



# Understanding and Overcoming Barriers to Small Businesses' Collaboration on Eco-Innovation

On behalf of:

**BSK CiC**

for :

**The EcoMind project**

By

**STEP AHEAD RESEARCH Ltd**



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# Executive Summary

## The Project

- This report investigates the barriers and drivers to collaborating on eco-innovation activities amongst small businesses. It considers different definitions of eco-innovation; examples of policies and initiatives that support collaboration; and case studies of successful partnerships.
- The study is part of a wider project that was commissioned as part of the EcoMind project by BSK CiC to identify actions that could be taken to encourage greater collaboration amongst SMEs in future eco-innovation projects.

## Eco-Innovation

- Eco-innovation is not a term that is used in all countries. In some, it is implicit but not explicit within innovation strategies. However, there are some countries where it has a high profile and where the development of eco products and services is seen as a strategic market opportunity.
- Eco-innovation has moved from mainly being concerned with technology and reducing environmental impacts to cover a broader range of activities and behaviours that have socio-cultural dimensions and which are more concerned with minimising the use of resources.
- Eco-innovation is a form of innovation and, to that extent, activities need to be new to the organisation that is undertaking them. However, it differs from market-oriented innovation in that it has a strong socio-environmental dimension; is focused on long-term lifecycles; and, typically relies on networks of stakeholders.
- Eco-innovation activities can be undertaken by businesses in all sectors of the economy, not just those in the 'eco-industries' sector. A strong demand for eco-solutions across an economy is likely to stimulate the growth of an eco-industries sector, whilst the availability of eco-products and services is likely to encourage businesses in other sectors of an economy to implement eco-innovation solutions in their products, services and processes.
- Eco-innovation activities can be undertaken by businesses in all sectors of the economy, not just those in the 'eco-industries' sector. A strong demand for eco-solutions across an economy is likely to stimulate the growth of an eco-industries sector, whilst the availability of eco-products and services is likely to encourage businesses in other sectors of an economy to implement eco-innovation solutions in their products, services and processes.

## Eco-Innovation Policies

- Reasons why there is a lack of collaboration between businesses cannot be divorced from other barriers that businesses face – a mix of policy approaches should be used to address interlinked barriers, rather than seek to address issues in isolation.
- There is a growing interest in small-scale 'bottom up' solutions that encourage collaboration at firm level. Policies that encourage collaboration tend to focus on network

development and could often include high profile Award programmes and incentives to collaborate.

- There are both supply-side measures and demand side measures that can be used in combination to encourage eco-innovation. Supply-side measures may include equity support, education and training and network and partnership development. Demand-side measures include green procurement; tax incentives; eco-labelling and public awareness campaigns, for example. Fiscal incentives (either positive or negative) and social pressure can also influence behaviour.
- A network of itself is unlikely to be sufficient – it needs to be dynamic and for most companies there needs to be a demonstrable link between competitiveness and environmental efficiency. Eco-labelling is seen to be effective because it can confer market advantage; can enable participating companies to identify each other; and by raising public awareness helps market development.
- How and why businesses collaborate is cultural and economic, as well as environmental. Businesses need to be clear about their economic rationale for engaging in partnerships, and to understand that approaches to eco-innovation are not uniform internationally.
- Some cultures operate a ‘bottom up’ approach to eco-innovation that encourages businesses to collaborate and seize the agenda on their own terms. Such a ‘small government’ approach fits well with companies that want to innovate and to collectively set the eco-innovation agenda themselves. Top down approaches may provide more certainty, but can mean that businesses are responding to, rather than leading on public policy - a pattern that doesn’t always win favour with creative and innovative businesses.
- There are many international examples of interventions that support collaboration implicitly, rather than explicitly. High profile programmes, such as the **Top Runner Programme** in Japan provide a good example of continuous cycle of eco-efficiency improvement and knowledge sharing between companies.
- **The Banksia Eco-innovation Awards** in Australia raise the profile of environmental protection and provide recognition to businesses that have implemented eco-innovative practices or developed eco-innovative products and services.
- The **Environmentally Friendly Company Certification System** in Korea provides environmentally-friendly companies with exemption from regular training and inspection, the ability to report the installation of emission facilities instead of the need to request them, and offers of environmental technology support and loans. This led to the establishment of The Korean Association of Environmentally Friendly Companies.

## Case Studies

There are many examples of good practice in eco-innovation, many of which enjoy the support of governments, but also industry and other private sector partners. There appears to be no “one best way” of delivering effective eco-innovation. Instead, different approaches can deliver equally effective results, with local policy, market and other factors playing a key role. Few of the case studies in this report focus on one aspect of eco-innovation, but they all act as a catalyst to some form of collaboration, even if they are sometimes under the umbrella of state funded agencies.

**Fundacion Chile**, for example, is an independent organisation which supports innovation and knowledge transfer into Chile by bringing together access to knowledge, finance,

strategic partners and distribution channels in its portfolio of companies in key clusters, which are typically sold when mature.

**General Electric** encourages eco-innovation through its major research and development establishments and competitions for innovators and entrepreneurs, who, if successful gain support in the form of finance, technical know-how and market access.

**Khosla Ventures** is a venture capital company that thinks that large companies can inhibit major innovation because of their aversion to risk, and support a wide ranging “cleantech” portfolio of “small bets” (rather than a small number of “big bets”) in start ups.

**SymbioCity** is a network of Swedish companies and organisations which delivers large scale place-based approaches to eco-innovation involving many partners. In Enköping, for example, a biocycle process was created that produces renewable energy via a system linking the municipal heating and sewage treatment networks with local farms, providing combined heat and power for all the town’s 20,000 homes.

Finally, the Japan’s **National Institute of Advanced Industrial Science and Technology** takes new intellectual property and channels it to appropriate implementing companies, providing support and accreditation in the process.

## **Conclusions and Recommendations**

Internationally, there is no universally agreed definition of eco-innovation, but it is increasingly recognised that environmental efficiency needs to contribute to business competitiveness. The immaturity of the market place, gaps in supply chains, and uncertain timescales for returns on investment can make it difficult to engage businesses in collaborative ventures that require investment.

The role that state agencies can have in helping to carry investment risks and stimulate the eco-innovation market should not be underestimated, particularly since longer term social and environmental benefits can still seem more transparent than shorter term commercial ones.

Some countries take a national (or international) strategic approach to eco-innovation, based on an expectation that to do so will deliver competitive economic advantages over the longer term. Others take a ‘bottom up’ approach that encourages innovation and collaboration at company level.

Government agencies and large, well-resourced organisations can influence behaviour through a range of measures that include regulation and standards, procurement policies, awards and competitions, targeted funding, network development and information and advice.

Approaches that seek to address one aspect in isolation are unlikely to be appropriate, because barriers and drivers tend to be interlinked.

### **The role of state supported agencies is important**

Many eco-innovation initiatives involve large budgets and national or international partnerships, so the role of state supported agencies is important. The state’s support for or leadership of a collaborative eco-innovation initiative can also reassure SMEs and send important market signals which are supportive of companies engaging in eco-innovation.

Only a few countries take a strategic approach to eco-innovation, developing the eco-services sector and embedding the demand for eco-innovation products and services across different sectors of the economy.

However, Government agencies can still take an active role in supporting collaboration by establishing and supporting networks for information, intelligence and knowledge exchange; prioritising funding so that it encourages collaboration; and acting as trusted intermediaries linking eco-innovative companies with each other, particularly where these involve transnational partnerships, where cultural factors may be a further barrier to overcome.

### **Support Needs to be Delivered at the Right Spatial Level**

At local level, state agencies may have a greater role in adopting an area-based approach (such as SymbioCity) that links businesses across different sectors under a local strategic eco-innovation umbrella. Sector or technology- based approaches are likely to need a national or international network to help businesses to prosper, unless the local area in question is home to a company cluster of national or international significance.

Where a strategic approach does not exist at national level, this report has shown that the umbrella organisations do not have to be state funded. There are good examples of where multi-national companies with global reputations have established networks for innovators and entrepreneurs to meet, and exchange knowledge and expertise. But, even here, state funded agencies may have a role in promoting these and encouraging engagement by small businesses. State authorities' policies can also influence inward investment decisions that would have a bearing on eco-innovation.

### **Award and Accreditation Schemes can Confer Market Advantage and Help SMEs Identify Partners**

In any market, trust and relationship-development are important. Such relationships are likely to be particularly important in eco-innovation, given its relative immaturity and the lack of universal clarity about what it actually is. Clusters and networks do not have to be established and sponsored by state agencies, but in some cases it may help.

Involvement in high profile competitions and award schemes that help to accredit products or services can enable businesses to identify trusted partners with whom they can collaborate and share knowledge.

### **SMEs Need to See the Commercial, as well as Environmental Benefits of Collaborating**

In any venture, businesses need to have a clear idea of why they should collaborate. Links between commercial benefits and environmental efficiency are likely to be important for most SMEs. However, changing procurement requirements, patterns of customer demand, and higher future energy costs are expected to drive them more closely together. Collaborative approaches to address the negative impacts and to derive positive advantages can share costs and spread risks for individual SMEs.

### **'Light Touch' Collaborations (Through Networks) May Lead to More Formalised Partnerships**

Collaboration can, of course, work at different levels. A loose involvement in networks to share knowledge and market intelligence may be the limit of collaboration for some SMEs. For others, more formalised collaborative arrangements may be required for joint projects, or supply chain and/or cluster development. Indeed, 'light touch' collaboration may be a precursor to more formalised engagement for many SMEs (re-enforcing the importance of network development). However, transition between different levels of collaboration may need to be facilitated by clear regulatory frameworks and additional support activities.

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# 1.0 Introduction

Step Ahead Research was commissioned by BSK-CiC to undertake a short study into the barriers to eco-innovation for small businesses. The study is part of the EcoMind project.

EcoMind is a three-year Interreg IVa Two Seas-funded programme aimed at supporting sustainable business growth and facilitating the development and market penetration of new sustainable products and services<sup>1</sup>.

It started in January 2008 and is due to complete at the end of October 2011. It operates across three regions of the European Union (the South East of England; Northern France and the Netherlands) and involves providing intensive expert support (one-to-one) to 270 companies and “light touch facilitation” (workshops, clinics and exhibitions, for example) to 600 businesses across the three regions. BSK-CiC, is the lead partner and it delivers the UK element of the programme with the Centre for Sustainable Design; EnviroBusiness and WSX Enterprise Ltd.

During the course of the programme it became apparent that a key barrier to eco-innovation is the ability and/or willingness for small businesses and larger businesses to engage in effective partnerships.

This study was commissioned specifically to investigate the barriers to such collaborations. This is exclusively a desk research project aimed at:

- Exploring different definitions of eco-innovation that are used nationally and internationally;
- Identifying international case studies where there have been successful collaborative approaches to eco-innovation between SMEs and large companies; and
- Providing examples of legislation and policies that are being pursued to support collaborative approaches to eco-innovation.

This report forms part of a wider study investigating barriers to collaboration. This includes primary fieldwork undertaken by other agencies. This report is structured as follows:

**Section 2** provides an analysis of the different definitions that are applied to eco-innovation.

**Section 3** considers the main barriers and enablers of eco-innovation and provides examples of the policy interventions that are used to encourage collaboration.

