not interested to talk to small companies. They just talk to companies which have deep pockets and they want to have some donations before they do any decision. (Interview 3, SME)

(continued)

SCOTLAND	It would be better to have the ability to interact with different people making decisions. It seems there are barriers. It would be better for the project to do this change a lot of times. It is hard to communicate that to that person who makes that decision, you know, in the planning process. It seems that there might be communication barriers. (Interview 5)
S. AFRICA	What is further needed is greatly improved and intensified coordination between all relevant government departments as well as the private sector (including NGOs, business and knowledgeable individuals. Municipalities should stop to block initiatives where they will earn less on selling electricity ... Actual projects which see collaboration between smaller companies and universities would help. With policymakers—I am not sure. There seems to be a disconnect. And we lack decision makers. Policymakers need to be more on the ground. (Survey respondent)

Given the importance of SMEs as vehicles for cluster innovation, and for regional employment this would seem to be an area where more concerted effort to engage this group in the development and effective implementation of policy could pay dividends, as it did in the oil and gas sector, where SMEs were also particularly vulnerable to short-term changes in policy on funding and incentives.

Lack of Access and Influence

The lack of regular and meaningful communication and engagement with businesses on the ground was viewed by many of them as a critical element of this, since their needs were seen as not being communicated, and thus not addressed. The lack of a more formal role for SMEs in decision making processes, combined with the impact of inherited networks of communication and influence between policymakers and established players, meant that the needs and concerns of smaller businesses were less likely to be taken account of.

Research on other collaborative contexts, involving multiple stakeholders, have highlighted the importance of how users of these systems shape it (or even appropriate it) in the course of their activities. One of the lessons from other sectors is the potential risk of developing policy without regular and representative feedback from those on the ground about emerging needs, as well as barriers, risks and potential opportunities (Ure, 2011). This was evident in the early oil and gas clusters we looked at in Chap. 3, as well as those described here, where the different opportunities afforded to stakeholders in shaping policy impacted on the ability of the cluster to innovate in particular.[13]

A range of mechanisms could be instituted to give SMEs a stronger voice in shaping policy at the start of the cycle, given their very specific needs, and the

[13]This is an area well documented in the social sciences where the so-called 'social shaping of technology', (Williams and Edge 1996) in larger and more distributed digital infrastructures (health, business and finance in particular) has become harder to ignore as a factor in economic performance.

importance of their role in achieving cluster goals such as innovation. SME representation at an executive decision-making forum has been instituted very successfully by the PILOT project[14] in the UK oil and gas cluster, to enhance competitive innovation, and ensure regional benefits. EBusiness and eHealth organisations already adopt more user-led or user-centric models of service development to better leverage what users know and can do, as a resource in attempts to cut costs and add value in increasingly competitive conditions (Ure et al. 2009; Tapscott and Williams 2006; Bate and Robert 2006).

Service users, including users of policy, are increasingly becoming integral to the design, improvement and innovation process, in ways they were less integrated before globalisation, when needs were more predictable, change was slower, and competition less fierce. The economic argument for involving users in coproduction is increasingly evident.

Universities could also be incentivised to engage with staff and student interns in more collaborative and practice-based research with companies.[15] This reconfiguration of existing resources could inform policy and professional development more quickly and more effectively than is currently the case (See Chap. 10).

An Uneven Playing Field for Renewables in the Energy Sector

Renewable energy companies in the study often indicated they felt that they were disadvantaged in the energy sector as well, in terms of policy in key areas such as subsidy, as compared with larger and more established fossil fuel companies. As the

[14]See Chapter 3.

[15]This has already been very effective in the development of telemedicine programmes in some of Latin America's rural economies (See Fernández and Oviedo 2011) Also in our projects student interns and staff were engaged in collaborative practice-based research with companies.

Jaegersberg and Hatakeyama "Supply Chain Project: Brazilian-German Auto Industry" (1999–2003), funded by Deutscher Akademischer Austauschdienst (DAAD) and Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES).

Jaegersberg and Ure "Trans-regional Supply Chain Research Network : Benchmarking Local and Global Economic Development Strategies Across Regions in the Oil and Gas Supply Chain" (2005–2008) supported by City Council Perth/Australia Curtin University of Technology and companies;

Jaegersberg and Ure "Trans-regional Research Partnerships in Renewable Energy: Creating Value through Knowledge Transfer Within and Across Clusters in Europe and the Americas" (2007–2015), supported by companies and a range of organisations including the Staatsministerium für Wissenschaft und Kunst, DAAD/IAESTE and the European Recovery Program, economic development agencies and Chambers of Commerce on a region by region/case by case basis;

Jaegersberg "Ciência sem Fronteiras" (2012–2016) supported by CAPES, DAAD and companies.

manager of one wind consortium in Uruguay put it - "If you want me to identify the main barrier, it is that there is no policy of any kind of subsidy, ... and the cost of clean energy production has to compete with the cost of traditional energy." In addition to having less of a voice, this was again, in the view of many, a reflection of the capacity of these larger incumbents to lobby, combined with a lack of understanding of the real needs of the sector by politicians.

A raft of reports from respected institutions in 2014 and 2015 give some weight to that perception. The IMF Working Paper (Coady et al. 2015) estimated that fossil fuel companies were benefiting from global subsidies of $5.3tn (£3.4tn) a year, equivalent to $10m a minute every day, according to the IMF's most recent Working Paper. These were complemented by the EU Commission report in 2015 measuring fossil fuel subsidies, and the OECD (2015) inventory of support measures for fossil fuels, Whitley and van de Bergh's (2015) working paper on fossil fuel subsidy reform[16] and the UK Overseas Development Institute[17] (Bast et al. 2015).[18]

The reports all indicated the scope and scale of current subsidy[19] to the fossil fuel sector and contrasted these with the potential benefits of reducing these to reflect the cost to governments of health and environmental damage, and thus provide a level playing field in which renewables are a much more attractive option (Coady et al. 2015).

Put another way, as Whitley and van de Bergh (2015) frame it, "the more it (government) subsidises fossil fuels, the more it has to subsidise renewables if it wants these to compete fairly". While any selection of what counts as a subsidy may be open to question, the scale of the estimated subsidies surprised many. It set the cost of subsidies for renewables in a different context, and raised questions about the representation of different players at the decision-making table at an international level as well, and the long-term commitment of policymakers to developing renewables.

11.5 Implications

The question is not whether government has a role, but what that role should be and how to coordinate policies across parts of government. Many countries have sought to limit the inappropriate roles of government while ignoring its positive roles. Government must set

[16]The report in www.neweconomy.net is for the Global Commission on the Economy and Climate - a major international initiative to examine how countries can achieve economic growth while dealing with the risks posed by climate change).

[17]The Overseas Development Institute (ODI) on https://www.odi.org is the UK's leading independent think tank on international development and humanitarian issues, and collaborated with Oil Change International on the report.

[18]http://www.odi.org/publications/10058-production-subsidies-oil-gas-coal-fossil-fuels-g20-broken-promises

[19]More than the total health spending of all the world's governments.

the right rules and incentives and make the public investments needed for a productive economy. ME Porter 2004[20]

The policy-related barriers perceived by stakeholders suggest that, in addition to taking account of the more traditional economic and political metrics, policymakers also need ongoing communication/feedback processes to identify and take account of needs, barriers and new opportunities on the ground.

Leveraging what stakeholders know is increasingly seen as central to an agile response to emerging challenges and opportunities. It is however not a new concept. Not only is it central to new models of product and service development in other sectors, it made up the essence of the democratic model in the public sector where feedback from the community served to lever macro-economic value to competitive advantage of the state, as pointed out by one well-known Harvard scholar (Ober 2008).

How should a democratic community make public policy? . . . A time travelling Athenian democrat would condemn contemporary American practice, on the grounds that it willfully ignores popular sources of useful knowledge. Ober J 2008

The policy development cycle requires more and more equitable feedback from stakeholders on the ground to meet the needs of those businesses which should thrive, innovate and become more productive within the cluster.[21]

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[21]The move from cost-based strategy to innovation-based strategy in the oil and gas sector highlighted the risks inherent in failing to provide an even playing field for the SMEs that hold the niche knowledge to achieve this.

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Chapter 12
Communication and Collaboration Barriers

Abstract In a cluster, where value is traditionally intended to accrue from the exchange and the strategic alignment of knowledge, skills and information between players (so-called positive externalities), the nature of the information and communication infrastructure would seem to be crucial. Yet despite investment in putting the pieces in place, there was often little evidence of any coherent strategy for connecting them up, either to support knowledge transfer, or collaboration in the creation of shared value. The chapter looks at key interfaces between players, and shows how the barriers to communication, collaboration and coproduction impacted on the competitiveness of companies and the cluster, and points to the lessons from other clusters and other sectors if clusters are to generate the benefits promised in the cluster rhetoric.

12.1 Lack of Communication/Collaboration at Key Interfaces

Communication and collaboration infrastructure is critical to the leverage of distributed knowledge, skills, and resources in clusters, and increasingly recognised as a key driver of value creation in successful clusters (Morosini 2004; Sölvell and Williams 2013). But were companies benefiting from the opportunities for knowledge transfer and value creation in the clusters we looked at? The study helped clarify the experience of SMEs at the key interfaces where one might expect knowledge transfer or value creation. (Fig. 12.1).

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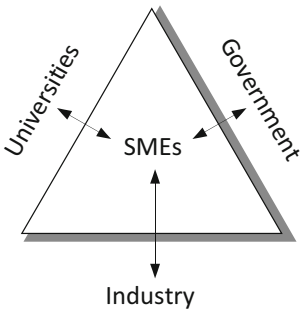

Fig. 12.1 Communication and collaboration at key interfaces where value can be created

In reality barriers to meaningful and reciprocal exchange between players were seen as one of the most cross-cutting and damaging barriers—particularly in relation to communication with policymakers (meaning policy did not meet real needs on the ground), and with Universities, (where there were barriers to research, innovation and professional development).

Given the cluster vision of strategic engagement by stakeholders to harness shared knowledge, skills and resources, it is surprising that the communication network intended to support this had so often developed by default rather than by design, reinforcing the existing connections between larger and more established players rather than the smaller companies who are the backbone of niche knowledge and innovation in the cluster (Fig. 12.2).

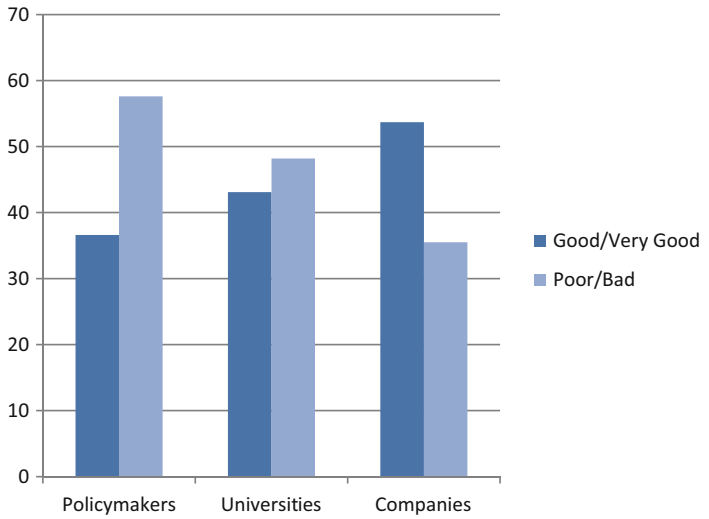

Fig. 12.2 Communication between companies and (**a**) government, (**b**) Universities (**c**) other companies

The feedback in all the clusters suggested strongly that meaningful communication and collaboration was not happening to any great extent, that there was little

in the way of coordinated planning to make this happen. Those most critical of the lack of opportunities were SMEs, who were most directly impacted by the lack of opportunities and influence in shaping cluster policies.

