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## **Enabling investment for the transition to a low carbon economy: Government policy to finance early stage green innovation**

Finance for early stage low carbon innovation

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### **Highlights**

- **Businesses need different forms of finance as they grow, including grants, venture capital equity, subsidised lending and crowd funding**
- **Government resources can encourage early stage low carbon innovation by enabling access to finance along the green finance escalator**
- **A wider green finance ecosystem is required that also sets an enabling policy environment, provides wholesale finance and provides business support that builds entrepreneurial skills for investment readiness**
- **Lack of effective evaluation of public sector low carbon finance initiatives limits lessons learnt**

### **Abstract**

Rapid transformation to meet the Paris 1.5°C climate target requires greater attention to be given to the role of innovative low carbon early stage businesses and the public sector's role in addressing finance gaps for longer horizon investment requirements. As entrepreneurs require different forms of finance as their businesses grow and move up the 'finance escalator', we explore the role of public sector support for grant, equity, debt and new forms of crowd funding finance. These funds can enable individual sustainability focussed businesses to access finance and encourage finance into new areas through having a demonstration effect. We conclude that a finance ecosystem approach is required that ensures complementary forms of finance for low carbon investment are connected at local, national and international scales, alongside support to build entrepreneurial skills and investment readiness. There is also a need for better evidence of the role of public sector support and where there is greatest impact on climate change.

## **Introduction**

With the need for rapid transformation of the economy and society to meet the 1.5°C target, there are urgent calls for further investment in low carbon businesses to meet finance gaps (UNEP, 2011; UNEP, 2017). These businesses are changing production and consumption patterns and developing mitigation measures while creating economic opportunity that addresses poverty (Fay & Hallegatte, 2012; Beltramello et al., 2013; Robins & McDaniels, 2016; Jackson, 2017). The Paris COP21 (2015) report calls for international collaboration to focus on developing financing instruments (international, regional and national) to support bankable low carbon projects (UNFCCC (2015). It also underlines the importance of having clear evaluations of the impacts of financing and associated support programmes.

There is a need for greater understanding of finance for new low carbon businesses and innovations (McDaniels & Robins, 2017; Rizos et al., 2016; Bocken, 2015; Criscuolo & Menon, 2015; Huhtala, 2003). This can include a key role for the public sector in supporting such investments, while not displacing existing private sector funds (Polzin, 2017; Colombo et al., 2016; Olmos et al., 2012; Randjelovic et al., 2003).

This paper focuses on the role of the public sector in addressing finance gaps for longer-term investment requirements from seed investment through to early growth commercialisation (up to two years established trading) of green innovation activities. The paper is particularly pertinent, given the debates around the role of the public sector in encouraging green investment and the analysis of interventions at multinational, national, or sub-national government levels (Mazzucato & Penna, 2016). Across the globe there is widespread recognition that governments should intervene to create suitable finance ecosystems for green business development which contribute to addressing regional economic imbalances and poverty alleviation (OECD, 2011; Fay & Hallegatte, 2012; Beltramello et al., 2013; UNEP, 2016; McDaniels & Robins, 2017).

Peer reviewed literature is identified from international studies, complemented by illustrative policy documents where evidence of impact is reported. There is a particular lack of evidence from lower income countries and so this paper has had to focus on the issues facing higher income countries, while drawing out the implications and a framework that can also be used to examine other contexts. The scope of the paper does not include finance for more established larger businesses, public private partnerships and infrastructure.

The paper first identifies the nature of finance gaps. The evidence of impact is then analysed in relation to different types of investment tools. We then explore the particular importance of a comprehensive 'green finance ecosystem' in each country, defined as a holistic set of institutions, policies and organisations enabling green investment.

## **Green finance gaps**

Finance gaps occur where demand for investment from businesses is not met by finance suppliers. This is a common constraint for many businesses, particularly those in more peripheral economies, where there is limited supply of bank and equity/business angel investment (Baldock and Mason, 2015; Criscuolo & Menon, 2015; OCED, 2011; Ghosh and Nanda, 2010). In recent years, particularly in the aftermath of the Global Financial Crisis (GFC), finance gaps and early stage risk investment shortfalls are observed in many G20 countries.

The financing gap is a greater problem for the diverse forms of green ventures which are capital intensive, have a high technology risk profile and uncertain exit opportunities for investors (Crisciolo & Menon, 2015; OCED, 2011; Ghosh and Nanda, 2010; Rizos et al., 2016; Polzin, 2017; UNEP, 2011; Scoones et al., 2016; Hamilton & Zindler, 2016). Early stage businesses developing renewable energy projects or reducing emissions can lack the track record that provides private sector investors with the information they need to assess risks of that particular business. Risk can be increased by information asymmetries where the investors do not have all the information required. Finance gaps are also exacerbated where investors lack the specialist knowledge of a green technology or service resulting in difficulties in assessing risk and a high cost of performing due diligence in each investment (Carpenter and Petersen, 2002).