**Section 4** provides details of case studies that provide examples of collaborative approaches to eco-innovation.

**Section 5** summarises the findings from the study and provides recommendations as to how best to improve eco-innovation collaboration between businesses.

In addition, the report contains a two Annexes.

**Annex I** provides a list of possible eco-innovation activities

**Annex II** provides list of possible policy interventions to support eco-innovation

**Annex III** provides a bibliography and further reading

## 2.0: What is Eco-Innovation?

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<sup>1</sup> [http://www.envirobusiness.co.uk/files/EcoMind%20Project%20Closure\(1\).pdf](http://www.envirobusiness.co.uk/files/EcoMind%20Project%20Closure(1).pdf), accessed 20/09/2011

Eco-innovation is a relatively new business activity that can cover environmentally-friendly technological developments through to the introduction of new business practices that support social progress. Within the 'eco-industries' sector<sup>2</sup>, activities<sup>3</sup> range from new, high-tech services, such as renewable energy and air pollution control, to well-established activities in recycling and waste management. However, eco-innovation activities extend beyond the 'eco-industries' into those that are pursued by companies across all sectors of the economy.

Its disparate nature means that there are often many agencies and Government departments that have responsibility for different aspects of eco-innovation, sometimes making policy formulation seem uncoordinated.

Some countries take a strategic approach to eco-innovation by specifically prioritising support for businesses in the eco-industries sector. In these countries, the eco-industries are seen as key to future economic growth and competitiveness, responding to a growing international demand for energy efficient products and services across all sectors of the economy.

In other countries, the eco-industries sector is not well established and there is insufficient critical mass to adopt such a strategic approach. Here, the focus tends to be on encouraging eco-innovation within businesses in traditional sectors of the economy. These two approaches are not mutually exclusive: A strong demand for energy saving products and services across different sectors is likely to support the development of a sustainable eco-industries sector. Equally, the supply of green technology solutions that add competitive advantage to companies outside the eco-industries sector can raise the profile of eco-innovation activities within businesses in other sectors.

The term 'eco-innovation' has broadened "from a traditional understanding of innovating to reduce environmental impacts towards innovating to minimise the use of natural resources in the design, production, use, re-use and recycling of products and materials".<sup>4</sup> There is also a growing recognition that change cannot be delivered through technology alone. Instead, there need to be "systemic innovations in the way services are delivered and organisations are run"<sup>5</sup>. This includes achieving both social changes and gaining public acceptance of the need for eco-innovation at different stages of the Research, Development, Demonstration and Deployment (RDD&D) process. This is reflected in the European Commission definition of eco-innovation:

*"All forms of innovation activities resulting in or aimed at significantly improving environmental protection. Eco-innovation includes new production processes, new products or services, and new management and business methods, whose use or implementation is likely to prevent or substantially reduce the risks for the environment, pollution and other negative impacts of resources use, throughout the life cycle of related activities."*<sup>6</sup>

Kemp and Pearson (2007)<sup>7</sup> provide a further definition of eco-innovation as:

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<sup>2</sup> "The environmental goods and services industry consists of activities which produce goods and services to measure, prevent, limit, minimise or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-systems. This includes cleaner technologies, products and services that reduce environmental risk and minimise pollution and resource" OECD/Eurostat Manual for Data Collection and Analysis in the Environmental Goods and Services Industry (OECD/Eurostat 1999)

<sup>3</sup> See Annex 1 for list of example activities

<sup>4</sup> Source: 2010 Annual Report, The Eco-Innovation Challenge: Pathways to a Resource Efficient Europe Eco-Innovation Observatory (2010)

<sup>5</sup> Source: ibid

<sup>6</sup> Source: [http://ec.europa.eu/environment/etap/inaction/policynews/232\\_en.html](http://ec.europa.eu/environment/etap/inaction/policynews/232_en.html)

<sup>7</sup> Source: Kemp R & Pearson P. Final Report MEI Project About Measuring Eco-Innovation. European Commission (2007)

*“the production, assimilation or exploitation of a product, production process, service or management or business method that is novel to the organisation (developing or adopting it) and which results, throughout its life cycle, in a reduction of environmental risk, pollution and other negative impacts of resources use (including energy use) compared to relevant alternatives”*

They suggest that anything is an eco-innovation if it is *“more environmentally benign than the relevant alternative”* and that the term eco-innovation *“crucially depends on an overall assessment of environmental effects and risks”*<sup>8</sup>

Eco-innovation is a form of innovation, which itself means that the activity is new to the business that is undertaking it. According to the OECD<sup>9</sup>, innovation is *“the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations”* and innovation activities are *“all scientific, technological, organisational, financial and commercial steps which actually, or are intended to, lead to the implementation of innovations”*.

The OECD differentiates<sup>10</sup> between four types of innovation:

- **Process innovation:** *“the implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software”*
- **Product innovation:** *“the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics”*.
- **Marketing innovation:** *“the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing This includes changes in positioning of products or services offered by companies e.g. low-cost airlines”*.
- **Organisational innovation:** *“the implementation of a new organisational method in the firm’s business practices, workplace organisation or external relations”*

Eco-Innovation includes all these components, but also includes:<sup>11</sup>:

- **Material flow eco-innovation:** *“innovation across the material value chains of products and processes that lower the material intensity of use while increasing service intensity and well-being. It aims to move societies from the extract, consume, and dispose system of today’s resource use towards a more circular system of material use and re-use with less total material requirements overall”*.

The Eco-Innovation Observatory also includes **social innovation** under the umbrella of eco-innovation. It references Phills et al (2008) definition of social innovation as *“a novel solution to a social problem that is more effective, efficient, sustainable than existing solutions and for*

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<sup>8</sup> Source: ibid

<sup>9</sup> Source: Oslo Manual, OECD 2005

<sup>10</sup> Source: Ibid

<sup>11</sup> Source: EIO Eco-Innovation Methodological Report Eco-Innovation Observatory 2010

*which the value created accrues primarily to society as a whole rather than private individuals”.*<sup>12</sup>

The EIO suggests that eco-innovation differs from market-oriented innovation in that it has a greater emphasis on social impacts, achieving goals over a longer timeframe; and is more reliant on networks of stakeholders.

The OECD<sup>13</sup> also recognises that eco-innovation may go beyond the innovating organisation and result in wider social and cultural impacts that can lead to lasting behavioural change:

*“The scope of eco-innovation may go beyond the conventional organisational boundaries of the innovating organisation and involve broader social arrangements that trigger changes in existing socio-cultural norms and institutional structures”.*

This paper identifies three facets of eco-innovation:

- a. **Eco-Innovation Targets.** These are the products, processes, marketing methods, organisations, and institutions that are the focus of the eco-innovation activity.. Eco-innovation in products and processes tends to rely on technological development, while eco-innovation in marketing, organisations and institutions relies on non-technological changes.
- b. **Eco-Innovation Mechanisms.** These are the way in which changes in the target area are made and can include modification of practices; re-design of practices; developing alternatives to existing practices; and/or creating of new practices.
- c. **Eco-Innovation Impacts.** These are how the eco-innovation affects environmental conditions within and outside the innovating organisation(s).

However, the term eco-innovation is not used across all countries. In some there is a emphasis on innovation and whilst eco-innovation may be implicit this, it is not reference explicitly.

The OECD has produced a series of papers that summarise a range of countries' eco-innovation policies. These suggest that there are different approaches to defining eco-innovation and, in some cases; no definition is used at all.

In the **Republic of Korea**, there is greater reference to environmental technology, which is defined as:

*“Technology necessary for preserving and managing the environment, including the enhancement and assimilative capacity, suppressing and removing causes of removing environmental damages on humans and nature, preventing and reducing environmental pollution, and recovering polluted and destroyed environment”*<sup>14</sup>.

In **Japan**, the definitions that the OECD has identified seem to incorporate both the cultural and social aspects of eco-innovation, as well as its technological aspects. For example the Ministry of Economy, Trade and Industry defines eco-innovation as:

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<sup>12</sup> Source: Phills J. A Jr., Kriss Deiglmeier K & Dale T. Miller D.T Rediscovering Social Innovation Stanford Social Innovation Review (2008)

<sup>13</sup> Source: Sustainable Manufacturing and Eco-Innovation<sup>13</sup>: Towards a Green Economy OECD Policy Brief June 2009

<sup>14</sup> Source: The Korean Act on Environmental Technology Development and Support in Korea, Ministry of Environment 2005 (quoted in Eco-Innovation Policies in the Republic of Korea; Environment Directorate OECD 2008)

*“Techno-social innovations to meet environmental challenge, resource constraints and diversification of values among the people with compatibility between economy and environment”<sup>15</sup>*

This approach is supported in a 2007 Japanese Cabinet Decision policy paper:

*“the comprehensive initiative for technology development and social reform, using its dominance of high level technologies in monozukuri (goods production) area and in environment or energy saving as driving force, in order to achieve the sustainable society”<sup>16</sup>*

In **Canada**, the OECD found no straightforward definition of eco-innovation, but notes that its innovation strategy defines innovation as

*“the process through which new economic and social benefits are extracted from knowledge”<sup>17</sup>*

The paper also references Canada’s national policy on green procurement which defines environmentally preferable goods and services as

*“those that have a lesser or reduced impact on the environment over the life cycle of the good or service, when compared with competing goods or services serving the same purpose”<sup>18</sup>*

In **Australia**, there is a recognition that eco-innovation is more than just about technology. The Victorian Eco-Innovation Lab suggests that:

*“We need a paradigm shift in the way that we think about systems of production and consumption, and about quality of life and prosperity. This is what we mean by eco-innovation”<sup>19</sup>*

Still in Australia, Banksia<sup>20</sup>, which organises a wide range of environmental and sustainability awards refers to three terms that relate to eco-innovation: eco-efficiency; cleaner production; and eco-design.

Eco-efficiency means: *“producing more goods and services with less energy and fewer natural resources”*; Cleaner production is *“a strategy to continuously reduce pollution and waste at the source”*; and Eco-design is *“the design of a product or process to reduce its environmental impacts all along the life-cycle”*.

In **Brazil**, eco-innovation is “not in itself a goal in official innovation and technology policies” (Seroa da Motta 2009). Instead, the focus is more explicitly on innovation and technology *per se*. However, the National Policy on Industry, Technology and Trade (PITCE) does focus on a number of areas in the eco-industries sector, including: biotechnology in the

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<sup>15</sup> Source: Ministry of Economy, Trade and Industry (quoted in Eco-Innovation Policies in Japan; Environment Directorate OECD 2008)

<sup>16</sup> Source: Economic and Fiscal Reform 2007 – Basic Policies Japan Cabinet Decision 19 June 2007 (quoted in Eco-Innovation Policies in Japan; Environment Directorate OECD 2008)

<sup>17</sup> Source: (<http://innovation.gc.ca/gol/innovation/site.nsf/en/in014144.html>) (Quoted in Eco-Innovation Policies in Canada; Environment Directorate OECD 2008)

<sup>18</sup> Source: ([www.pwgsc.gc.ca/greening/text/proc/pol-e.html](http://www.pwgsc.gc.ca/greening/text/proc/pol-e.html)) (Quoted in Eco-Innovation Policies in Canada; Environment Directorate OECD 2008)

<sup>19</sup> Source: Victorian Eco-Innovation Lab: [www.ecoinnovationlab.com/paper/about.php](http://www.ecoinnovationlab.com/paper/about.php) (Quoted in Eco-Innovation Policies in Australia; Environment Directorate OECD 2008)

<sup>20</sup> Source: Economic Environment Dictionary 2004; Ministry of Environmental Protection website ([www.sviva.gov.il](http://www.sviva.gov.il)) (quoted in Eco-Innovation Policies in Australia; Environment Directorate OECD 2008)

Amazon region; the development of biodiesel and innovation in “environmentally sound technologies”<sup>21</sup>

In the **United States** the term ‘environmental innovation’ or ‘clean technology’ is more commonly used than ‘eco-innovation’. The OECD suggests that the US Environmental Protection Agency<sup>22</sup> approaches environmental innovation as a “results oriented, collaborative endeavour”, offering regulatory incentives for environmental improvements, grant programmes and self certification procedures, for example.