The lack of influence on policy was a main concern, given that many felt their needs were not being (or likely to be) met.

The issues were about both having the opportunity to communicate concerns, and having the influence to have them taken account of in the decision-making process. While Associations were valued, they were not seen as having the kind of influence that other lobbies had.

PORTUGAL	They (policymakers) are not very interested in our arguments . . . with government organisations the experience has been negative, in the sense of difficult, very difficult. There is a lack of dialogue in areas of mutual interest [between SMEs and policymakers] to speak about what people think. (Interview A/6, SME) We don't have any influence on political processes. (Interview A/10, SME) Government doesn't really listen to associations . . . from the point of view of government, a suggestion of an association never is an acceptable suggestion. (Interview B/14, SME)
CANADA	We're not big enough to be a player that could influence the government at all. . . . Unfortunately, all those associations are national associations . . . they're all centred in ON (Ontario) or QB (Quebec). So they don't seem to understand our problems in Alberta as an association, so we get like zero support from them to try to influence government in Alberta. Sorry to be so negative, it's just the reality. It's a really uphill slug in Alberta. (Interview B/18, SME)
S. AFRICA	Well, if certain White Papers with certain objectives are written, and the industries are not asked for their opinion with regard to their realisation—Otherwise there would not be such objectives like the installation of 1 million units by 2013. Obviously, the industry could have told them earlier that is not realistic. (Interview 5, SME)
GERMANY	These very fast changes and especially the latest amendment that have been discussed among politicians . . . The way politics work there has been very little opportunity for influence from the sector possible and very little consideration of economic policy. (Interview 4, large company) What can one expect from politics? . . . The big electricity providers . . . regard us as disrupting their business, and the nuclear energy lobby has been able to make their case and is doing that again. . . . That's a well-rehearsed argument, and we've got to make our case against it ourselves. (Interview 8, cutting edge collaborative of players) There you speak to a brick wall. And it is clearly a certain brown coal lobby that is behind it. (Interview 11, SME)

The infrastructure in place (both real and digital) often presented individual actors with opportunities and incentives to create value for themselves at the expense of the cluster, as we saw in the Portuguese case, and others, such as this one in Spain.

> *The main problem is that the electric companies who authorize you to connect your installation to the national net are private companies. Company X, Company Y—all of them have their own engineering companies—who are focused—their main businesses are focused also on installation. ... So they are our main competitors and they are doing their*

own business. So they keep the information of the net for themselves. . . . So I think it's not fair. The electric company must be a public company. And then in that way it was an equal opportunity for everyone. But this way they are private and they are doing also this, not legal competence I think. . . . And you have to pass through their barrier to get your installation running. (Spain, large company)

We looked at communication with Universities, with other companies, and with government or government sponsored agencies in the interviews, and in the surveys that built on them. One of the strongest cross-cutting themes was the lack of effective communication with policymakers, and its consequences for actors on the ground, operating in unnecessarily difficult environments. What is also striking is the extent to which many of the government sponsored agencies we talked to felt that there were in fact adequate lines of communication. If industrial clusters are "social communities specialising in efficient knowledge creation and transfer" (Morosini 2004), it seems that this process requires more than simple co-location. The soft infrastructure for inter-actor collaboration is also important -especially in regions without pre-existing business networks.

12.2 Interface with Policymakers

The research suggests that communication and collaboration at this interface is perceived as largely Poor or Bad by SMEs across the clusters, particularly in the early stages where there are fewer players, limited opportunities for communication and coordination between players, and a lack of experience in managing the process of cluster development. Not only does this create significant gaps that prevent the kind of brokerage of capital that Burt (1992) and Granovetter (2005) refer to,[1] it creates an uneven playing field in many respects.

Looking across clusters[2] communication between SMEs and Policymakers was rated largely Poor or Bad. With Universities it was more evenly split, while communication with other companies was generally Good or Very Good. The importance of this theme became apparent in the course of the different case studies, after the very early Italian cluster interviews, so data is not available for Italy here.

Interestingly, government sponsored agencies often greatly underestimated this. The very lack of an effective channel of communication meant that this, like many of the other concerns, were effectively invisible to policymakers in some regions.

Communication between government and industry (in particular SMEs) was perceived as limited both in terms of representation and access, and also in terms of influence. These asymmetric relationships impacted on the nature and effectiveness of the policies adopted, and on the economic outcomes. Stiglitz, speaking of the economics of information in 2001, says that "just as markets strive to overcome

[1] Granovetter in particular provides a coherent overview of this in the context of business networks.

[2] This question was not included in the first cluster study, done in Italy.

asymmetries of information, we need to look for ways by which the scope for asymmetries of information in political processes can be limited and their consequences mitigated."

If the intention of clustering is to leverage networked human and technological capital to regional advantage through knowledge externalities, then most of the renewable energy clusters we looked at do not provide the communication infrastructure for this to happen. One might argue that it actually prevents it from happening.

The lack of communication infrastructure was a particularly strong cross-cutting issue, mainly in relation to policy development. The lack of consultation, representation and influence in the shaping of government policy led to policies and practices that were not always a match to real needs on the ground, and which penalised SMEs disproportionately. This is demonstrated in the ratings of communication with policymakers (Fig. 12.3).

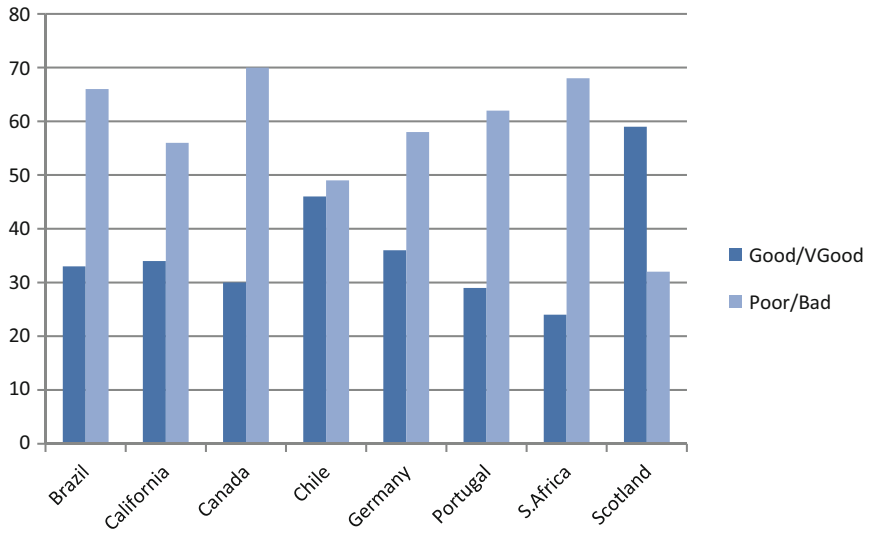

Fig. 12.3 Communication with policymakers was typically rated poor or bad, rather than good/very good

The interview quotes provide a rich seam of evidence as to why this was. In Canada, for example, with the worst ratings for exchange with policymakers, this was seen as reflecting the eclipsing of their voice by large oil and gas companies with influential lobbies.[3] For many, however, this simply reflected the lack of an established and effective mechanism for communication and collaboration with policymakers—for SMEs in particular.

[3]Although interestingly, government organisations we interviewed did not see this as a problem, and felt there was in fact a lot communication and consultation!

CALIFORNIA	Policymakers are not interested to talk to small companies. They just talk to companies which have deep pockets and they want to have some donations before they do any decision. (SME) Policymakers seem to listen a little bit more to the big guys, and utilities of course. Some of the larger players in the solar industry resisted us and didn't want a German style FiT. The big players have rolled into the dominant position in the market so they do not necessarily want to see all these new competitors coming into the market. (SME)
PORTUGAL	Of course, we are disadvantaged . . . government always gives preference to the big companies. If someone here is running a small company with 10 or 20 people the support is zero . . . Everything that's big automatically receives support. Everything that's small automatically does not get support—this is the basic policy. (SME)
	The biggest companies have very strong links with government or certain parties. They are big families (EconDev.Assoc.ChCommerce)
CHILE	I don't think they (SMEs) do take them into account, because obviously there are no policies(to support SMEs) so there is little chance that they will meet the needs of my company. (SME)
BRAZIL	They(policymakers) need to establish mechanisms to facilitate and develop the life of small and medium enterprises, because people are facing many difficulties. (SME)
S. AFRICA	The industries are not asked for their opinion . . . otherwise there would not be such objectives like the installation of 1 million units by 2013. Obviously, the industry could have told them earlier that is not realistic. (SME)

The lack of regular opportunities to both be heard and to have influence was very evident, and even where relationships had been developed, changes of party in government often meant these had to start from scratch every few years. Thus policy and policy development was seen as neither consistent nor constructive by most of those we interviewed or surveyed.

While Associations were to some extent able to represent some of the concerns and requirements of SMEs to government, they were perceived as having limited influence compared with lobby groups for oil and gas, for example in Alberta.

There was clear evidence that the needs of SMEs were taken less account of, even when they were communicated. Apart from failing to meet the needs of the SMEs that created much of the potential value of the cluster for the region, this also deprived policymakers of information about emerging threats and opportunities, as well as about avoidable issues in the way policy was implemented on the ground in different regions.

Even in regions with good opportunities for networking, such as California, the importance of this issue for businesses/SMEs was surprising. With policymakers, the need for improved collaboration was rated as the main gap, by 74.6%, with the collaboration of Universities and R&D institutes a much lower second (See Fig. 12.4).