In **Israel** there is a distinction between eco-innovation and eco-efficiency. Eco-innovation is defined as *“increasing the potential of new technologies, products and services which contribute to financial and ecological efficiency”*. **Eco-efficiency** refers to *“efficient usage of natural resources in order to satisfy human needs and demands”*.

However, in a number of countries, the OECD found it difficult to find any reference to the term eco-innovation. In the **Mexico** briefing, for example, it states that “the concepts of ‘environmental innovation’, ‘clean technology’ and ‘sustainable technology’ are not easily identified”<sup>23</sup> and the **Turkey** briefing states that “no definition of eco-innovation has been found”.<sup>24</sup>

The relative immaturity and disparate nature of eco-innovation activities means that it is not a term that is used commonly in all parts of the world. Different countries are at very different stages in their pursuit of environmental innovations and goals. However, where there is a greater understanding and commitment to sustainability, definitions seem to suggest that there is a growing recognition that environmental solutions cannot be delivered through technology alone. This means that the term eco-innovation has social and cultural aspects, making it a cross-cutting theme that impacts on the activities and responsibilities all types of businesses and Government agencies.

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<sup>21</sup> Seroa da Motta R. Eco-Innovation in Brazil. Global Forum on Environment and Eco-Innovation OECD (2009)

<sup>22</sup> Eco-Innovation Policies in the United States; Environment Directorate OECD (2008)

<sup>23</sup> Eco-Innovation Policies in Mexico; Environment Directorate OECD (2008)

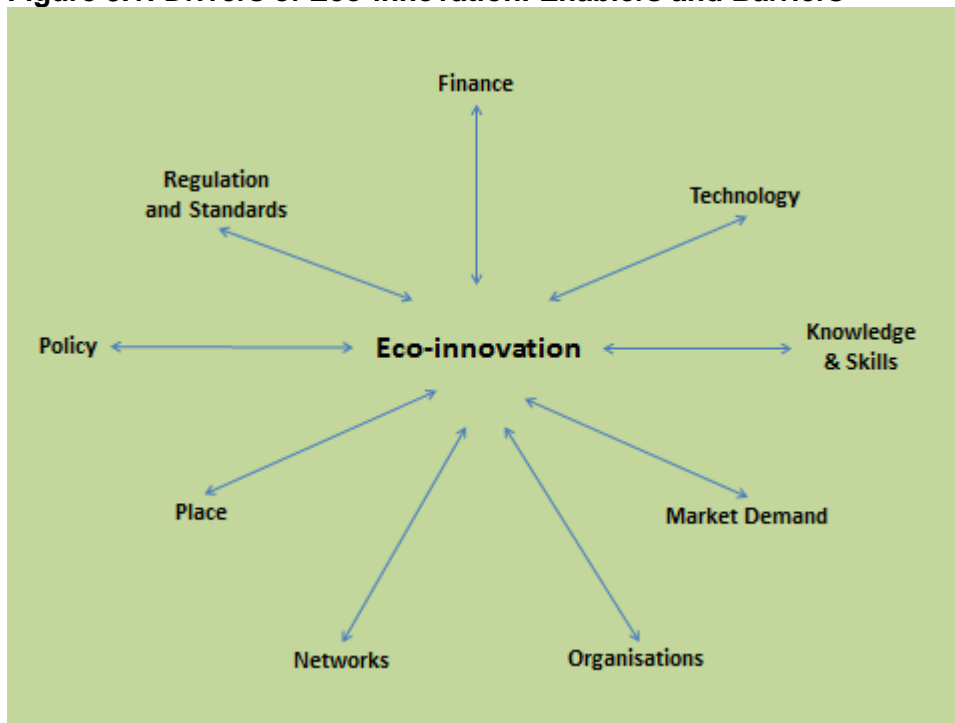
<sup>24</sup> Eco-Innovation Policies in Turkey; Environment Directorate OECD (2008)

## 3.0: Supporting Collaborations and Partnerships

### 3.1 Enablers and Barriers

The main focus of this paper is to consider policies that support eco-innovation collaboration between small and large businesses. However, it is worth reviewing the drivers and barriers to eco-innovation activity that have been identified in previous studies. Policies need to remove barriers and provide incentives to encourage eco-innovation activities.

**Figure 3.1: Drivers of Eco-innovation: Enablers and Barriers**



The factors set out in Figure 3.1 (above) are essentially two sides of the same coin, and can act as *both* enablers and barriers, depending on the context.

#### **Regulation and Standards**

Long-term clarity in the regulatory environment provides an arena of certainty within which investment decisions can be taken: higher environmental standards on recycling or emissions, industry quality marks or legally binding greenhouse gas limits, for example, create a more favourable climate for the adoption of new technologies, processes and systems to address these legal and regulatory requirements.

#### **Knowledge and Skills**

Whether the right knowledge, management expertise and workforce skills are present will shape an organisation's ability to research, develop or deploy a new technology.

#### **Organisations and Networks**

Organisations and the networks they inhabit may or may not be sufficiently developed to deliver eco-innovation at different stages of, for example, a product life cycle or in the early stages of a new company's operation.

Being part of the right network helps organisations to develop and implement eco-innovations. Public sector bodies and private sector companies and venture capitalists often facilitate connections to suitable partners when supporting eco-innovation. Place-based eco-innovation initiatives, such as those based on the “closed loop” principle of industrial ecology or greater localisation can create a community of organisations – large and small, public and private – who work together deploying a range of eco-innovations.

## **Finance**

Financial interventions need to be located within a broader ecology of public and private sector interventions. Public funds are often associated with projects not yet especially close to market, and may include research and development grants (often in identified “priority” sectors or technologies) or “accelerators” (to test and evaluate technologies, systems and processes). Public money can also match private sector investment or reduce private sector risk through co-investments, loans or guarantees. Public finance can also shape end consumer behaviour and market demand. Grants to households for insulation or energy generation feed-in tariffs would fall into this category.

Private finance plays a key role in eco-innovation. Large transnational corporations, like GE, make significant investments in their in-house development capabilities, invest in start-ups and new technologies as part of their eco-innovation activities. The investment strategies of venture capitalists also dictate what gets funded: some identify key growth sectors and target investments, while others have broader portfolios, allowing them to hedge risks and handle uncertainty.

## **Technology**

Technology drivers can take the form of emerging market needs, like that of using more abundant catalysts in fuel cell technologies, but often involve the transfer or local adaptation of existing technologies. The ease with which technology moves from one location to another is known to be related to the extent to which Intellectual Property Rights are protected.

## **Market Demand**

Market demand - whether actual or latent – needs to be present in the target markets for eco-innovations to be adopted. This might include a need for customers to accept different product or service features or outcomes, but will also, in turn, be driven by the prevailing policy and regulatory environment.

These drivers and barriers have been identified in a number of studies. For example, the Eco-Innovation Observatory<sup>25</sup> has found key drivers to be energy and material costs, having “good business partners”; having access to subsidies and fiscal incentives; and having (or having access to) the technological capability to implement changes.

A study for the European Cluster Observatory<sup>26</sup> identified drivers as regulation compliance; current and expected rises in energy and material costs; having a good understanding of supply and demand within the supply chain; and having strong collaborative networks.

The Eco-Innovation Observatory<sup>27</sup> has found common barriers to be a lack of funds; uncertain market demand; the long timeframe for returns on investment to be realised; lack of funds or access to fiscal (and other) incentives; technological ‘lock-ins’ and a lack of qualified personnel and technological capability.

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<sup>25</sup> Source: Wuppertal Institute. The Eco-Innovation Challenge: Pathways to a Resource Efficient Europe – Annual Report 2010 European Commission 2011

<sup>26</sup> Source: Barsoumian S, Severin A, & van der Spek T. Eco-Innovation and National Cluster Policies in Europe – A Qualitative Review for the European Cluster Observatory (2011)

<sup>27</sup> Source: Attitudes of European Entrepreneurs Towards Eco-Innovation Analytical Report. Eurobarometer (2011)



The European Cluster Observatory qualitative study, referred to above, suggests that the relative immaturity of the market means that there are gaps in the supply chain, which results in products and services that have potential, failing to come to market. It also suggests that there is insufficient awareness of the market potential of eco-products and services. Other barriers that are identified are similar to those identified in other studies: a lack of in-house or access to technological expertise; and an inconsistent legal framework particularly in relation to Intellectual Property Rights (IPR) that inhibits cross-border knowledge transfer and activity.

Developing and embedding strong links between economic competitiveness and environmental efficiency is likely to be important in promoting eco-innovation. Barsoumian et al<sup>28</sup> draw a distinction between drivers of eco-innovation in the eco-industries and those within other sectors of the economy.

Within the eco-industries, there is a clear emphasis on addressing environmental and climate issues. However, for companies in traditional industries, economic considerations are the primary driver and the environmental and climate aspects are often secondary considerations. In other words, for most businesses, introducing energy saving processes or products needs to lead to increased company profitability, either directly or indirectly.

### **What this means for Collaboration**

Small businesses need to understand what their own drivers and barriers are to eco-innovating and to consider how these can best be supported through collaborative partnerships. Identifying appropriate networks can help small businesses to identify collaborative partners with whom they can feel confident working with.

It may be important to acknowledge that many competitors and potential partners are facing the same challenges and uncertainties that make them hesitant to engage in collaborative activity. But there are benefits of pooling expertise, sharing costs and collectively influencing or benefiting from public sector leadership and investment in driving eco-innovation across different sectors of the economy.

## **3.2 Approaches to Supporting Eco-Innovation**

Policies to support eco-innovation depend on the strategic importance that is attached to the development of the 'eco-industries' sector; the profile and density of the sector; the extent to which the market for green technology solutions exists in non-eco-industries sectors; and how clear the link between eco-innovation and economic competitiveness is seen to be.

Within the Europe (and beyond), many member states do not have explicit eco-innovation policies, although they are often implicit in broader innovation policies and/or in environmental policies.

The OECD<sup>29</sup> has found that an increasing number of countries now see eco-innovation as a new opportunity, rather than as a barrier to growth, and a report for the European Cluster Observatory<sup>30</sup> suggests that public policy to promote eco-innovation should focus on establishing and strengthening the links between competitiveness and environmental performance.

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<sup>28</sup> Barsoumian S, Severin A & van der Spek T. *Eco-Innovation and National Cluster Policies in Europe – A Qualitative Review* Greenovate! Europe EEIG for the European Cluster Observatory Brussels (2011)

<sup>29</sup> Eco-Innovation in Industry: Enabling Green Growth. OECD (2010)

<sup>30</sup> Barsoumian S, Severin A & van der Spek T. *Eco-Innovation and National Cluster Policies in Europe – A Qualitative Review* Greenovate! Europe EEIG for the European Cluster Observatory Brussels (2011)

Countries that have an established demand for eco-solutions tend to be those that have seen a competitive 'eco-industries' sector emerge. Within the European Union, these include Austria, Belgium Denmark, Finland, Germany, France and Luxembourg<sup>31</sup>. In other countries, where the 'eco-industries' sector is less strong, the focus is more likely to be on taking a horizontal approach to eco-innovation across all sectors of the economy. This may help to stimulate demand for eco-solutions that may then, in turn, create a stronger market for an emerging 'eco-industries' sector in the future.

## Policy Approaches

The different policy instruments used can usefully be divided into demand side and supply side initiatives, and are typically used in combination, often involving networks, clusters and partnerships of public and private sector organisations. Cluster development may have an especially important role to play in addressing identified weaknesses in supply chains:

*"Internationally, competitive clusters play a vital role in bringing together – physically and virtually – large companies and SMEs, universities, research centres and communities of scientists and practitioners to exchange knowledge and ideas"<sup>32</sup>*

Clusters can formalise networking opportunities and collaborations; help to integrate supply chains; improve knowledge and information exchange; and address skills shortages amongst technology-driven businesses.

Policy can also take a "top down" or "bottom up" approach, depending on the degree of local flexibility or central direction and control exercised. Traditionally policy has often focused on large-scale projects that have emphasised the transfer of hardware<sup>33</sup>. However, increasingly, there is an interest in more small scale activity, perhaps related to transferring knowledge about specific technologies and recognising the cultural and social contexts within which the activity takes place.

The main **supply-side** policy interventions that have been identified<sup>34</sup> include:

- **Finance:** support with accessing loan or equity finance, including taking on the role of co-funder with other organisations, or being able to accept higher levels of risk with newer or more speculative technologies. Financial support in practice often dovetails with other support to help with business and technology development.
- Support with **research and development**, typically before commercialisation at scale or more widespread adoption. This might involve funding of research, support for incubation facilities and enabling of technology transfer and local adaptation.
- **Information, advice and support** services can help individual inventors, entrepreneurs and sector or place networks to develop and implement eco-innovations. Information-based policy tools can include support for eco-innovation awards.
- **Education and training**, to increase the pool of available skills and knowledge that could enable eco-innovations. Experience suggests that *generic* skills, such as mechanical engineering knowledge and skills can play an important role, if people

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<sup>31</sup> Source: EIO .*The Eco-Innovation Challenge: Pathways to a resource-efficient Europe*. Eco-Innovation Observatory. Funded by the European Commission, DG Environment, Brussels. (2010)

<sup>32</sup> Source: *A Resource Efficient Europe – Flagship Initiative of the Europe 2020 Strategy* European Commission (2011)

<sup>33</sup> OECD *Sustainable Manufacturing and Eco-Innovation - Framework, Practices and Measurement – Synthesis Report* OECD (2009)

<sup>34</sup> Source: Kletzan-Slamanić D; Andreas Reinstaller A; Unterlass F & Stadler I. *Assessment of ETAP Roadmaps with Regard to their Eco-innovation Potential: Final Report: Part 1 – Analysis of Country Roadmaps*. Austrian Institute of Economic Research for the OECD Environment Directorate (2009)

are to be able to acquire more *specific* ones related to the technology, product or process in question.

**Demand-side** policy measures<sup>35</sup> typically relate to the ways in which governments – national or local/regional – shape the markets for eco-innovations. The main types of policy here include:

- **Legal regulation and standards** are fundamental to shaping market expectations, and potential eco-innovators especially need a high degree of predictability and certainty to commit to major investments.
- **Government procurement rules** also play an important role, given the scale of government contracts. “Green procurement” methods and the procurement of public services requiring eco-innovations are especially relevant here.
- **Intellectual property law** and the extent to which it is enforced can also drive markets for eco-innovations. Strong protection regimes are believed to encourage technology transfer and adaptation (inward and outward) by increasing the confidence of the IP owner that their rights will not be infringed.

Other demand-side measures include eco-labelling or energy labelling schemes; differential tax rates; VAT reductions or exemptions; subsidies; scrapping premiums; feed-in tariffs; white/green certificates; and public awareness campaigns<sup>36</sup>.

A further typology that can be used to classify policy interventions is identified by <sup>1</sup> Bleischwitz et al (2009). This includes:

- **Information based tools**, which may include supporting eco-innovation awards and education and awareness initiatives;
- **Incentive based instruments**, such as product labelling and negotiated environmental agreements; and
- **Direct regulation**, such as public procurement rules, licensing and obligations<sup>37</sup>.

### **What this Means for Collaboration**

How and why businesses collaborate is cultural and economic, as well as environmental. Businesses need to be clear about their economic rationale for engaging in partnerships, but to understand that approaches to eco-innovation are not uniform internationally. Eco-labelling schemes and networks can help to develop a collective identity and market advantage for participating companies, whilst responding to and influencing changes in how public sector bodies procure services, so that they favour eco-innovating businesses, requires a collective approach and a common voice.

Some cultures operate a ‘bottom up’ approach to eco-innovation that encourages businesses to collaborate and seize the agenda on their own terms. Such a ‘small government’ approach fits well with companies that want to innovate and to collectively set the eco-innovation agenda themselves. Top down approaches may provide more certainty, but can mean that businesses are responding to, rather than leading on public policy approaches to business and eco-innovation development, a pattern that doesn’t always win favour with creative and innovative businesses.

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<sup>35</sup> *ibid*

<sup>36</sup> Source: COWI: The Potential of Market Pull Instruments for Promoting Innovation in Environmental Characteristics Director General, Environment, European Commission (2009)

<sup>37</sup> Bleischwitz R, Giljum S, Kuhndt M, Schmidt-Bleek F et al. *Eco-innovation – putting the EU on the path to a resource and energy efficient economy*. Wuppertal Institute for Climate, Environment and Energy, European Parliament, Brussels (2009)

### 3.3 Examples of Interventions and Initiatives

Below are a series of examples of interventions and initiatives that have or are being used to encourage eco-innovation across different countries. They seldom exist explicitly to foster collaboration and, in many cases, the role of public sector organisations and government agencies is critical. However, whether it is through grant programmes, knowledge exchange networks, labelling or excellence award schemes, they are all aimed at bringing businesses (and others with an interest in eco-innovation) together. Some of these might operate quite locally, whilst others operate nationally and internationally. Overall, they emphasise the importance of 'belonging' or engaging with others with a shared interest in eco-innovation.

#### **The United States**<sup>38</sup>

The United States Environmental Protection Agency (EPA) has a particular focus on collaboration and shared responsibility. The US approach to eco-innovation is decentralised and encourages "multiple forms of collaboration". Technological innovation is acknowledged to be a collaborative venture and there are a wide range of programmes that are aimed at providing incentives to innovate. Leveraging resources and sharing expertise are considered key success factors.

**The National Centre for Environmental Innovation (NCEI)**<sup>39</sup> runs a network of ten regional offices and works at firm level to lever resources and to share experience. The National Renewable Energy Laboratory organises industry growth forums, which bring together clean energy companies, venture capitalists and senior business executives to "catalyse learning about business growth strategies and facilitate strategic business partnerships". There are now more than 13,000 firms and other organizations participating in EPA Partnership Programs, under the following categories: Agriculture; Air Quality; Energy Efficiency and Global Climate Change; Pollution Prevention; Product Labeling; Technology; Transportation Programs; Waste Management; Water. In addition, the EPA runs Regional partnership programs.

**The National Environmental Performance Track**<sup>40</sup>, led by the Environmental Protection Agency provides networking opportunities through regional round tables, member events, joint workshops to its 470 members. Applicants to join the NPT must have an Environmental Management System in place; have a track record of compliance with environmental laws, be able to demonstrate past environmental achievements; and be prepared to share their accomplishments with the public. The EPA claims that the programme has helped to foster a more collaborative and constructive dynamic.

**The Clean Energy Technology Export Program (CETE)**<sup>41</sup> aims to address export barriers to global markets. It includes an outreach, information sharing and co-ordination service; developing tools to enable companies to address issues that they cannot address alone; and partnership development, institutionalising contacts and fostering regular collaboration, such as forums for venture capitalists and new technology companies.

**The Small Business Innovation and Research Program (SBIR)**<sup>42</sup> The Office of Technology administers the Small Business Innovation Research (SBIR) Program and the Small Business Technology Transfer (STTR) Program. Through these two competitive programs, SBA ensures that the nation's small, high-tech, innovative businesses are a significant part of the federal government's research and development efforts. Eleven federal

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<sup>38</sup> Eco-Innovation Policies in the United States. OECD (2008) Environment Directorate

<sup>39</sup> <http://www.epa.gov/partners/index.htm>

<sup>40</sup> <http://www.epa.gov/performancetrack/>

<sup>41</sup> <http://usgreentechnology.com/stories/u-s-associations-push-clean-energy-technology-exports/>

<sup>42</sup> <http://archive.sba.gov/aboutsba/sbaprograms/sbir/index.html>

departments participate in the SBIR program; five departments participate in the STTR program awarding \$2billion to small, high tech businesses

**Federal and State Technology (FAST) Partnership Program**<sup>43</sup> provides technical assistance to small high technology businesses. It provides grants for research and development; technology transfer, diffusion and deployment; establishing consortia and mentoring networks

## Brazil

In Brazil<sup>44</sup> there is an **Innovation Law** (Law 10973/2004) that provides fiscal incentives to finance partnerships between private sector businesses, universities, government departments and research centres; an **Asset Law** aimed at providing R&D incentives; and a **Productive Development Policy** aimed at enhancing Brazilian exports. The Clean Development Mechanism, which allows businesses to purchase carbon credits generated by projects hosted in developing countries has led to a number of energy conservation, biomass, methane and waste management projects in Brazil<sup>45</sup>.

## Japan<sup>46</sup>

Japan is considered to be a “world leader” in eco-innovation. Over 20,000 Japanese companies have been ISO 14001 certified and the trend is for certification to extend from larger to smaller companies and from manufacturing to service sector businesses. Japan recognises that innovations are not realised by technological innovations alone – they need to be appreciated and embraced by consumers.

There is a heavy reliance on public support for Research and Development and there are several funds and initiatives that promote the R&D phase of environmental technologies.

**The National Institute of Advanced Science and Technology (AIST)**<sup>47</sup> has created a system of technology transfer that is aimed at contributing to more advanced industrial activity and the creation of new industries based on intellectual property created at the Institute. The patent rights of an invention originating from an AIST researcher are transferred to AIST, which then searches for an implementing company through a technology licensing office (TLO).

The **Eco Mark Program**<sup>48</sup> is aimed at certifying and spreading eco-friendly products, based on a set of standards that are agreed by a committee of academics, governments, consumer groups and industry experts. The Eco Mark is labelled on products that have less environmental impact compared to similar products during the entire product development lifecycle. By 2008, more than 4,000 products had been certified.