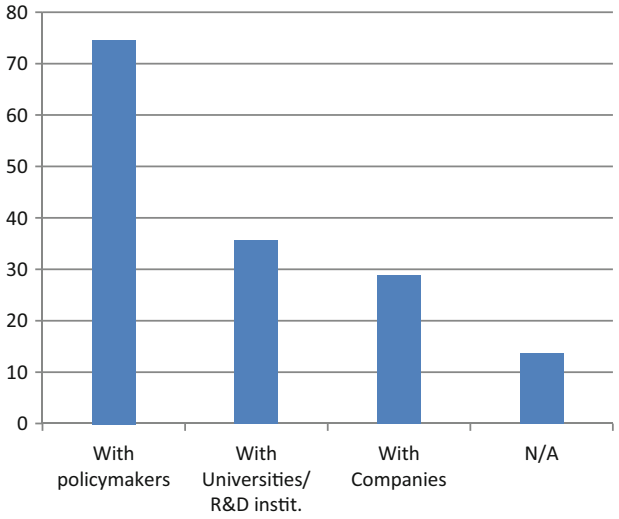

Fig. 12.4 Views on improving collaboration among Californian SMEs with policymakers, Universities and other companies. (Created by Rolletschke R. 2010, from the case study data)

There was also interesting variation in terms of distance from the centre, in that smaller clusters reported a greater sense of being sidelined. Those located further from the legislative centre felt less well represented—from the periphery of the main cluster in the Valley in California,[4] to the regional sites in Canada far from national government, and in the emerging cluster in Chile, with sites far North of the seat of government in Chile. There seems to be some evidence supporting the centre-periphery dichotomy, in the sense of access to the legislative centre. Here research at larger scale would be desirable, and might support Marshall's spatial proximity argument in agglomerations.

Asymmetry of Access and Influence

Disproportionate Influence of Large Incumbent Players

> *Across virtually every type and class of emergent infrastructure we can identify provisional "winners" and "losers"—those whose positions, programs, work experiences, or general qualities of life are enhanced (or conversely, challenged and undermined) by the developing infrastructure. Clear examples can be found in the nineteenth–century towns through which rail lines did and didn't pass, the former rising to prominence in the reorganized economic geography of the American West, the latter fading to shadowy reminders of past importance. (Edwards et al. 2007)*

[4] See Chap. 4, Fig. 4.1.

Communication infrastructure—formal and informal—dictates the ebb and flow of information and influence between connected players in the political infrastructure, but also the digital infrastructure that mediated much of their exchanges.

SMES overwhelmingly felt they were under-represented in those networks, except weakly, by Associations, and that their needs and concerns were therefore also largely ignored.

Large players in early stage clusters were seen as more likely to be shaping the policy agenda, through more communication and influence, particularly in early stage clusters in rural regions, where there were a few large players with little competition, and a lack of extant business networks. Portugal and South Africa fell into this category. It was also evident in mature clusters such as Germany as well, however.

> *The big electricity providers … regard us as disrupting their business, and the nuclear energy lobby has been able to make their case and is doing that again. … That's a well-rehearsed argument, and we've got to make our case against it ourselves. (EconDev.Assoc. ChCommerce, Germany)*

However, as in complex systems of every kind, the starting point often had a disproportionately large effect on the downstream development of the cluster, whether by default, or by design.[5] In Brazil, for example, Petrobras controlled most of the oil and gas drilling and Eletrobras held the majority of hydropower, nuclear and wind power companies. This virtual monopoly meant they inevitably influenced the way renewables evolved as part of the matrix.[6]

Disadvantage Mediated by Digital Infrastructure

The web-based portals which mediated the transaction of permits, registrations and accreditation in Portugal (Chap. 5) were an example of how software can also embody and even reinforce those differences (Dourish 2004). The administrative portal used to manage registrations and other services was managed by one of the incumbents, and was viewed by SMEs as unfairly limiting their access, and facilitating that of the incumbent. This was seen as distorting the free play of market forces, as well as the performance of smaller players.

> *If all companies had equal access there would be competition based on technologies and sales and not a question of who has the best access. (SME, Portugal)*

The risk that the increasingly digital channels of communication between players could benefit individual firms at the expense of others is beginning to be recognised. (The online portals often used for registration, permits and other services for example). A recent call for research information to support the development of cluster policy in the US pointed out the need for a coordinated strategy to ensure

[5]Egidi and Narduzzo (1997) provide an early overview of these path-dependency effects in cooperative business contexts.

[6]As clusters have evolved since these studies, many of these countries now have new legislation, introduced to separate interests, and ensure transparency and equity where there are potentially competing interests.

this disbursement of public funds benefits the cluster, and the region, rather than individual constituents.

> *Cluster policy is NOT about interventions that enhance the private profitability of firms in a given location in ways that are not related to their level of productivity or innovation. For private profitability to align with the economic performance of a region, it needs to be based on strong productivity, rather than market restrictions or subsidies that achieve private profit by shifting value from the region's consumers and taxpayers to an individual firm. (Ketels et al, Harvard Business School Institute for Strategy and Competitiveness 2010)*[7]

There are a range of areas where inequities militate against the free play of market forces, and the fair play that might allow SMEs to survive, prosper and create value for the cluster and the region. These inequalities are increasingly recognised and Stiglitz (2012) provides a range of compelling examples.

12.3 Interface with Universities

Early stage clusters created in rural areas were most likely to have difficulties at the interface between companies and Universities (Fig. 12.5), however even in areas with excellent Universities and an established business culture this was still an issue

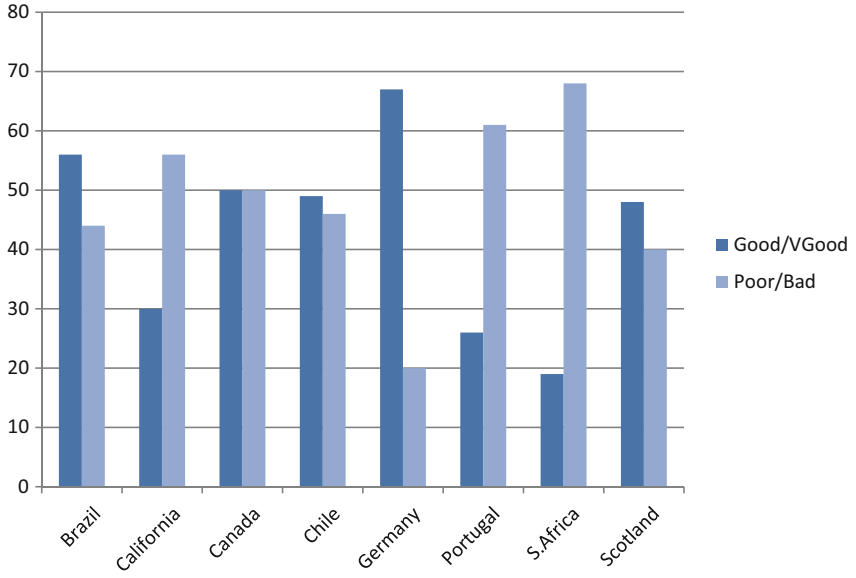

Fig. 12.5 Ratings of communication with universities

[7]This was a response to the EERE Commercialisation RFI on effective cluster policy, published by the Department of Energy's Office of Energy Efficiency and Renewable Energy and Available on: http://clustermapping.us/sites/default/files/files/resource/DOE_RFI%20Cluster%20Development%2010-22-13.pdf Accessed 9th Jan. 2016.

to some extent, and in cases such as California, there was a demonstrable difference in the responses of those based in the centre of the Valley, and those based further away.

Clusters are intended to enhance competitiveness and development through the transfer and leverage of social and intellectual capital, creating value through innovation, the transfer of knowledge, and skills, as well as the strategic alignment of players to cut costs or create value in a variety of ways. This, in other words, is the engine that drives value creation in clusters, and the rationale for public investment.

It is generally assumed, and often proclaimed by Universities, that Universities contribute significantly to the economy through research, innovation and professional development.[8]

> *University collaboration with businesses and the wider community (activity known as 'knowledge exchange') plays an important part in improving the UK's economic growth and productivity, and in the success of our public services, Universities also help to ensure that the UK remains competitive in the global market by supporting greater business innovation and export-led, knowledge-intensive growth (The Economic Role of Universities, Universities UK 2015)*

Yet the narrative presented by companies, and particularly small to medium-sized companies, paints a very different picture.

The vision of collaboration and value creation commonly presented in relation to clusters, and the role of Universities in supporting them, has not been adequately translated into specific measures to achieve that collaboration in most clusters.

There is a lack of incentives, targeted funding, or feedback and coordination by cluster managers or regional policy managers, as well as a lack of alignment between the aims and modus operandi of Universities and companies.[9] Facilitating knowledge transfer in such a way as to create shared value appears to require some over-arching management. As others have pointed out, simply putting the pieces in place does not ensure that collaboration will happen automatically.

This is not a new problem, and arguably it is the problem of all large agglomerations of disparate entities. Democracy, after all, was one of the first mechanisms at scale to harness the power of disparate knowledge for collective benefit both politically and economically (Ober 2010).

As Hayek put it, as far back as 1945 "The problem [of dispersed knowledge] which we meet here is by no means peculiar to economics but arises in connection with nearly all truly social phenomena . . . and constitutes really the central theoretical problem of all social science knowledge should be used that is dispersed among many people."[10]

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[8] http://www.universitiesuk.ac.uk/policy-and-analysis/reports/Pages/the-economic-role-of-universities.aspx

[9] The management of incentives plays a role in decisions to align with other players. Pitelis (2012) for example, points out that "entrepreneurial managers, faced with a degree of choice, will help co-create clusters and be part of them, for as long as they can appropriate more value in this way than through alternatives."

[10] Something arguably as applicable to industry clusters as well as health services, big data grids or well drilling!

If the Business: University interface is to create value in the ways intended, the means by which this happens needs to be designed and managed to that end. Companies/SMEs felt that targeted funding in the key areas where they needed to collaborate with Universities was one strand of this—on concept development, and commercialisation with SMEs in particular, and on research and development of the often practice-based issues of designing and installing new technologies optimally.

As the preceding chapter shows, there is a basic misalignment between the incentives government provides to Universities, and the needs of small research-active companies in particular.

12.4 Interface with Other Companies

It should be acknowledged here that most companies are referring here to the many other companies in their immediate supply chain with whom they necessarily communicate as part of their business, as clarified by the interviews (Fig. 12.6).

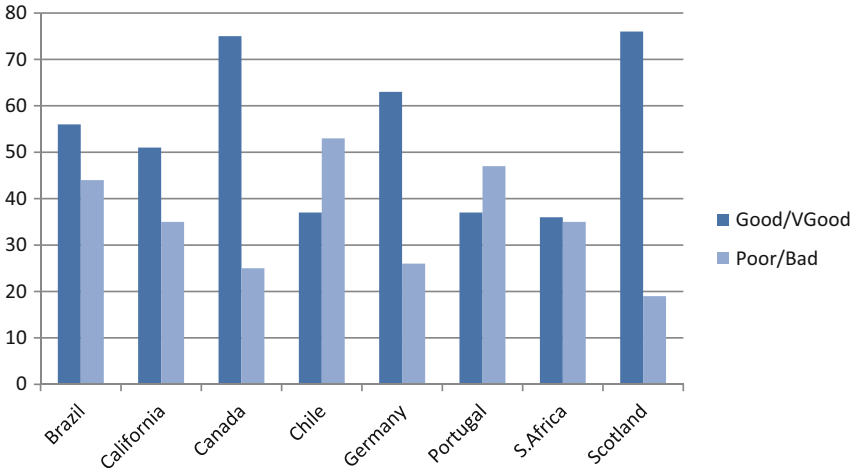

Fig. 12.6 Ratings of communication with other companies

Although not all the studies included questions that discriminated between exchange with large and with small companies, those that do, indicate that SMEs communicate largely with other SMEs in their immediate context, but that there is much less communication with larger companies. Yet it is also clear from the interviews, and from the comments included in the surveys, that companies often expressed an interest in more communication and more collaboration with larger companies, and in some cases, with companies in other clusters.