**The Green Purchasing Network**<sup>49</sup> aims to promote the concept and practices of green purchasing, by producing guidelines for purchasers of a range of products. The International Green Purchasing Network, which was launched in 2005 has internationalised this approach and provides a vehicle through which information and best practice examples can be shared.

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<sup>43</sup> [http://archive.sba.gov/idc/groups/public/documents/sba\\_homepage/sba\\_fast\\_program\\_annnc.pdf](http://archive.sba.gov/idc/groups/public/documents/sba_homepage/sba_fast_program_annnc.pdf)

<sup>44</sup> Seroa da Motta R. Eco-Innovation in Brazil. Global Forum on Environment on Eco-Innovation. OECD (2009)

<sup>46</sup> Eco-Innovation Policies in the Japan. OECD (2008) Environment Directorate

<sup>47</sup> [http://www.aist.go.jp/aist\\_e/about\\_aist/index.html](http://www.aist.go.jp/aist_e/about_aist/index.html) (see also section 4.9 of this report)

<sup>48</sup> <http://www.ecomark.jp/english/>

<sup>49</sup> <http://www.japanfs.org/en/pages/026007.html>

**The Top Runner Programme**<sup>50</sup> is an internationally acclaimed programme that is recognised as having successfully encouraged innovation in a range of areas. It sets energy efficiency targets at industry level. Standards have been set for passenger vehicles, air conditioners, electric refrigerators, freezers, TV sets, computers, copying machines and a range of other products.

When a manufacturer produces an appliance with the best energy efficiency performance (during use-phase) within its Top Runner category, all other appliances are required to reach that level within an agreed time scale. If the required level is achieved or surpassed before the deadline, the process can start again, and the cycle continues. If manufacturers or importers do not meet the targets, the government makes recommendations, which can be enforced in the event of further non-compliance.

What distinguishes Top Runner from other regulatory standard setting programmes is the process and active engagement of all relevant actors in the target value and timescale setting stage. In this way importers and manufacturers buy-in to the scheme, share the regulatory burden, and are incentivised to make improvements beyond the agreed targets

## **Australia**<sup>51</sup>

Many eco-innovation initiatives relate to funding, but there are also a large number of voluntary labelling schemes.

**Greenhouse Challenge Plus**<sup>52</sup> was a joint initiative between the Australian Government and industry to encourage greenhouse gas abatement; improve greenhouse gas management; improve emissions measurement and monitoring; and strengthen government/industry information sharing. Members included large and small public and private organizations from almost every business sector. Participants signed agreements with the Government that provided a framework for undertaking and reporting on actions to reduce greenhouse emissions. Challenge Plus delivered an expanded industry partnership program that integrated greenhouse issues into business decision making, further reducing greenhouse gas emissions, and accelerating the uptake of energy efficiency. The program lapsed in June 2009.

**The Banksia Eco Innovation Awards**<sup>53</sup> are awarded for outstanding projects practices and programs that result in increases in energy efficiency and reduction in resource use. The Banksia Environmental Foundation aims to raise the profile of the current environmental issues facing Australia and recognise those whose initiatives are an encouragement and an example for others to follow. The Awards provide winners and finalists with public recognition and acknowledgement that can be utilised to attract funding, public support.

## **Korea**<sup>54</sup>

Eco-innovation funding seems to have shifted from research and development towards the deployment and commercial phase, focusing on creating demand and raising awareness, with a strong focus on eco-labelling.

**Regional Environmental Technology Development Centres**<sup>55</sup> are based within universities and provide an example of collaboration between industry, the university sector

<sup>50</sup> <http://www.leonardo-energy.org/drupal/node/991>

<sup>51</sup> Eco-Innovation Policies in the Australia. OECD (2008) Environment Directorate

<sup>52</sup> <http://www.environment.gov.au/archive/settlements/challenge/index.html>

<sup>53</sup> <http://www.banksiafdn.com/the-awards.html>

<sup>54</sup> Source: Eco-Innovation Policies in the Korea. OECD (2008) Environment Directorate

and government (and non-government agencies). The centres identify and analyse local environmental pollution, develop environmental technologies, provide environmental education to businesses, disseminate new environmental technologies and hold joint seminars.

The **Environmentally Friendly Company Certification System**<sup>56</sup> encourages enterprises to voluntarily make efforts to improve the environment by assessing their influences on the environment in the entire business process by setting concrete goals to develop cooperative partnerships. The government provides environmentally-friendly companies with: exemption from regular training and inspection, the ability to report the installation of emission facilities instead of the need to request them, and offers of environmental technology support and loans. This led to the establishment of The Korean Association of Environmentally Friendly Companies<sup>57</sup>.

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<sup>55</sup> <http://www.oecd.org/dataoecd/46/34/37544374.pdf>

<sup>56</sup> [http://eng.me.go.kr/content.do?method=moveContent&menuCode=pol\\_pol\\_com\\_enterprises](http://eng.me.go.kr/content.do?method=moveContent&menuCode=pol_pol_com_enterprises)

<sup>57</sup> [www.ef21.co.kr](http://www.ef21.co.kr)

## 4.0: Case Studies

In this section we provide examples of good practice in collaborative eco-innovation from around the world, briefly describing each initiative and highlighting the key lessons that they may contain for collaborative eco-innovation activity more generally.

The case studies identified are considered to be successful in that they deliver eco-innovation, in the form of new products, services, processes successfully taken to market or mainstreamed. This success is shaped by the ability of a given organisation, network or partnership to effectively respond to the drivers of eco-innovation (summarised in Section 3 of this report).

### 4.1 Fundacion Chile

#### Key Lessons

Fundacion Chile addresses organisational and network drivers by supporting the creation of new companies and providing them with the necessary networks and support to develop from incubation through to production, when firms are often sold off.

From a technology perspective, the focus is especially on transfer and local adaptation in pre-determined clusters and technology areas. It delivers direct impact (new businesses, technology deployed, etc) and indirect value through, for example, capacity building and dissemination.

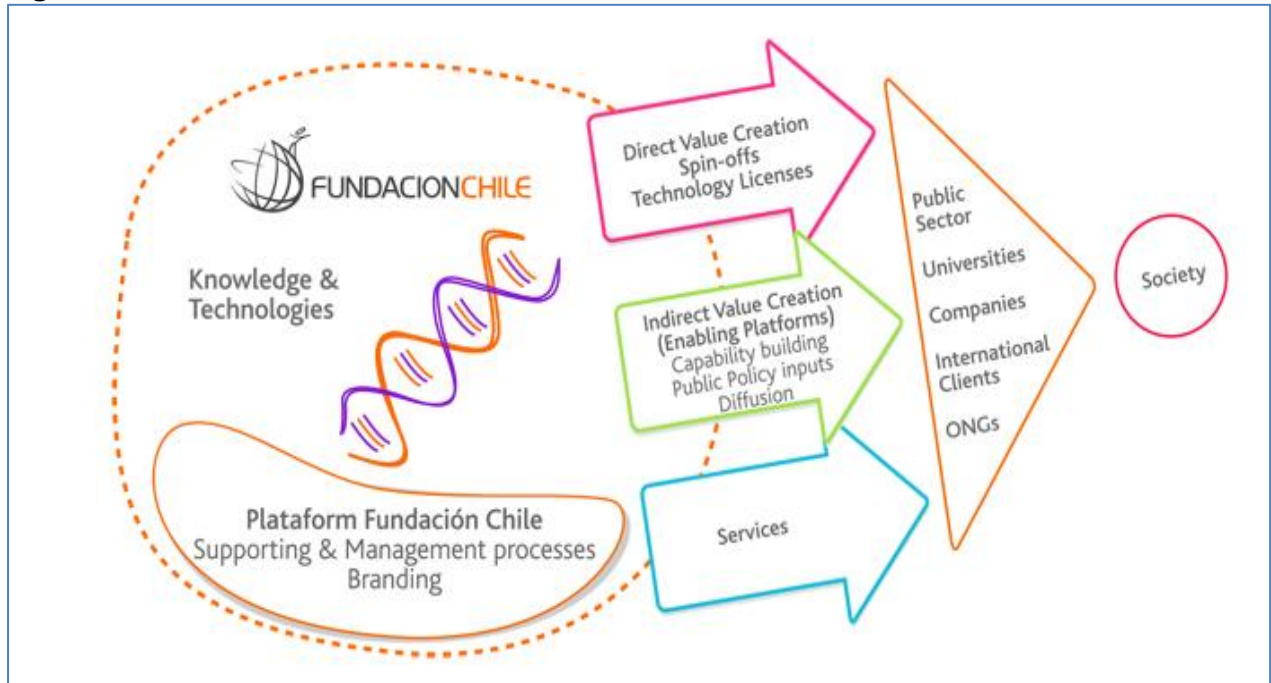
Such an approach takes a flexible approach to collaboration, enabling companies to find the right partners and to share knowledge with others in specific sectors and at the different stages of the innovation process.

Fundacion Chile was originally established by the Chilean government and the American corporation ITT. It is now is an independent national agency that works to develop a portfolio of products and services related to technology transfer and innovation, including eco-innovation related ones, through the Fundacion's innovation model (see Figure 4.1 below) which includes:

- National and international networks that can provide access to knowledge, finance, strategic partners and distribution channels.
- A “platform” based on knowledge clusters (agro-industry, forestry, human capital, environment, energy and education) and enabling technologies (financial engineering, ICTs, chemistry, biotechnology, environmental technologies, food technologies and bioprocesses).
- Mainstreaming new innovations via “direct value creation” (spin-offs, technology licences), “indirect value creation (capacity building, informing policy and dissemination), and the provision of services.
- Delivers impact on society via the public sector, universities, companies, international clients and NGOs.



**Figure 4.1: Fundacion Chile Innovation Model**



Source: <http://www.fundacionchile.com/en/quienes-somos/nuestro-modelo/>, accessed 19 October 2011

The Fundacion has a portfolio of companies, each located in one of three stages, “incubation, scaling and production” (see Figure 4.2 below). New companies are usually sold off when they mature at the “production” stage.

**Figure 4.2: Fundacion Chile’s Portfolio of Companies**

PORTAFOLIO ACTUAL DE EMPRESAS					
INCUBACIÓN		ESCALAMIENTO	EN PRODUCCIÓN		
INNOVAFOODS	GENVITIS	GTN LA	INACUI	SURAUSTRAL	SIF
BIOENERCEL	ECOSEA	PHYTOMEDICS	TECHNOPRESS	SRC	MULTIFLORA
BIOFRUTALES	GENÓMICAFORESTAL		GENFOR	OLEOTOP	ECOPELLETS
			QTECH	GCL	
			NEOSYLVA	CULTIMAR	
				ALIMTEC	

Source: <http://www.fundacionchile.com/en/quienes-somos/portafolio/>, accessed 19 October 2011.

Activities include eco-innovation (eg: GTN Latin America which specialises in geothermal energy), but also the development and application of other technologies like genetically modified organisms (eg: Genfor, which develops genetically modified trees and Genvitis, a developer of GM vines).

## 4.2 Recycla Chile SA

### Key Lessons

Recycla Chile highlights that eco-innovation can also apply to social enterprises, delivering benefits for businesses (reputation, compliance and quality), socially (staff are mainly ex-offenders) and environmentally (e- and other waste is recycled responsibly rather than landfilled or processed in health and ecologically harmful ways).

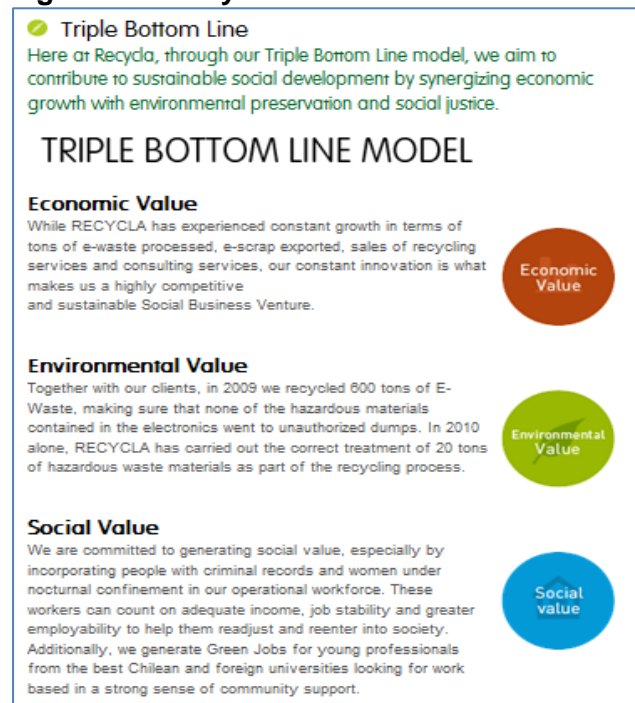
Securing start-up finance was a challenge, and this had to come from progressive investors in the US and a Chilean state economic development agency.#

This example shows how innovative enterprises can enhance their profile and reputation and lead the eco-innovation agenda across different sectors of the economy through consultancy and standards certification.

Recycla Chile is a highly regarded social enterprise and SME which has attracted praise from many quarters, including World Economic Forum, The Schwab Foundation and the Chilean President, who has described the company as a good example of “multiple innovation”, given its ability to address social, environmental and business needs<sup>58</sup>. The company recycles e-waste and non-ferrous waste, with a workforce of ex-offenders, while also providing consulting and standards certification services to business.

The innovative nature of the company is two-fold: it uses advanced recycling technologies and processes currently only used in some northern European countries, and its business model explicitly seeks to address social, environmental and business needs (see Figure 4.3 below) through a “triple bottom line” approach.

**Figure 4.3: Recycla Chile SA Business Model**



Source: <http://www.recycla.cl/en/main/empresa/51>

<sup>58</sup> <http://www.recycla.cl/en/main/noticia/88>

Start-up finance was a key initial challenge and funding was secured from private investors in New York and from a program of Chile's national state economic development agency, Corfo.

### 4.3 Bloomberg New Energy Finance

#### Key Lessons

The market, regulatory and technological complexities of eco-innovation activities mean that reliable and high quality information is needed to inform technology choices and investment decisions. Bloomberg is a global specialist provider of such information, but access to other sources of knowledge (such as smartplanet.com or national, regional or local sector or place-based networks) can also be essential.

This example emphasises the importance of intelligence sharing and awareness raising in developing and sharing eco-innovation knowledge across different sectors of the economy.

Bloomberg LP acquired New Energy Finance to create Bloomberg Energy Finance in 2009, with the global clean energy investment market reaching \$240bn in 2010 (from \$52bn when the firm was originally established in 2004)<sup>59</sup>. By providing accurate, timely, and complete information and analysis the company aims to support the long term success of the clean energy sector. Bloomberg Energy Finance analyses and publishes intelligence about emerging energy markets (including renewable energy, carbon markets, energy smart technologies, carbon capture and storage, renewable energy certificate markets and nuclear power) and has a team of 200 analysts, researchers, reporters and others around the world.

The key function of the company is to provide an accurate basis for investment decisions related to eco-innovation in the field of clean energy through a range of services (see Figure 4.4 below).

Figure 4.4: Bloomberg New Energy Finance Services

**Services structured to meet your needs**

Bloomberg New Energy Finance delivers a range of subscription-based services including research, investment data and news on the clean energy industry and carbon markets. We work to give you the timely information and analysis to help drive organisational performance. With our services, you can be confident that you are making decisions based on the best information available.

By building strong relationships with stakeholders in clean energy and the carbon markets, we are able to see the industry from all angles and create a service that meets the needs of our diverse global client base. When clients subscribe to our services, they join the industry's inner circle. Our services are designed to support your entire team.

As you build your business. From understanding the landscape to exploiting opportunities, we help you anticipate the markets and verify and execute your decisions.

Our services are not simply to explain the present - they anticipate the future. We can help you to identify emerging opportunities and challenges facing your business, evaluate risks and identify potential new markets and partnerships.

**Insight**  
To give our clients insight and up-to-the-minute analysis to support their strategic decisions, we provide robust and up-to-date analysis on the key issues facing the sector: policy, energy markets, economics, supply chain factors, technology and finance.  
TO FIND OUT MORE, GO TO [INSIGHT](#) >>

**Industry Intelligence**  
Our industry intelligence portal gives access to the most up-to-date information on investment activity across the industry, covering transactions, deals, projects and companies, together with powerful report-generating and analytical tools to inform financial, strategic and operating decisions.  
TO FIND OUT MORE, GO TO [INDUSTRY INTELLIGENCE](#) >>

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**Indexes**  
Benchmarks for clean energy and the carbon markets.

Source: <http://bnef.com/services/>, accessed 20 October 2011

<sup>59</sup> *Bright Green Book: 100 Initiatives that are Greening the World*, ILED Instituto Brasil and Forum das Americas, 2011, <http://www.brightgreencities.com/v1/en/category/bright-green-book/>, accessed 19 October 2011.

These are insight (analysis to support strategic decisions); industry intelligence (using standard reporting and analytical tools); news and briefing (news coverage and alerts from expert journalists around the world); applied research (select consulting, custom research and data-mining work for clients); and indexes (benchmarks for clean energy and the carbon markets). These services are used globally by over 500 clients who are investors, energy market participants, supply chain players, and governments and multilateral agencies.

IBM's [www.smartplanet.com](http://www.smartplanet.com) provides a more general awareness raising service about new technologies (including eco-innovations) from around the world and their potential.

## 4.4 Vantage Point Capital Partners

### Key Lessons

This case study shows the important role that venture capitalists can play in eco-innovation, not just by making available necessary investment funds, but in bring knowledge of technology and the operating environment, and access to markets, as well as to specialised partners and networks that can support fledgling initiatives.

This example demonstrates how collaborating with larger, international companies can validate companies' innovations and open up opportunities in new markets.

The US based Vantage Point works across three sectors – clean technology, information technology and health care – and combines the capital, technology, people and partners needed for what it describes as “transformative companies for a new economy”, supplying portfolio companies with capital, but also internal experts, external advisors and world-class Strategic Partners to provide specialist guidance in finance, human capital, legal, marketing, science, portfolio management and more<sup>60</sup>.

The company's internal team of specialists are experts in the fields of energy, lighting, water, materials and transportation. Strategic relationships with ten of the world's most influential corporations (eg: BP, Air Products and Du Pont) with an interest in clean tech have also been established, given their ability to open up growth opportunities through the validation of new technologies, definition of markets, and serving as distribution channels.

The clean tech portfolio is centred on key global issues - resource scarcity, industry modernization, energy security, and climate change – and is mainly comprised of US companies, along with some from the UK, Canada, Sweden and Taiwan. Portfolio companies' activities include power generation, transportation, Smart Grid, power management, energy storage, water or materials.

## 4.5 General Electric

### Key Lessons

Large corporations can also drive eco-innovation, outside the immediate organisation, as well as from within. GE, for example, is investing in major R&D assets, like its new Rio de Janeiro Research Centre, and is encouraging access by innovators and entrepreneurs to venture capital, networks and expertise through a global competition.

This example shows the benefits that can accrue to smaller organisations by

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<sup>60</sup> <http://www.vpcp.com/approach>

becoming involved in networks established by global players, which have the resources and the global market reach to attract the best innovators to engage with each other through competitions and collaborative networks.

Large multinational companies can play a significant role in eco-innovation through their research and development activities. These can include major investments like GE Global Research's new \$500m Research Centre in Rio de Janeiro (see Figure 4.5 below), which will focus on transportation and renewables, enabling technology transfer and the development of new technologies tailored to local needs (in this case the Latin American market).

**Figure 4.5: GE's New Rio de Janeiro Research Centre**



Source: <http://brazilcenter.blog.com/2011/02/16/research/>

GE's own commitment to more sustainable business practices extended into the Ecoimagination Challenge, where inventors and entrepreneurs were invited to compete for venture capital funding from major investors including Emerald Technology Ventures, Foundation Capital, KPCB and Rockport Capital, and technical support from the Carbon Trust.

## 4.6 Khosla Ventures

### Key Lessons

In many ways Khosla operates like many other venture capital companies, but aims to engage with potentially transformational new technologies from small and new companies, which it believes are far more innovative than large organisations. It is prepared to take more of a long view and aims to hedge its investments to allow for unexpected market developments.

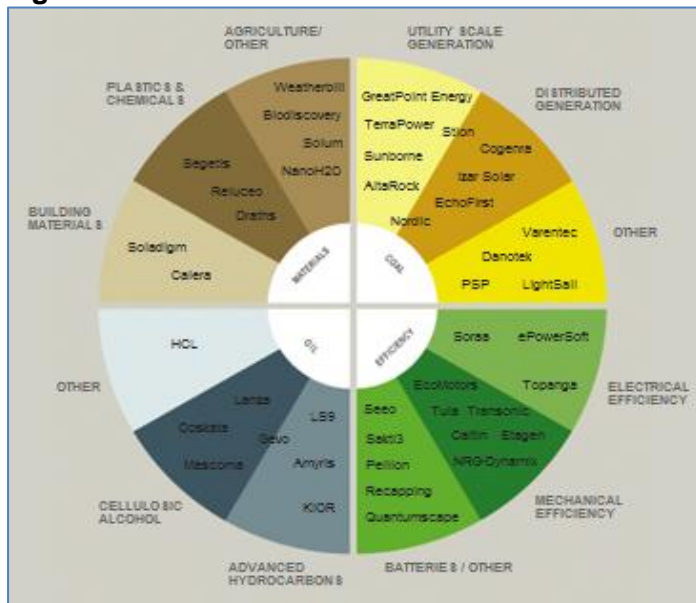
This example shows the value of collaborating with the right investors, who may take a different approach to investment, recognising that innovation is borne out of experimentation (and sometimes failure).

Khosla Ventures considers itself to be more of a "venture assistant" than a venture capital company. It has a main fund that supports early- and late-stage investments and a seed fund for developing very early-stage experiments. The focus is on next-generation energy

projects, new materials, mobility, the Internet and silicon technology. The clean tech portfolio is substantial (see Figure 4.6 below) and covers 12 sub-sectors.

The company’s philosophy is that significant innovation seldom comes from large corporations or public sector bodies, and that investment portfolios in new ventures should be seen as “insurance”, “opportunity” or “option value” given the many and unexpected changes that may lie ahead, and not be over-reliant on mainstream measures like earnings per share and subject to bureaucratic development processes<sup>61</sup>:

**Figure 4.6: Khosla Clean Tech Portfolio**



Source: <http://www.khoslaventures.com/khosla/cleantech.html>, accessed 20 October 2011.