In California, Associations were seen as effective facilitators of such alliances between companies. (Many felt that the associations that represented them had insufficient influence to impact directly on policy, however.)

> *The most successful strategy is partnering with [industry associations] and contributing as a part of [them] . . . SunPower, BP, First Solar and Sun Edison -established players in the US—you could work with them through these industry associations. (SME, California)*

Some saw Associations as a means of learning from other regions abroad and supporting technology transfer to enhance the sophistication of firms, and the competitiveness of products—particularly in Chile.

> *One of the objectives of the Centre for Renewable Energies is precisely to form all these international networks, with other centres like that. I mean, it is fundamental to maintain all these institutional relations to exchange experience. (SME, Chile)*

One of the interesting pilot projects in Canada was to pair up knowledge-rich but cash-poor renewables companies with larger oil and gas companies seeking to diversify into renewables and able to support innovation (A similar strategy was used in the UK oil and gas industry to support SME innovation).

Interestingly, in California and in Canada, this approach to strategic alignment reflected a wider view of the energy market, where strategic alliancing across stakeholders, and across sectors, could contribute more to the competitiveness of the regional market as a whole.

> *I think the key here is to understand that companies are not competing among themselves, but rather, they are on the same side. And so the developers, all the engineering companies, all the generating companies—shouldn't be afraid of being united in an Association such as this, and to work with the government, work with the authorities, to achieve the big objectives which are the modification of the regulations. (EconDev.Assoc.ChCommerce, California)*

In both cases, when asked about the factors that had supported the development of the cluster, the responses showed a quite distinct construction of the driving forces, with more emphasis on the unique business and entrepreneurial culture as a factor. It suggests a greater awareness of the potential of the value of facilitating networking and strategic alliancing as strategies for creating shared value through better leverage of the knowledge and resources of disparate actors.

The Cost of Creating an Uneven Playing Field

Design by Default

Far from promoting opportunities for the exchange of knowledge, skills and resources, and fostering synergies and strategic alliances—the channels of communication and the opportunities for collaboration and coproduction were often absent for key players. If co-location in clusters is intended to facilitate constructive

exchange and interaction, including innovation and effective policy, then the infrastructure in place requires urgent and pro-active redesign.

The very uneven distribution of opportunities and incentives for collaboration was widely observed, and clearly perceived as a barrier to the competitiveness of small and medium-sized companies, and of the cluster itself.

Access to information through formal, informal and digital interfaces within the cluster was very constrained and asymmetric, and SMEs' ability to either participate or exert real influence on the dialogues around strategy was equally limited. The needs of the SMEs that made up most of the cluster were different from those of larger companies, yet significantly under-represented and not addressed—leading to a disconnect between the stated aims of cluster policy, and the needs of the majority of constituents on the ground.

The nature of communication and collaboration in the clusters was often more by default than by design, reflecting historical, cultural, geographical or even accidental arrangements. An overall strategy to promote the kind of strategic alignment of actors towards common ends was lacking, despite this being one of the core advantages clusters are perceived to have.

A Critical Gap, with Implications for Economic Outcomes

Given that regional SMEs were the vehicles for mediating the key benefits for the sponsoring region, and for generating much of the innovation, the fact that their needs, according to stakeholder feedback, were neither being communicated nor met represents a critical gap with implications for the cluster.

There is a cross-cutting perception that lack of equal access to and influence on policy damages both SMEs and the cluster as a whole. SMEs' needs were not identified or addressed, with a resulting loss of SMEs and their capacity to support innovation and provide regional employment.

Assembling the actors as a geographical cluster may provide opportunities, collaboration and economies of scale, but the social, cultural, intellectual and organisational capital of a cluster can only be leveraged to advantage if there are arrangements for all of these diverse actors to come together regularly and effectively to create value and to mitigate risks, as these emerge.[11]

> *I think that creating green tech clusters is beneficial theoretically but is dependent mostly on the people that occupy these clusters. Events have to facilitated to introduce the players and the technologies have to be synchronized. (Survey respondent, large company, California)*

The surveys highlighted the difference between a policy vision, and an active effective implementation of that on the ground—with the necessary feedback

[11]The Romans and the Greeks both used the forum to leverage the knowledge and the agency of a much greater diversity of actors towards economic and political ends that would otherwise not have been possible (Ober 2010).

from users at regular strategic meetings. They also reiterated the apparent bias towards large-scale energy distribution, with large companies, and the lack of support for the development of microgeneration, off grid generation and small-scale projects. In many of the emerging countries, such as Brazil and South Africa, the scale of demand would have justified greater emphasis, and would have paid greater returns in terms of regional employment by SMEs and the provision of electricity in regions with little infrastructure. In Latin America this was a growing strand of development, particularly in Uruguay, where the need to do this, and to support co-generation as part of the rural agricultural economy.

12.5 Implications: Creating Value Within Clusters

Creating the Conditions for Co-location to Facilitate Co-production

Creating the conditions for value creation was seen as requiring more effective, more complete and more equitable communication and collaboration infrastructure, where disadvantaged groups are better able to communicate business needs and barriers on the ground, and have more impact on the process of policy development.

As far back as 1945, Hayek pointed to the lack of consideration of how distributed knowledge could be shared in distributed collaborations as a central problem for economics that was often ignored.

> *The various ways in which the knowledge on which people base their plans is communicated to them is the crucial problem for any theory explaining the economic process, and the problem of what is the best way of utilizing knowledge initially dispersed among all the people is at least one of the main problems of economic policy—or of designing an efficient economic system. (Hayek 1945)*

Hayek (1945) reframes the problem as one of how the conditions can be created to harness "the interactions of people each of whom possesses only partial knowledge"

Perhaps the most damaging barrier was at the interface with policymakers, where companies felt their needs were not communicated and thus not addressed. Given the resulting loss of SMEs in many clusters and the associated loss of innovation, in-house niche knowledge, skills and employment—this seemed at odds with the portrayal of clusters as a means of creating value for regions.

In fact, even where their views were presented, for example through business associations, the perception was that their voice was taken less account of. This was most evident in the perceived failure of funding policies to meet the needs of smaller companies, struggling to survive short-term changes in funding policies such as FiTs, or to find funding for the concept testing of innovations, or financing for small projects. This lack of influence was compounded by the perceived influence of other lobbies—those inherited from the pre-existing business networks, from utilities, parastatal organisations and from the oil and gas lobby in particular.

Communication and collaboration infrastructure was the 'social glue' which mediated the transfer of knowledge and capital in different forms, between players.

The opportunities and the barriers were embodied in the legislation and in its implementation (often by default rather than by design). The architecture of opportunities and incentives which shapes such exchanges was often absent or very asymmetric. The difficulties faced by SMEs seeking to develop innovations with Universities are a good case in point (See Chap. 10).

So what are the implications for policy—and for the policy-making process?

Communication, Collaboration and Decision-making in Distributed Communities

There are regularities in the way information and knowledge is collected and shared in all distributed collectives, as Seeley (1995) points out in his study of how social insects harness distributed knowledge in the creation, recreation and adaptation of their collective environment in the face of unpredictable external change. He foregrounds common bases for competitive advantage in successful examples of complex, dynamic and evolving ecosystems.[12] Much of it hinges on the ability of these systems to harness the distributed knowledge of the members of the hive through effective communication and feedback.

The landscape of opportunities and incentives for communication and collaboration in clusters is designed in large part by default. Sometimes it is a legacy of earlier industrial or political activities—subsequently appropriated to the advantage of particular players. Sometimes it has simply not been put in place. Sometimes, again, the players and the links are in place, but their incentives are misaligned, making collaboration difficult at best, as for example at the interface between smaller companies and the research institutions charged with generating and sharing knowledge and expertise to regional advantage.

Those most likely to be left out of these networks of information and influence are emerging new players such as SMEs which play such a crucial role in mediating the intended benefits of clusters. Whatever the origin of these gaps and inequalities, they impact on those aspects of competitiveness that clusters seek to create—such as innovation, productivity and regional employment, in which SMEs play such a critical role.[13]

[12]Segel and Cohen (2001) highlight a range of comparable issues in an overview of other distributed autonomous systems.

[13]The work of Burt (1992) on structural holes, and the work of Granovetter (2005) both provide fascinating studies of the impact of social structures on economic outcomes, as does Scott in relation to the socio-political structures underpinning capitalism (Scott 2011) and Sölvell and Williams 2013 in relation to the creation of the 'Cluster Commons'.

One respondent pointed out rather acutely that it was as if no-one was coordinating from the top, and there was an over-riding perception that policy in this, as in some other areas, was a thing of parts—created across multiple Ministries, in relation to different policies and regions, with little coherent consideration of how and by what means communication and collaboration could be helped, rather than hindered.

The combination of limited feedback, or fragmented executive processes and lack of a clear rationale for creating conducive conditions all play a part in the lack of pro-active and focused strategy in the creation of this crucial, if somewhat intangible infrastructure.

The conditions for communication and collaboration between players were neither mapped, nor managed. Not only were there gaps and barriers—the incentives of players were often misaligned, such that the opportunities available were not taken up as intended.

Unlike the gentle evolution of Marshall's early clusters, leveraging the benefits of densely networked social and professional communities;[14] many clusters lack this ecosystem of communication, shared aims and shared spaces. Nor has policy fully engaged with the importance of building this critical soft infrastructure of connections and incentives to drive interaction, and harness the distributed knowledge and resources of the cluster to collective advantage.[15]

Our take-home argument here, is that practice-based research with companies, easily incorporated into what universities routinely do, can make this tangible, and thus manageable, and subject to monitoring and improvement.[16] When the research process is also used as a catalyst for engaging stakeholders in shaping solutions this has the added value of creating spaces for developing a shared construction of the issues, and the viability of possible solutions (Golsorkhi et al. 2015).

This is increasingly central to the design and implementation of large-scale infrastructure and service development in other sectors, such as eHealth, eBusiness and eScience. The cost and risk of not involving knowledgeable users on the ground in this way has been evident in high-profile failures of many large government-funded projects around the world (Ure and Jaegersberg 2005; Ure et al 2007; Ure 2011; Jaegersberg et al 2007).

[14]Although the role of social capital in creating human capital in organisations is well recognised (Coleman 1988), there is little coherent leverage of this in creating the conditions for harnessing this in clusters, where arguably, the lack of a pre-existing network of relationships is most critical.

[15]Nakwa et al. (2012) and Johnson (2009) suggest for example a strategy to mobilize intermediary organisations to broker and facilitate interaction between players.

[16]Earlier publications on the automotive supply chain, and in the oil and gas sector, outline projects across cluster in this area. (Jaegersberg et al. 2002; Jaegersberg and Ure 2008; Ure 2003, 2011).

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Part IV
Conclusion

Chapter 13
Are We Missing Something? How Can Cluster Policies Create the Conditions for Value Generation?

Abstract This chapter summarises the recurring barriers identified and their impact on the vision of clusters as a focus for value creation. It underlines the crucial importance of more timely feedback on operating conditions on the ground, to better inform policies on emerging needs, challenges and opportunities that also impact on economic outcomes. This is presented as complementing the role of models dealing with the factors and condition in the market. The chapter highlights the economic advantages of better leveraging the distributed knowledge of stakeholders on the ground, and the potential for more pro-active involvement of Universities in mediating this, through collaborative and practice–based research on the ground.

13.1 Mapping Barriers to Cluster Development and Competitiveness

The literature on the benefits of clusters makes many claims, which are generally accepted in theory, but which are often not realised in practice. The WHY of this has been the focus of this book. What are the barriers and the configurations of people, processes and technologies which routinely hamper the expectation of competitiveness—creating cost and risk rather than value?

Across clusters in 11 very different countries, we have been able to produce robust qualitative and quantitative evidence of recurring barriers which are not adequately addressed in policy, practice or professional development. Could they have been anticipated? How can they be addressed? What are the implications for cluster policy, and for the roles of stakeholders in the cluster?

We argue that this research fills a gap in theory, and most importantly in practice, where policymakers and cluster managers increasingly need to recognise and respond to emerging needs and barriers on the ground. We summarised the key recurring barriers to cluster development and competitiveness at the two most salient interfaces—the interface between companies and policymakers, and between companies and Universities. We look first at the policy barriers (See Fig. 13.1).

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Fig. 13.1 Policy-related barriers

Our key contribution in this has been raising awareness of some of the most recurrent barriers, the conditions that create them, and the implications for addressing them. While these cognate sets of recurring barriers in Fig. 13.1 (Policy-related) and Fig. 13.2 (R&D-related) are visualised in a very simplified form, it is clear from all of them that current arrangements penalise precisely those actors most likely to create value for the cluster and the region—namely SMEs.

These are cross-cutting barriers which could be addressed, if adequate processes were in place to identify and communicate them, and if there was a willingness to adapt or introduce policies to support SMEs at the key interfaces.

These are barriers which ought to be addressed because of the impact on:

- economic outcomes for clusters in areas such as innovation and competitiveness.
- SMEs, which are the vehicles for regional benefits such as employment for the regions which fund the investment

Policy-Related Barriers

While many of the barriers reported by stakeholders related to the nature of policies themselves (short-term, fragmented, un-coordinated) others related to unmet needs in key areas impacting on operations on the ground, such as access to funding or the support for research and innovation.

This was mostly perceived as reflecting the gaps and inequities in the underlying arrangements for informing the policy-making process itself, such as the lack of feedback from smaller companies on the ground. The barriers associated with funding policy were a particular case in point. Such barriers were clearly an issue in other sectors also.

Funding Policy: Related Barriers

In the interviews and surveys there was a consistent reiteration of the lack of funding for research-active SMEs in the concept testing and commercialisation of innovation. Compounded with the difficulties in collaborating with Universities, this constituted a barrier at the very heart of what clusters were supposed to be about.

Access to funding in terms of bank loans and government loans was also consistently seen as constraining SMEs disproportionately. This was compounded by the lack of long-term stability of funding policy which naturally put smaller companies with limited research funding more at risk. Taxes were also seen as disproportionately high for smaller companies, and government grants and loans were perceived as geared more to larger companies and larger projects. In all these areas, policies could have been more supportive of this core constituency. These are all issues evident also in other sectors, but which have been slow to be recognised and addressed, despite the avowed importance of policy that supports innovation.

In Chap. 3 we cite almost identical issues in oil and gas clusters, as the cluster moved from cost-based strategies for competing, to innovation-based strategies, only to find their base of niche knowledge and innovation had largely disappeared, where SMEs succumbed to the financial constraints they faced—from unfair payment practices, to excessive tax and risk, and lack of support for innovation (Ure et al. 2007; Jaegersberg et al. 2007).

Research, Training and Innovation–Related Barriers

Figure 13.2 highlights some of the key barriers here. Those small companies most able to create innovation that will benefit themselves, the cluster and the region, are least able to access the research and development support they need. They are also least likely to be able to compete for the limited pool of trained workers, often having to rely on in-house training, given the lack of both specialist and basic training offered by Universities. This is nowhere more obvious than in the barriers to entry presented to SMEs in terms of funding and financing. In part, this is because the feedback which could better inform policy is not adequately, or quickly enough collected and communicated. From the perspective of the majority of participants, it is because other voices were often louder and better represented, in an area sufficiently new and dynamic for decision makers to lack a comprehensive understanding of the barriers to innovation and competitiveness on the ground.

Fig. 13.2 Research, training and innovation-related barriers

Learning from Other Clusters

Collaborative research networks across clusters can help new clusters learn from those at different stages of maturity, and help anticipate recurring risk scenarios such as those mentioned above. This was the basis for the early pilots in other

sectors,[1] where this also allowed the sharing of experiences in addressing these challenges earlier than would otherwise have been possible. In dynamic and high-risk environments, the potential to reuse, rather than simply reinvent is an asset, and one which requires collaborative networks across clusters to leverage (Jaegersberg and Ure 2003, 2005, 2008, 2011).

13.2 Informing Cluster Policy

Both mapping and managing barriers depends on the speed and adequacy with which they are identified. In this the role of feedback played a key role.

Informing Cluster Policy: Feedback

How, and to What Extent Is Cluster Policy Informed by Feedback from the Ground?

In the context of eBusiness and eHealth, the potential of technology to harness the knowledge and agency of distributed users in designing products or services is part of a more adaptive and cost-effective business model. Increasingly, system and service designers are making better use of what core users know and can do, in the design and development of complex services (Tapscott and Williams 2007; Ure et al. 2009; Nicolini 2009; Schermer 2009).[2]

In most clusters, however, what cluster players know and can do is a largely untapped resource according to these findings. The connections between actors were often by default rather than by design, and empowered some actors at the expense of others, and often at the expense of the cluster as a whole.[3] The value of what stakeholders on the ground can tell policymakers and economists is increasingly being recognised. In reality however—this was already something many economists had commented on.

Hayek, as far back as 1945, charged economists with over-emphasising the theoretical and the mathematical and ignoring other sources of knowledge which also impact significantly on economic outcomes—citing in particular the knowledge of those on the ground. This then raises the issue of how (or if) this knowledge is captured or taken account of.

[1] See footnote in Chap. 11, Sect. 11.4, on research networks associated with the projects.

[2] In part this is also a response to a series of high profile, high cost software failures where the design of services (both commercial and public) failed to be implementable in practice, as a result of failure to take sufficient account of the knowledge and skills of service users on the ground (Ure J. PhD thesis).

[3] Despite the portrayal of clusters as a focus and a vehicle for collaborative action and change in terms of development and competition.

Addressing Gaps, Distortions and Delays in Feedback

The feedback loop to policymakers was slow, fragmented and skewed in favour of particular players. SMEs in particular felt under-represented at this interface, with the result that their needs were often not met and their perception of risks and opportunities was less likely to inform policy. There were also concerns about lobbying by particular groups in this regard.

This was a cross cutting barrier with significant implications for the economic outcomes for the cluster, for companies and for the region.

- Unequal access to the policy table meant policy was often blind to the needs of a key group, and slow to take account of emerging costs, risks (and opportunities) on the ground.
- Unequal access to information and to services managed by larger companies, utilities or monopolies limited the performance of many SMEs.
- Resulting inequities in access to funding limited the capacity of research SMEs to innovate, as compared with larger companies, who were perceived to have easier access to funding from banks, and from government programmes, as well as access to private or in-house laboratory facilities.

There is increasing evidence of the economic value of ensuring mechanisms for equal representation in the co-production of policy and practice, if risks are to be avoided and opportunities to be enabled as early as possible. In a business environment that is increasingly competitive and increasingly volatile, the 'unknown unknowns' are often where the action is.[4]

While poor or asymmetric access to information may be less damaging in a 'steady state' environment, it is far from the case in the dynamic, competitive and unpredictable context of global/local markets, where the speed and accuracy of feedback from the ground is crucial for organisations to deal with emerging risks, and emerging opportunities.

Stiglitz (2012) and Piketty (2013) for example, point to the economic disadvantages of inequality with the implication that there is a need for more government involvement to provide an even playing field. Economists such as Ketels et al (2012) and economic sociologists such as Bruce Scott (2011), at Harvard Business School, also flag the need for government to ensure that appropriate regulation is in place so that the market can then operate more "fairly and efficiently".

In many other contexts involving complex and dynamic systems at different scales, both social and technical, the range of mechanisms whereby this can be achieved is a growing focus of research (Segel and Cohen 2001; Bar Yam 2005, 2006; Seeley 2010).

[4] Sawhney and Parikh (2001).

Directing the Flow of Knowledge and Capital Towards Cluster Goals

Many of these landscapes were designed by default, by cultural and historical relationships (legacies), and by policies implemented without a clear view of their (often unintended) consequences on the ground. In addition to the gaps and barriers, there were also clear pathways for communication and collaboration that were remarkable in their lack of use. The interface between SMEs seeking support from Universities to develop in-house innovations is a case in point. Part of the value of this kind of practice-based research, is the discovery of why the physical, financial and legislative infrastructure does not produce the intended interactions, as a basis for more targeted interventions. The importance of bridging these gaps, and the strategic role of intermediary organisations in supporting is beginning to be recognised, though not necessarily addressed (Nakwa et al. 2012; Johnson 2009).

Collaborative Research and Development on the Ground as a Key Source of Feedback

In the context of markets which are more dynamic and higher risk, there is a need for a greater focus on practice-based research, and for Universities to take more of a role in this, if they are to help rather than hinder in harnessing the distributed knowledge and skills in clusters.[5]

In many cases, the barriers related to the misalignment of incentives. The qualitative research allowed us to map the misalignment of incentives at the interface between companies and Universities, for example, by open questions eliciting their view of the landscape, their role in it, and the incentives and disincentives to collaboration. In Fig. 13.3 we have mapped out the key areas where the incentives for Universities often ran counter to those of companies—something that is covered in more detail in Chap. 10. The interface between Universities, and SMEs was one example where competing incentives hampered knowledge transfer and innovation of critical types.

[5]Such as collaborative action research (Reason and Bradbury 2008; Carr and Kemmis 1986) and Strategy as Practice(Golsorkhi et al. 2015).