Encouraging innovation means creating environments such that people are free to fail often. The smart way to do this is to help them fail small and fail early and encourage them to try again. In our portfolio, we’d much rather take fifty \$20M bets than one \$1B bet. Large companies tend to do the latter because they want to go big in markets they know are big.

## 4.7 LOMADEF

**Key Lessons**

LOMADEF (and other agricultural initiatives in, for example, Spain and Brazil) underline the importance of public sector support, promotion, education and finance in mainstreaming eco-innovations in the landbased sector through place-based networks.

This example shows the importance of engaging with Government agencies that have been established to share best practice and to develop collaborative partnerships for training and promotional activities.

Lipangwe Organic Manure Demonstration Farm (LOMADEF) was established in Malawi in 1980 to support hundreds of farmers to produce organic fruit and vegetables using traditional composting and rotation-based farming methods. LOMADEF adopted an outreach model to disseminate good practice based on carefully selecting Agricultural Advisors on the basis of

<sup>61</sup> *Innovation – An Entrepreneur’s Perspective*, Vinod Khosla, Khosla Ventures, August 2011. [http://www.khoslaventures.com/presentations/Innovation\\_9\\_8\\_11.pdf](http://www.khoslaventures.com/presentations/Innovation_9_8_11.pdf), accessed 20 October 2011

their innovative approach to farming, training them in sustainable farming techniques and in communication and facilitation skills so they could pass on their learning to fellow farmers. By producing food organically, producers are less vulnerable to high fertiliser and pesticide prices. The Malawian Ministry of Agriculture has also recognised the benefits of the approach in terms of preserving and intensifying soil fertility<sup>62</sup>.

Supported networks of organic food growers have also been developed in other parts of the world. In Spain's **Basque Country**, for example, The Organic Agriculture Development Plan (2009-2012)<sup>63</sup> is based upon developing a more detailed picture of the market for organic food, support with marketing and measures to develop skills and knowledge among producers. In Cidade de Joao Pessoa, Brazil the **Cinturao Verde** (Green Belt) project promotes organic family farming through promotional activities, support, finance and training<sup>64</sup>.

## 4.8 SymbioCity

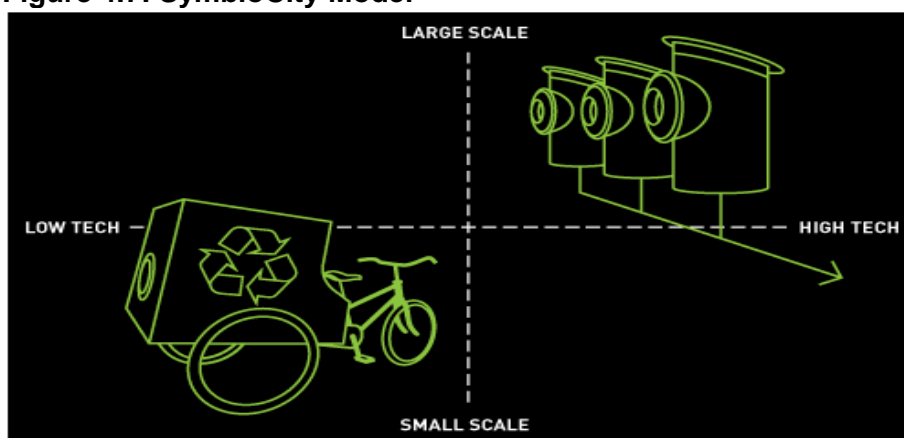
### Key Lessons

SymbioCity shows the potential of place-based approaches in delivering an integrated programme of eco-innovations in a given locality to address policy priorities such as reducing carbon and ecological footprint and increasing energy efficiency. Creating such "closed loop" systems needs to involve big players like local authorities and utility companies, but the place-based networks created also involve SMEs and can boost the local economy.

This example shows the benefits of small businesses of getting involved in spatial approaches to eco-innovation, creating new opportunities for local businesses and developing new networks and supply chains.

Sweden's SymbioCity develops place-based approaches which integrate a number of sustainability initiatives to create closed resource/waste loops along the lines of industrial ecology, creating an array of collaborative opportunities, involving large and small organisations, and high and low-tech approaches (see Figure 4.7 below).

**Figure 4.7: SymbioCity Model**



<http://www.symbiocity.se/en/Concept/Scalable-solutions/>

<sup>62</sup>[http://www.theecologist.org/how\\_to\\_make\\_a\\_difference/food\\_and\\_gardening/517421/malawi\\_reaps\\_the\\_reward\\_of\\_returning\\_to\\_ag\\_eold\\_chemicalfree\\_farming.html](http://www.theecologist.org/how_to_make_a_difference/food_and_gardening/517421/malawi_reaps_the_reward_of_returning_to_ag_eold_chemicalfree_farming.html)

<sup>63</sup> [http://www.infoagro.com/noticias/2009/4/8975\\_nuevo\\_plan\\_desarrollo\\_agricultura\\_ecologica\\_pais\\_v.asp](http://www.infoagro.com/noticias/2009/4/8975_nuevo_plan_desarrollo_agricultura_ecologica_pais_v.asp)

<sup>64</sup> *Bright Green Book: 100 Initiatives that are Greening the World*, ILED Instituto Brasil and Forum das Americas, 2011, <http://www.brightgreencities.com/v1/en/category/bright-green-book/>, accessed 19 October 2011.

In Enköping<sup>65</sup>, for example, this involved a unique biocycle process that produces renewable energy via a system linking the municipal heating and sewage treatment networks with local farms, providing combined heat and power for all the town's 20,000 homes. Cooperation between different partners is at the heart of the Enköping model. The municipality works closely with local farmers, who grow the salix crops and use the ash left behind after biomass incineration as agricultural fertiliser.

Area-based sustainability initiatives can drive eco-innovation and offer much scope for sharing of good practice across local areas and municipalities. The Global Mayors' Forum, for example, provides a platform for the sharing of good practice in local eco-innovation and sustainable development<sup>66</sup>.

## 4.9 METI (Japan)

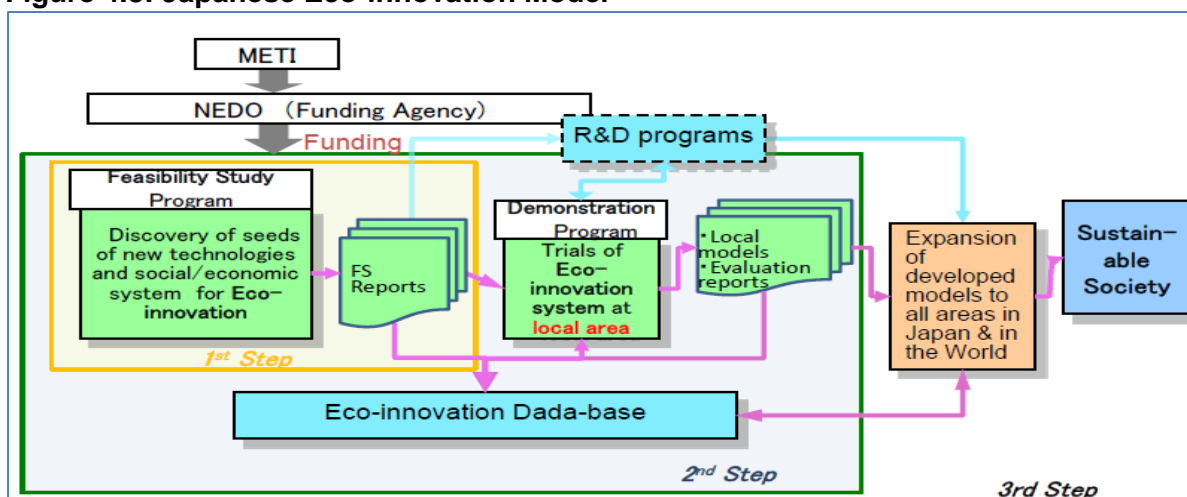
### Key Lessons

The Japanese state's "end-to-end" approach to discovering, developing and deploying new technologies is a very systematic approach, which includes an expert technology licensing function and use of national quality marks.

This represents a good example of how small research companies and implementation companies can be brought together through an intermediary (METI) for mutual benefit.

The Ministry of Economy, Trade and Industry (METI) eco-innovation initiative in Japan is geared towards industrial development<sup>67</sup>. The National Institute of Advanced Industrial Science and Technology (AIST) has created a system for technology transfer (see Figure 4.8 below) which contributes to more advanced industrial activity and the creation of new industries based on the intellectual property created through R&D at the Institute. The patent rights of an invention originating from an AIST researcher are transferred to AIST, which, in turn, searches for an implementing company through the services of a technology licensing office (TLO).

Figure 4.8: Japanese Eco-innovation Model



Source: <http://www.oecd.org/dataoecd/46/29/41504023.pdf> (Lower blue box should read "data" base, not "dada base")

<sup>65</sup> <http://www.symbiocity.se/en/Cases/Enköping-Municipality/>

<sup>66</sup> <http://www.globalmayorsforum.org/a/Sustainable%20Practice%20Zone/>

<sup>67</sup> *Eco-innovation Policies in Japan*, OECD (2008). <http://www.oecd.org/dataoecd/27/15/42876953.pdf>, accessed 25 October 2011



When AIST staff creates new ventures, the ventures are accredited as AIST ventures, and the Institute may choose to offer support such as preferential use of facilities and reduced royalties.

## 4.10 UK Carbon Trust

### Key Lessons

The Carbon Trust focuses on specific low carbon technology areas, based on its detailed understanding of market trends, and then is especially active supporting market development and providing a wide range of support (including finance, knowledge & skills, networks, technology licensing) for start-ups and small companies to achieve their “next big step”.

The key lesson here is the benefit of companies engaging with wider networks through established organisations that can facilitate collaboration. Such an approach is likely to be less risky than ‘open market’ approaches to collaboration.



The UK's Carbon Trust works with industry and academia to accelerate the development and deployment of low carbon technologies<sup>68</sup>. It targets support where it can make the biggest difference.

There are customised projects for particular low carbon technologies, while “Technology Accelerators” aim at opening markets for low carbon technologies. “Research Challenges” are about commercialising promising technologies which have not yet entered the market.

Current work is focused on 11 low carbon technology areas:

- Polymer fuel cell challenge
- Algae biofuels challenge
- Pyrolysis challenge
- Advanced photovoltaic challenge
- Micro-combined heat and power accelerator
- Industrial energy efficiency accelerator
- Offshore wind accelerator
- Marine renewables proving fund
- Biomass heat accelerator
- Low carbon buildings accelerators
- Marine energy accelerator

The objective of the Carbon Trust Incubator<sup>69</sup> is to help promising early stage UK companies achieve the ‘next big step’ in their development, by raising finance, securing licence deals or partnering with a major player in their market. The Trust works with companies that have

<sup>68</sup> <http://www.carbontrust.co.uk/emerging-technologies/current-focus-areas/pages/default.aspx>

<sup>69</sup> <http://www.carbontrust.co.uk/about-carbon-trust/case-studies/low-carbon-transport/pages/evoelectric.aspx>

developed innovative technologies and services that demonstrate exceptional commercial and carbon saving potential, with a commitment to high growth. The Incubator project involves delivering consulting support, specialised training events and facilitating strategic partnerships across a wide range of technologies and markets.