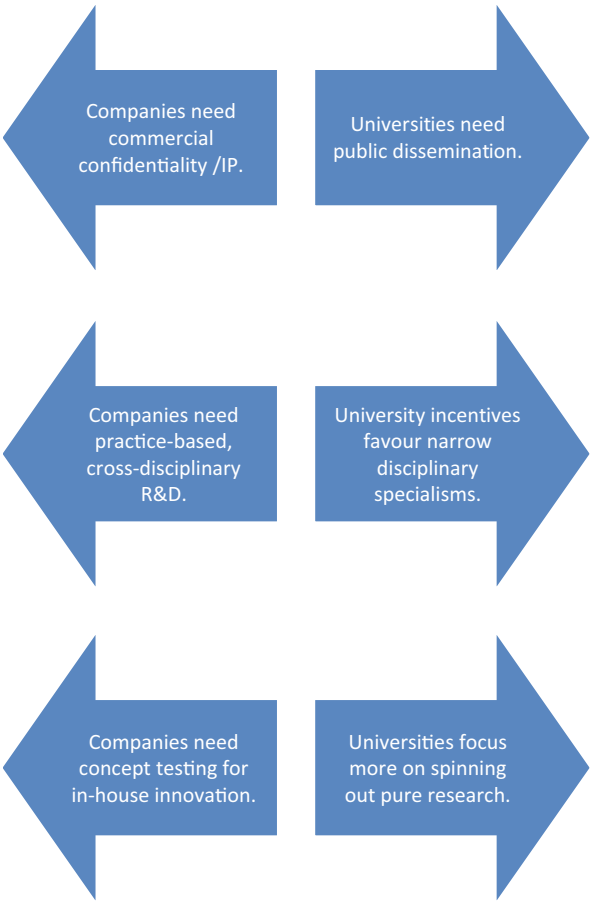

Fig. 13.3 Force-field representation of competing incentives and working practices

The incentives for Universities and for SMES ran completely counter to each other.

- Universities are rated and funded, to a great extent, on their ability to publish high quality research in particular high impact journals. Companies on the other hand, benefit from retaining the IP on innovations, and patenting rather than publishing to retain commercial confidentiality, given the reliance of many research-active SMEs on commercial innovation as a source of income.
- Universities tend to be rewarded in terms of funding, for theoretical research, often in a single area of a single discipline, where they have advantages in attracting grant funding and publishing in high impact journals specialising in a particular area. Practice-based research and cross-disciplinary research of the kind most useful for renewables at this point, is less likely to attract funding. Most high impact journals prefer theoretically rooted work. Practice–based, cross-disciplinary journals tend to be low impact.

- Again, in terms of the concept of and approach to innovation, there is a mismatch. Universities focus more on the spin-out of in-house research—innovative materials for example, while companies, and SMEs in particular, are seeking R&D support for concept testing and commercialisation of their own innovations, often in more practice-based contexts (See von Hippel 2004).

It is clear from the diagram that targeted polices could do more to better align the incentives and the aims of Universities and SMEs at this interface, if there is to be effective knowledge transfer and collaboration on SME-led innovation. Where Universities and SMEs were agreed, however, was in the need for targeted funding that would support more collaboration between SMEs and University research laboratories on concept testing and commercialisation. This was particularly critical for SMEs, since larger companies have readier access to in-house testing facilities, or funding to access them. Many of these regions now offer more support for this, for example in the form of research vouchers for SMEs seeking lab research facilities.

Mapping and Managing Incentives and Opportunities on the Ground

The very cross-cutting nature of these barriers and misalignments underlined the reality of the phenomenon, and the implications for both adequately mapping and managing the less visible (but critically important) landscape of incentives and opportunities.

The public narrative espoused by Universities and in the cluster literature paints a very idealised picture of Universities doing ground-breaking research on materials, and spinning out innovation through companies.

Yet companies themselves often depend on the support and the income from in-house innovations, building on niche knowledge of the requirements of the field. Around a third of the companies responding to the surveys in most clusters had already developed or patented an innovation. They were critical of the barriers they faced, and the lack of impact of their views on those in a position to reconfigure the landscape to better foster innovation of this kind.

Making the Operating Landscape More Visible Through Research Feedback

The dynamics that create both cost and risk are evident at different levels[6] and on different timescales. Making these visible is central to making them manageable, and that requires feedback.

[6]Pentland et al. (2012) provide interesting work in this area on the links between action on the ground and organisational routines, and the implications for both research and policy development.

Without a window on what actually happens on the ground in the production of successful innovation from different perspectives, these barriers will remain. Just as one would not envisage traffic management policy, cameras and traffic monitors on the ground to monitor emerging problems, so it seems to us do clusters.

What is perhaps puzzling is the extent to which the literature points to interaction at this level as something vague, and difficult to understand,[7] yet here, as in any other complex system, there are still regularities and patterns. The language used often tends to convey the impression that these themes do not lend themselves to closer analysis in an accessible way.

Part of our argument is that not only can these barriers be mapped and managed, but it is increasingly important that they are. The study uses qualitative and quantitative methodologies to achieve this in an easily reproducible way. Qualitative methods at, one end of the spectrum, reduce uncertainly about themes, using open interviews to scope them, while quantitative measures, at the other end of the spectrum, validate these, reducing uncertainties associated with small interview samples and different populations.

The research process itself can provide a vehicle for collaborative action or change—particularly in the context of disruptive technology, where the implementation of new digital systems requires a reconfiguration of roles, risks and resource allocation by the actors themselves.

Health technology is a good example of this, with both significant failures of high profile government projects that failed to leverage what service users know, and the significant economic benefits from more inclusive 'co-production' by service users and other stakeholders that do. The UK Innovation Foundation NESTA, cites estimates of savings of up to 20% in the provision of care services that are 'co-produced' in this way, for example (Morioka et al. 2013).

This is well established in the context of eBusiness, where the potential of leveraging what users know, or what they can do is increasingly evident. Tapscott & Williams book "Wikinomics" in 2006 is testament to the speed with which this approach has been adopted.

The growing use of collaborative action research (Reason and Bradbury 2008; Carr and Kemmis 1986) and 'strategy in practice' (Golsorkhi et al. 2015) all reflect this change in the perception of service and product users as potential co-producers.

Informing Cluster Policy: Models

A fundamental question for any discipline that studies financial markets is how we should theorise actors and action in those markets. (MacKenzie 2006)

[7] Atkinson and Audretsch (2008) for example comment on the "social technologies" of institutions, culture, norms, laws and networks that are so central to growth, yet are so difficult for conventional economics to model or study.' Marshall's (1919) 'Local industrial Atmosphere' is equally opaque.

Models and other abstractions from reality play a role in how we understand and manage complex assemblies of actors, agencies and relationships,[8] and how we seek to create value or determine appropriate optimisation strategies (Zott et al. 2010; Kavadias et al. 2016[9]), as Donald MacKenzie points out in the preface to his book on financial markets (2006).

This is a question which goes to the heart of how aggregates of people, processes and technologies are configured to create value, and for whom. The models that overtly or covertly shape these arrangements may be political, for example, or economic and are often simply historical legacies.

What Are Models Missing?

The problem with many traditional models is that they are blind to changes in the environment which may invalidate some of the assumptions and the weighting of variables. In such a context, models and other abstractions can be as much a barrier as a facilitator. Schumpeter (1942), for example, criticises economic models precisely for a tendency to emphasise all but a few variables, and to assume conclusions can be drawn from a model that is abstracted from a much more complex and dynamic reality. Atkinson and Audretsch (2008) ask if the twentieth century models guiding economic policymakers have kept pace with the advent of globalisation and competitive innovation.

The market for energy generation and distribution, like many others, is a case in point. Energy generation and distribution is a market that is being reshaped by globalisation, digital technologies, environmental laws and subsidies. Figure 13.4 highlights the different configurations of actors and relationships as models have evolved, in response to new challenges (e.g. globalisation) and new technologies (e.g. energy generation and distribution).

[8]Bourdieu also highlighted the extent to which this abstraction took the focus away from the social dynamics within which these practices were rooted. “The science called ‘economics’ is based on an initial act of abstraction that consists in dissociating a particular category of practices, or a particular dimension of all practice, from the social order in which all human practice is immersed” (Bourdieu 2005).

[9]Kavadias et al. looked at the characteristics of business models that helped companies create value with new technologies, highlighting six key characteristics of successful models. Interestingly, these included (a) a more collaborative ecosystem that improves collaboration with supply chain partners to reduce costs (b) an agile and adaptive organisation that allows real-time decision making that better reflect market needs.

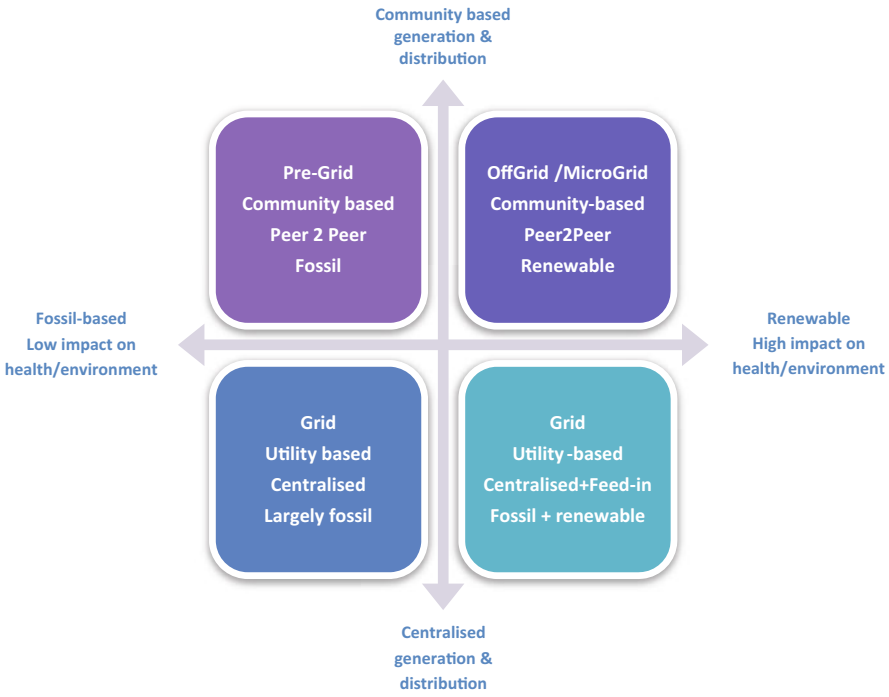

Fig. 13.4 Different business models have evolved around different market conditions

Emerging offgrid models use technical and financial innovations to create value in new ways. Community Charging Aggregates (CCA) now being piloted in many US cities for example, and Pay As You Go Models (PAYG) for financing off grid solar modules in Africa—have opened up new ways of configuring and connecting actors and resources that are bottom-up and community-based, rather than top-down and utility-based.

Work in other sectors such as eBusiness, eHealth and eScience already demonstrates the evolution through different generations of models from more top-down, static centralised approaches through to the more user-centred and mutually constitutive arrangements afforded by digital technologies in many sectors (Ure et al. 2001, 2009; Ure and Jaegersberg 2005; Ure 2011; Bate 2006). It is now taken for granted that online businesses can create value in new ways, where new actors and new relationships and interdependencies need to be taken account of. The business models for online retailers for example, now take account of what users know and can do in ways which verge on the

intrusive. Models in other sectors -from education to business and healthcare—have changed radically to optimise the value of what users know and can do.[10]

While current cluster policy models increasingly acknowledge the role of the social and the behavioural, it is not in a form which provides a basis for decision-makers to map or manage these more effectively on the ground. The point here is that models are very effective 'black boxes'[11] for managing complex systems, by focusing on particular configurations of variables—at a time when the real world being modeled may have changed significantly. Roberto Caballero (2010) in the National Bureau of Economic Research in the US puts it very bluntly in an article after the financial crash.