ACAL Energy<sup>70</sup>, for example, is a recent start-up company which uses alternative more cost-effective catalysts as part of fuel cell technologies for energy generation, in a new market which is expected to be worth £180bn by 2050. ACAL Energy started working with the Carbon Trust as part of the Trust's Business Incubator Programme in 2006. In 2011 year they were selected for a £1 million investment as part of the Carbon Trust's Polymer Fuel Cell Challenge. The Polymer Fuel Cell Challenge was launched in 2009 to deliver the critical reduction in fuel cell system costs that must be achieved to make mass market deployment a reality.

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<sup>70</sup> [http://www.carbontrust.co.uk/\\_layouts/ctassets/asp/publications/downloadpublication.aspx?id=CTS284&returnUrl=http://www.carbontrust.co.uk/Publications/pages/publicationssearch.aspx?q%3dCTS284%26pn%3d0%26ps%3d10](http://www.carbontrust.co.uk/_layouts/ctassets/asp/publications/downloadpublication.aspx?id=CTS284&returnUrl=http://www.carbontrust.co.uk/Publications/pages/publicationssearch.aspx?q%3dCTS284%26pn%3d0%26ps%3d10)

## 5.0: Conclusions and Recommendations

Eco-innovation is a complex and wide-ranging field, involving a range of policies and practices that reflect different industries and local contexts. There is no universally agreed definition of what constitutes eco-innovation and approaches that are adopted can be influenced as much by culture as by environmental factors.

There needs to be a strong alignment between economic competitiveness and environmental efficiency for businesses to eco-innovate. The immaturity of the market place; gaps in supply chains; and uncertain timescales for returns on investment can make engagement difficult.

The role that state agencies can have in helping to carry investment risks and stimulate the eco-innovation market should not be underestimated. Furthermore, longer term social and environmental benefits can sometimes seem more transparent than shorter term, company-level commercial ones.

To this extent, some countries are clear 'market leaders'. They take a national (or international), strategic approach to eco-innovation that sees the development of an eco-industries sector as providing long term competitive advantage by stimulating domestic demand for eco-innovation products and services across different sectors.

A bottom-up approach may provide good individual examples of collaboration, but government agencies and larger organisations can influence behaviour through a range of measures that include regulation and standards, procurement rules, awards and competitions, targeted funding, network development and information, advice and guidance.

The numerous barriers to eco-innovation mean that addressing one aspect (such as collaboration) in isolation is unlikely to be appropriate. This is why many of the examples provided in this report address a range of issues.

### **The Role of State Agencies is Important**

Many eco-innovation initiatives involve large budgets and national or international partnerships, so the role of state supported agencies is important. The state's support for or leadership of a collaborative eco-innovation initiative can also reassure SMEs and send important market signals which are supportive of companies engaging in eco-innovation.

Only a few countries take the strategic approach to eco-innovation identified above. However, Government agencies can still take an active role in supporting collaboration by establishing and supporting networks for information, intelligence and knowledge exchange; prioritising funding so that it encourages collaboration; and acting as trusted intermediaries linking eco-innovative companies with each other, particularly where these involve transnational partnerships, where cultural factors may be a further barrier to overcome.

### **Support Needs to be at the Right Spatial Level**

At local level, state agencies may have a greater role in adopting an area-based approach (such as SymbioCity) that links businesses across different sectors under a local strategic eco-innovation umbrella. Sector or technology- based approaches are likely to need a national or international network to help businesses to prosper, unless the local area in question is home to a company cluster of national or international significance.

Where a strategic approach does not exist at national level, this report has shown that the umbrella organisations do not have to be state funded. There are good examples of where multi-national companies with global reputations have established networks for innovators and entrepreneurs to meet, and exchange knowledge and expertise. But, even here, state funded agencies may have a role in promoting these and encouraging engagement by small businesses, and local and state authorities' policies can influence inward investment decisions that would have a bearing on eco-innovation.

### **Award and Accreditation Schemes can Confer Market Advantage and Help SMEs Identify Partners**

In any market, trust and relationship-development are important. Such relationships are likely to be particularly important in eco-innovation, given its relative immaturity and the lack of universal clarity about what it actually is. Clusters and networks do not have to be established and sponsored by state agencies, but in some cases it may help.

Involvement in high profile competitions and award schemes that help to accredit products or services can enable businesses to identify trusted partners whom they can collaborate and share knowledge.

### **SMEs Need to See the Commercial, as well as Environmental Benefits of Collaborating**

In any venture, businesses need to have a clear idea of why they should collaborate. Links between commercial benefits and environmental efficiency are likely to be important for most SMEs. However, changing procurement requirements, patterns of customer demand, and higher future energy costs are expected to drive them more closely together. Collaborative approaches to address negative impacts and to derive positive advantages can share costs and spread risks for individual SMEs.

### **'Light Touch' Collaborations (Through Networks) May Lead to More Formalised Partnerships**

Collaboration can, of course, work at different levels. A loose involvement in networks to share knowledge and market intelligence may be the limit of collaboration for some SMEs. For others, more formalised collaborative arrangements may be required for joint projects, or supply chain and/or cluster development. Indeed, 'light touch' collaboration may be a precursor to more formalised engagement for many SMEs (re-enforcing the importance of network development). However, transition between different levels of collaboration may need to be supported by clear and unambiguous regulatory frameworks.

An example of where there is a concentration of companies in the Biotech sector is in Oxford. Here, a critical mass of local companies in the Oxford Biotech Network is able to support both "light" and deeper collaboration [http://www.obn.org.uk/obn\\_/index.php?r=&p](http://www.obn.org.uk/obn_/index.php?r=&p).

## Annex I: Examples of Eco-Innovation Activities

<b>Renewable energy sources</b>	<ul style="list-style-type: none"> <li>• Biomass (electricity a/o heat generation)</li> <li>• Geothermal</li> <li>• Solar photovoltaic and solar-thermal water-heating</li> <li>• Tidal energy, wave energy</li> <li>• Wind power (onshore and off-shore)</li> </ul>
<b>Water management and treatment</b>	<ul style="list-style-type: none"> <li>• Management of water resources, upgrading of infrastructure</li> <li>• Demand-side efficiency (incl. water metering, gray water recycling,)</li> <li>• Rapid analysis of drinking water and waste water</li> <li>• Online monitoring networks and automated sensing technologies</li> <li>• Restoration techniques for degraded water resources</li> <li>• Disinfection of drinking water, desalination</li> <li>• Wastewater treatment, membranes, reduction of sludge production</li> <li>• Nanotechnologies for water treatment</li> </ul>
<b>Waste management and treatment</b>	<ul style="list-style-type: none"> <li>• Effluent (incl. landfills leachates) treatment</li> <li>• High-efficiency recovery of energy and chemicals, re-use of off-gas</li> <li>• Safe disposal of dangerous substances, especially mercury</li> <li>• Composting units and biogas processing for biodegradable waste</li> </ul>
<b>Recycling</b>	<ul style="list-style-type: none"> <li>• Collection, separation and treatment for re-use or recycling of all materials, in particular plastics, polymers, tires, batteries and accumulators, end-of-life vehicles, ships and planes</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• Techniques of soil remediation</li> </ul>
<b>Environmental services and monitoring</b>	<ul style="list-style-type: none"> <li>• Analysis, including LCA, environmental surveys and expertise</li> <li>• Eco-design of products and services</li> <li>• Environmental services (such as energy contracting)</li> </ul>
<b>Conventional energy and energy efficiency</b>	<ul style="list-style-type: none"> <li>• Carbon dioxide sequestration</li> <li>• Combined heat and power</li> <li>• Fuel cells (materials, membranes, systems...)</li> <li>• Radical innovation in production processes</li> </ul>
<b>Energy distribution and storage</b>	<ul style="list-style-type: none"> <li>• Energy storage (flywheel technology, superconducting magnetic storage...)</li> <li>• High-voltage direct current (HVDC) transmission to shore</li> <li>• Environmentally-friendly Hydrogen production, storage and distribution</li> <li>• Intermediate energy vectors (ethanol, methanol...)</li> </ul>

<b>Industry</b>	<ul style="list-style-type: none"> <li>• Process optimization using enzymes</li> <li>• Carbon emission management</li> <li>• Alternative equipment for motors, heat power and refrigeration</li> <li>• Eco-friendly materials (ceramics, specialist metals), substitute for chemicals</li> <li>• Process control and intensification – smaller plants with same capacity,</li> <li>• Better management of supply chain.</li> <li>• Separation processes (membrane, distillation)</li> <li>• Substitutions of hazardous substances in industrial processes</li> </ul>
<b>Information and communication services</b>	<ul style="list-style-type: none"> <li>• Measurement and control of pollution from existing processes</li> <li>• Environmentally friendly “smart metering”, semi-conductors for remote reading</li> </ul>
<b>Transport</b>	<ul style="list-style-type: none"> <li>• Advanced uses of biomass/biofuels</li> <li>• Fuel cells</li> <li>• High efficiency energy recycling</li> <li>• Hybrid engines</li> </ul>
<b>Construction</b>	<ul style="list-style-type: none"> <li>• Passive houses</li> <li>• Superinsulation, radiant heating and heat recovery ventilation, local heat generation and cooling, earth-sheltering</li> <li>• Day-lighting, calibrated solar orientation and cross-ventilation</li> <li>• Renewable resources and photovoltaic system</li> <li>• Environmentally-friendly construction materials</li> </ul>
<b>Agriculture</b>	<ul style="list-style-type: none"> <li>• Organic farming, low protein food production</li> <li>• Development of renewal natural resources, bio-energy, bio-materials</li> <li>• Reduction of environmental load, reduction of herbicide / pesticide use</li> <li>• Reduction of water consumption and water use</li> <li>• Reducing Nitrogen pollution (greenhouse gases, nitrates, ammonia) in an integrated way</li> </ul>

Source: European Investment Fund 2010)

## Annex II: Examples of Eco-Innovation Policies

Currently there are a large number of policy instruments available that could help to promote eco-innovation, a number of which are shown in the table below.

Broad Approach	Policy/Intervention Options	Processes Tools
<b>Information Based Tools</b>	Awards / Recognition Public Information / Education Life-Cycle Analysis Environmental Accounting / Reporting Eco-Audit / Management Product Labelling Right to Know	Strategies / Communications / plans  Green book / white books
<b>Incentive Based Instruments</b>	Negotiated Environmental Agreements Regulatory reforms Liability Rules Public procurement rules Pro-environmental subsidies Subsidy Removal Marketable Permits Eco-Taxes / Tax reform	Road maps (and processes to develop)  OMC processes with guidance, benchmarking, (aspirational) targets  Technology) platforms Impact Assessment
<b>Direct Regulation</b>	Environmental Impact Assessment Trade Restrictions Ambient, Emissions and Technical Standards Licensing / Permitting (Purchase) Obligations or Bans	Policy targets

Source: Policy Pathways to Promote Eco-Innovation EU Sixth Framework Programme Policy Oriented Research Thematic Priority 8.1, Policy-oriented research (SSP), FP6-2002-SSP-1, Project no. 502487 POPA-CTDA 2007

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