> *... the current core of macroeconomics—by which I mainly mean the so-called dynamic stochastic general equilibrium approach—has become so mesmerized with its own internal logic that it has begun to confuse the precision it has achieved about its own world with the precision that it has about the real one. This is dangerous for both methodological and policy reasons.*

Models are based on assumptions about the critical factors and relationships at a particular point in time and from a particular perspective. Yet these require constant re-analysis to assess changes in the nature of the external and internal challenges.[12] The landscape in which countries, businesses and societies interact, collaborate and compete have changed. Risks and opportunities are less predictable, faster to emerge, and more extreme in their impact. This has been driven in large part by disruptive technologies that ultimately drove radical changes in the way actors were configured. eBusiness, eHealth and eLearning are testament to that. Digital technology has created the potential for both global scale as well as multi-local aggregation, for new opportunities for some, and for new risks for others.[13] In such a fast moving market, it is more necessary than ever, to identify the impact of changes on the ground for different actors, to complement the broad brush of macroeconomic strategy and create the conditions on the ground for value generation.

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[10]Hayek makes this point very directly when he says that "The various ways in which the knowledge on which people base their plans is communicated to them is the crucial problem for any theory explaining the economic process, and the problem of what is the best way of utilizing knowledge initially dispersed among all the people is at least one of the main problems of economic policy—or of designing an efficient economic system" (Hayek 1945).

[11]Models are blind to new variables, and well-established models are resistant to change, because they are interdependent with the associated interests, incentives, resources and routines that have built up around them. There is a real sense in which they create their own self-reinforcing and self-referential environment.

[12]Hayek in 1945, claimed that "... economic problems arise always and only in consequence of change. So long as things continue as before, or at least as they were expected to, there arise no new problems requiring a decision, no need to form a new plan" Our point here is that models encourage a static view, and at a time where change (and often unanticipated change) has never been more likely.

[13]Callon and Rabeharisoa (2003) provide fascinating insights into the changing roles, rights and influence of patient groups within the medical arena as digital technology opened up new opportunities for communication and collaboration in the public domain.

13.3 Creating the Conditions for Value Creation

The aim of the book has been to provide a focus for understanding, researching and managing the dynamics on the ground which also contribute to economic outcomes, in addition to those driven by political objectives and associated economic models.

As in the circuit-diagram in Fig. 13.5, the expected output is dependent on a range of conditions being met. The pieces must all be functional and in place, the right connections must be there, there must be no gaps, or barriers to the flow of electricity through the circuits. The kinds of issues on the ground which can prevent the expected output are well established, and taught in almost every technical college.

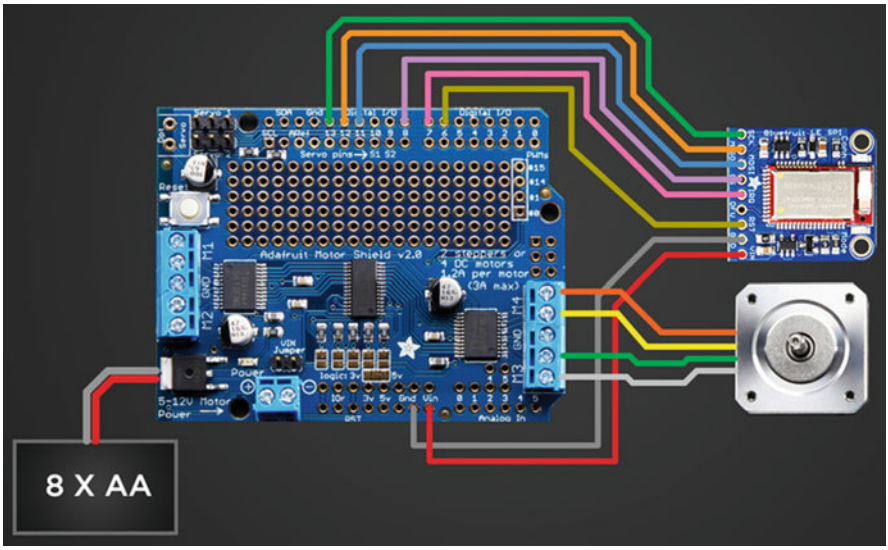

Fig. 13.5 Bridging the gaps and activating the circuits. Circuit diagram image created by Ruiz Brothers at Adafruit.com, and reproduced under a creative commons share and share alike licence. Source: https://cdn-learn.adafruit.com/assets/assets/000/027/745/medium800/3d_printing_circuit-diagram.png

What has been missing in clusters is a more pragmatic understanding of the arrangements on the ground, and the implications for policymakers and cluster managers. We hope this book goes some way towards the development of better feedback loops between those in the engine room, those at the helm in highlighting:

- the recurring barriers on the ground that fail to inform policy, generating instead, unnecessary cost and risk for the key vehicles of value that could inform policy and practice

- the lack of appropriate processes to feedback into policy, practice and professional development and create an even playing field capable of achieving levels of competitiveness and innovation that can generate value
- the lack of formal and informal networks, spaces and incentives to foster the kind of communication, partnering and coproduction that can create value in co-located clusters.
- the potential for collaborative action research in universities to identify the gaps and barriers, as a basis for shaping and incentivizing the flows of knowledge and resources in a more timely and targeted way.
- the value of harnessing what users on the ground may know, or can do, which has rewritten the rules in terms of business infrastructure and management. Wikipedia, Facebook, Amazon, and AirBnB and Twitter create value precisely because the digital infrastructure they use is designed to harness the knowledge, the resources and the agency of individual actors to economic advantage.
- the critical importance of feedback mechanisms to support the communication and consideration of that feedback, if policymakers are to meet the needs on the ground, and achieve the benefits which are claimed for clusters.[14]
- the need to map and manage/align incentives so that they help rather than hinder communication and collaboration

A key barrier relates to feedback, as a critical factor in effective action. Informing policy through feedback from stakeholders, as currently organised, gives a very uneven and asymmetric view of the challenges in the field for key innovators such as SMEs, whose needs are therefore not being met in time.

Reconfiguring Roles and Relationships in the Cluster

> *The global energy transition will require profound changes in the way that energy is produced, distributed and used, and require a reorientation of the policies and institutions that manage activities in the sector. International Renewable Energy Association (2015). REthinking Energy Report*[15]

The speed and unpredictability of change in markets, and the complex interdependencies in clusters themselves, means that it is more important than ever to know (a) what problems are emerging on the ground, and will create tomorrow's crisis (b) what the barriers are to the aims of policy on the ground (c) what actors in the cluster (and in other clusters) think should be done to address them.

This has implications for how policy is generated, and implemented, and how users can contribute more equitably to informing that. Sawhney and Parikh (2001) were

[14]Scott (2011) is one of a growing group of economists who also look at the way government regulations shape markets more widely, to the advantage of some players more than others, and suggests that the free flow of market forces operate more effectively if there are fair rules of play.

[15]http://www.irena.org/rethinking/IRENA%20_REthinking_Energy_2nd_report_2015.pdf

early highlighters of the role of users 'at the edge' as a resource for creating the kind of value that good digital design can harness, as was von Hippel (2004) in relation to innovation. Wikinomics (Tapscott and Williams 2007), Web 2.0, peer-to-peer models, and the sharing economy (Botsman and Rogers 2010; Hamari et al. 2015) were among the terms that arose around some of the new arrangements for creating business value through harnessing what service or product users know and can do.

A recent review of policy from McKinsey (Farrell and Goodman 2013) suggests that "by engaging and empowering citizens to co-design and co-deliver public services, governments can not only better meet citizens' needs; they can also shift some of the burden of accountability from the state to the people, allowing high-quality delivery of services in an environment of constrained resources." and a later report (Desmet et al. 2017) highlights the potential of technology to enhance the potential for better leveraging ecosystems of stakeholders to greater advantage.

Universities could also contribute more effectively. The collaborative process of research and action planning, and practice based research can be a catalyst for this.[16] And the process of engaging students in practice-based research with companies on the ground is useful training, as well as constituting both research as a basis for strategy, research as a basis for the curriculum, and as a catalyst for engaging stakeholders in new space around emerging challenges and viable strategies to address them.

Porter (1998) points out that "a cluster allows each member to benefit as if it had greater scale, or as if it had joined others without sacrificing its flexibility". The feedback from the studies suggests that this is harder for the SMEs that make up the majority of the cluster. Policy which facilitated the fora, the incentives and the opportunities for this group more effectively, would benefit the cluster on many levels.

If the whole is to be more than the sum of the parts, as clusters promise, then the linkages and the incentives that mediate exchange between players need to be taken account of in a more consistent way. Different models—both economic and political—may assign different roles, rights, relationships and resource-allocations—however design by default appears to be an option that disproportionately undermines value creation for clusters.

[16]It reappears in multiple other guises in different disciplines—as business process reengineering for example, as a software design scrum, as experience based design or user-led design. The essential element these share is that it is collective, collaborative, often iterative, and acts as a vehicle for identifying shared problems from the perspective of different actors, whole roles and experience allow them to negotiate a new arrangement. Michel Callon takes this further, and looks at how actors can come together to construct what he calls an 'agencement', emphasising the active construction and maintenance of particular arrangements by those involved to create particular social or economic outcomes.

Appendix

Policy dos and don'ts in a nutshell

Don't	Do	How?
Don't ignore what policy users know	Get feedback to ensure you know how policy is impacting on different groups, if it meets their needs, and what the operational barriers are on the ground-such as bureaucracy	Executive fora for policy co-production Ongoing collaborative action research by Universities with companies
Don't have policy which is short term, fragmented, uncoordinated	Provide long stability, predictability, consistency, and coordination in part through better integration with other long term economic goals and policies, and their implementation	Consider how renewable energy fits into wider energy & economic policies over the long term Expedite coordination of standards, processes, permits, regulations, across regions Coordination of renewables policy X Ministries.
Don't expect communication and collaboration between cluster players without opportunities and incentives	Support and incentivise alliances between actors, to leverage disparate knowledge skills and resources more effectively for innovation	Map gaps, barriers or disincentives to communication or collaboration as part of collaborative action research with Universities Provide mechanisms and incentives to bridge these gaps e.g. Share Fairs, mentoring, executive fora[a]
Don't reinvent the wheel	Learn from other sectors and clusters and anticipate or mitigate unnecessary cost and risk	Cross cluster research and collaboration networks. Awareness of barriers in other sectors
Don't consider renewables policy in isolation from energy and economic policy, or as an 'add-on'	Integrate renewables into longer term economic policy, as part of managed change to address long term goals in energy, the economy, employment, health and the environment.	Interdepartmental committee to look at coordination, potential synergies towards common goals e.g. data sharing, interoperability, incentives for shared aims.
Don't concentrate on the knowledge and the needs of larger companies at the expense of SMEs	Provide opportunities to leverage what all stakeholders know, and Identify the very different needs of SMEs which are so central for innovation in the cluster, and employment in the region	Executive fora for policy co-production Ongoing collaborative action research by Universities with smaller companies

(continued)

Don't	Do	How?
Don't look at innovation simply as the spinning out of pure research on materials in Universities,	Recognise that much of the innovation in renewables is about more practice –based, company-led innovation[b] by SMEs who typically find it hard to get R&D support, research facilities or funding for concept testing	Provide targeted funding and incentives for collaboration of SMEs and Universities on more practice-based company-led innovations Provide research vouchers for SMEs Address the issues of IP and publication which deter collaboration (See Chap. 11)
Don't restrict access to research facilities to SMEs that can foster innovation and regional employment	Recognise that large companies have access to in-house and private labs as well as university facilities, while SMEs often don't	See above Use targeted funding to even the playing field Matching large oil and small renewables SMEs
Don't let lack of training and expertise constrain the growth of companies and the cluster	Identify and address the gaps in skills and knowledge in relation to emerging industries such as renewables as both (a) a constraint on access to trained staff (b) a barrier to informed policy	Incentivise Universities to focus some of their student internships on more collaborative and practice-based research with businesses (i) to identify gaps in skills and knowledge; (ii) to inform professional development & policy.

[a]As long as these are not just 'talking shops' Senior executive staff must be there
[b]E.g. new renewable installations and constructions where the power, reliability, cost, lifetime, scale etc need multidisciplinary research support to be viable, as well as new products and applications

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Appendix

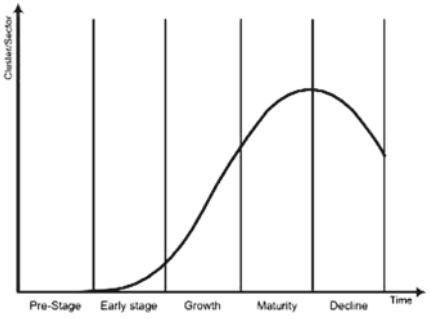
The Solar Sector in South Africa

1. DEVELOPMENT OF THE SOLAR SECTOR IN SOUTH AFRICA

More than one answer may apply. Tick all those you feel are relevant

*** How would you describe the stage of the development of the solar sector/cluster in your region?**

- ○ no cluster development
- ○ early stage
- ○ growth stage
- ○ mature stage
- ○ decline



*** What is your vision for the development of the solar sector in your region within the next three to five years?**

- ○ will not further develop
- ○ will turn into a future market
- ○ will attract foreign investment (from other companies)
- ○ other

G. Jaegersberg, J. Ure, *Renewable Energy Clusters*, Innovation, Technology, and Knowledge Management, DOI 10.1007/978-3-319-50365-3

The Solar Sector in South Africa

*** What things do you think really made a difference and got things happening in this sector in your region?**

- [ ] environmental laws (Kyoto Protocol, Copenhagen…)
- [ ] governmental policies (e.g. White Paper on Renewables)
- [ ] high levels of solar radiation in the region
- [ ] power cuts / insecure electricity supply highlighted the need for it
- [ ] presence of supporting industries (e.g. semi-conductor, ???)
- [ ] support from regional organisations
- [ ] foreign investors
- [ ] skilled labour force
- [ ] training opportunities
- [ ] easy access to capital
- [ ] incentives (feed-in-tariffs, tax reductions etc.)
- [ ] incubators for companies
- [ ] 2010 FIFA World Cup
- [ ] cost of oil /coal by comparison
- [ ] other

The Solar Sector in South Africa

*** In your opinion, what factors will make a difference in the further development of this sector in your region?**

- ☐ environmental laws (e.g. 2012 post-Kyoto agreement)
- ☐ liberalisation of the electricity market
- ☐ rising costs of conventional fuels e.g. oil
- ☐ introduction of a feed-in-legislation (so that ESKOM must feed-in renewable electricity)
- ☐ feed-in-tariffs also for small-scale producers (under one megawatt)
- ☐ faster and more decisive action on behalf of politicians (words must be followed by deeds)
- ☐ upgrade of grid infrastructure (power system, power stations, power lines and the grid)
- ☐ rural electrification
- ☐ off-grid solutions
- ☐ more foreign investors
- ☐ governmental cluster / network initiatives
- ☐ better commercialization of innovations
- ☐ support for research and development
- ☐ other

The Solar Sector in South Africa

*** What are the principal barriers in the solar sector in your region?**

- [ ] ESKOM monopolising the generation, distribution and the transmission of electricity
- [ ] liquidity issue within ESKOM
- [ ] the cheap electricity offered by ESKOM
- [ ] funding problems because there is only one utility
- [ ] fluctuations in the electricity network / also maybe interoperability????
- [ ] solar lead time of 2.5 to 3 years (deterrence of esp. foreign investors)
- [ ] non-existence of feed-in-legislation
- [ ] non-existence of regulatory legislative framework for
- [ ] registration as Independent Power Producer
- [ ] Power Purchase Agreement
- [ ] the capital required to start up the sector
- [ ] the difficulty to obtain venture capital
- [ ] difficulty to obtain finance for project realization
- [ ] criteria for participating in tenders comments:
- [ ] lack of raw materials (silicon, glass, CIGS, CdTe)
- [ ] lack of companies in the supply chain in the field of _____
- [ ] lack of specialized Universities/R&D Institutions
- [ ] IPR problems (e.g. in collaboration with Universities/R&D Institutions, in IDZs)
- [ ] absence of specialist training programmes
- [ ] shortage of skilled workforce
- [ ] insufficient information and communication to companies in the sector
- [ ] lack of coordination in the sector
- [ ] bureaucratic hurdles
- [ ] other

The Solar Sector in South Africa

*** How could the support for your organisation be improved?**

- ☐ better access to venture capital
- ☐ reduction in taxes
- ☐ improvement of research in the sector
- ☐ improvement of collaboration with other companies
- ☐ simplification of the licensing process (reduction in bureaucracy)
- ☐ improvement of information and communication to companies
- ☐ giving more security to the future of the sector (secure funding)
- ☐ creation of a regional cluster/network
- ☐ other

*** In your opinion, how should the solar energy sector be incentivized?**

- ☐ tax reduction
- ☐ feed-in-tariffs
- ☐ not at all
- ☐ other

The Solar Sector in South Africa

2. COLLABORATION IN THE SOLAR SECTOR

*** How would you assess the formal and informal exchange of knowledg ...**

	very good	good	poor	bad
a) between your company and other SMEs	○	○	○	○
b) between your company and LMEs	○	○	○	○
c) between companies and policy organisations	○	○	○	○
d) between companies and Universities/R&D Institutions	○	○	○	○
e) between companies and regional economic development / enterprise organisations	○	○	○	○

*** Does your company work with ...**

- ☐ other companies, local/regional suppliers
- ☐ companies, suppliers in South Africa
- ☐ international companies, suppliers with location in South Africa

companies abroad (where?, what kind?)

*** What are the criteria for choosing suppliers?**

- ☐ quality above all
- ☐ price above all
- ☐ cost-effectiveness
- ☐ their experience
- ☐ their availability
- ☐ their location
- ☐ their reliability

Other (please specify)

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Is the labour force in your region sufficiently skilled / qualified?

○ yes ○ no

comments:

*** In your opinion, could collaboration between company, university/R&D institutions and policy makers be improved in any way (Please give suggestions)**

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3. INNOVATIONS IN THE SOLAR SECTOR

*** Has your company already developed an innovation?**

- ○ yes
- ○ no

*** What are the barriers to innovation in the solar sector?**

- ☐ convincing those required to fund and support it at the level of government
- ☐ financial barriers
- ☐ political barriers
- ☐ technological barriers
- ☐ barriers to research and development (lack of collaboration with universities or other)?
- ☐ there are no barriers
- ☐ other

The Solar Sector in South Africa

4. INFORMATION ABOUT YOUR COMPANY

Where is your company located?

City/Town:

ZIP/Postal Code:

Where are your headquarters?

City/Town:

State/Province:

Country:

How long has your company existed?

years

*** What is your field of activity?**

- ☐ production of silicon
- ☐ production of wafers
- ☐ production of cells
- ☐ production of modules
- ☐ Inverters
- ☐ Trackers/ Mounting systems
- ☐ Distributor
- ☐ Construction
- ☐ Power Producer
- ☐ Utility
- ☐ other

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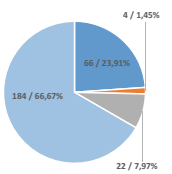
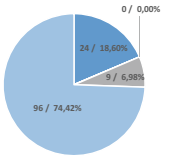
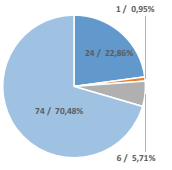
*** Used Material**

- ☐ Amorphous Silicon
- ☐ CdTe
- ☐ CIGS
- ☐ Dye-Sensitized
- ☐ Crystalline Silicon
- ☐ other

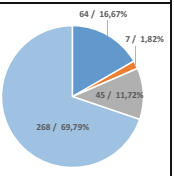
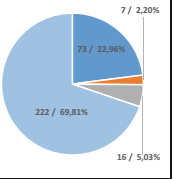
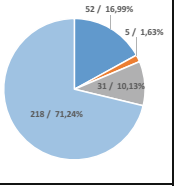
*** Please describe the size of your company.**

- ○ Start-up
- ○ micro company (< 10 employees)
- ○ small company (< 50 employees)
- ○ medium-sized company (<250 employees)
- ○ large company (> 250 employees)

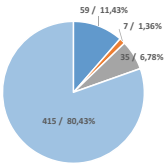
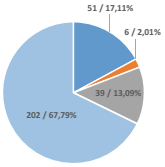
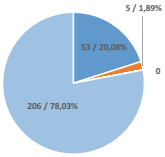
Survey Breakdown

	Survey					
	invitations	complete return	opted out	bounced	not completed	breakdown (survey)
South Africa	276	66	4	22	184	
	100,00%	23,91%	1,45%	7,97%	66,67%	
Brazil	129	24	0	9	96	
	100,00%	18,60%	0,00%	6,98%	74,42%	
Alberta	105	24	1	6	74	
	100,00%	22,86%	0,95%	5,71%	70,48%	

Survey Breakdown

	Survey					
	invitations	complete return	opted out	bounced	not completed	breakdown (survey)
Portugal	384	64	7	45	268	
	100,00%	16,67%	1,82%	11,72%	69,79%	
Mitteldeutschland	318	73	7	16	222	
	100,00%	22,96%	2,20%	5,03%	69,81%	
Chile	306	52	5	31	218	
	100,00%	16,99%	1,63%	10,13%	71,24%	

Survey Breakdown

	Survey					
	invitations	complete return	opted out	bounced	not completed	breakdown (survey)
California	516	59	7	35	415	
	100,00%	11,43%	1,36%	6,78%	80,43%	
Scotland	298	51	6	39	202	
	100,00%	17,11%	2,01%	13,09%	67,79%	
Italy	264	53	5	0	206	
	100,00%	20,08%	1,89%	0,00%	78,03%	
Spain	ongoing					
Uruguay	ongoing					