The time required for investment can also result in finance gaps. A long recognised feature of the perpetual finance gap facing early stage ventures is the lack of long horizon investment of between 5-15 plus years (Baldock et al., 2015; OECD, 2011; Rowlands, 2009), Furthermore, in the context of climate change, innovation to reduce emissions may also need to consider timescales over many decades. Furthermore, economic down-turns in both higher and lower income countries can also reduce the supply of external finance to all businesses (Cowling et al., 2012; Mason and Pierrakis, 2013; Wilson and Silver, 2013).

There is evidence of a short-term investor mind-set with investment managers seeking shorter term profits to meet the performance criteria and the demands of annual financial reporting to asset owners. This can be exacerbated by tax break incentives that reward shorter horizon investments (Cowling, 2016). Even in countries where extensive green finance is available, gaps can occur when there is limited supply of 'follow on' funding for businesses as they grow towards established commercialisation.

In addition to gaps in supply, there can also be gaps in demand as businesses are discouraged from applying for finance, lack the ability to develop investable propositions or present poorly developed proposals. For example, Fraser (2014) found that demand for finance dropped following the global financial crash as businesses had less appetite for taking on debt in an uncertain environment.

This paper argues that support for green innovations should consider both supply-side and demand-side issues with holistic responses that tackle gaps from different perspectives. The analysis of gaps therefore has to consider the whole green finance ecosystem. The gaps in these finance ecosystems are highly local and regional, requiring public sector interventions to be sensitive to differences.

### **The role of public sector finance schemes and instruments**

In this paper, we examine the range of investment instruments (debt and equity) used by businesses as they move from seed to early commercialisation stages to scale up growth for SMEs. We refer to this as 'finance escalator' theory (Nightingale et al., 2009; Berger & Udell, 1998). The changing risk profile of businesses results in them seeking different sources of funding and facing different institutional barriers as they grow and become more established. This section therefore reviews the evidence available on the different types of investment instruments found along the green finance escalator.

#### *Grants*

Finance escalator theory indicates that the seed stage of business start-up is riskiest for investors. Government grants, prizes and advanced R & D support are provided in a wide range of countries, aiming to address seed finance gaps for early stage innovation proof of concept and R&D ( Criscuolo & Menon, 2015; Beltramello et al., 2013; Olmos et al., 2012).

As an example of a higher income country context, UK government grant provision operates through Innovate UK, which fosters all stages of innovation through inter-department, external agency and institutional collaboration and finance (BEIS, 2017). Smart grants of up to £250,000 form a major early stage financing mechanism for proof of concept, prototyping and marketing. Almost one in ten (9%) of grants are for environmental technology and energy projects and between 2011-2015, 7,000 applications led to £160m funding for 1,600 projects leading to net impact of over 3,000 jobs and more than £250m Gross Value Added (GVA) (SQW, 2015).

The last decade has seen a proliferation of incubator and ‘accelerator seed’ investors focusing on enhancing potential high growth businesses but often at the expense of longer term innovation and sustainable business development (Brown and Mawson, 2016). Brown and Mawson (2016) highlight the UK government backed £200m Growth Accelerator programme as demonstrating good practice in offering management training. BIS, (2014) calculated this was offering an economic return of £12.50 for each £1 invested in support and grants, but was discontinued arguably because it did not lever private funds and operate a sustainable direct investment return model. Research in both UK (Baldock et al., 2015) and Canada (Bak, 2017), found that innovations often fail to get past early stage hurdles to commercialisation where matching and follow-on funding are required.

#### *Early Stage Equity investment: VC and Business angels*

Where bank borrowing is not available for higher risk ventures, venture capital providers and individual ‘Business Angel’ investors can take an equity stake in seed and early stage businesses to enable their growth. For example the Canadian Nova Scotia Clean Technology Innovation Fund, established in 2011 has invested in 12 seed companies including bioscience and smartgrid (WCTIJ, 2017).

The £20.5m EU funded East of England Low Carbon Innovation Fund offers investment up to £750,000 requiring at least 50% private match funding for early stage R&D and commercialisation. Scheme evaluation of 59 investments into 36 SMEs found strong private funding leverage (72%), with co-investors taking a ‘patient capital view’, timely follow-on investment, and only two business failures (UEA, 2015). Key issues related to investment delays and high costs of due diligence investigating applicant firms’ low carbon credentials.

The impact of these public sector supported equity investment funds is greater where investees can raise large scale follow on funding (North et al., 2013). This is more likely to occur when low carbon innovations are closer to the market and have clearer commercial potential (Olmos et al., 2012; Criscuolo & Menon, 2015). For example, the UK Government Angel Co-investment Fund supporting angel syndicates can still struggle to raise large-scale follow-on funding rounds, particularly for capital intensive longer horizon green businesses (Baldock and Mason, 2016).

Larger scale funds which are more attractive to institutional investors can offer both early stage funding and follow on scale-up funding to full commercialisation (Cumming et al., 2014). This has notably been achieved through the public sector supplying a ‘fund of funds’ structure. For example, the £330m UK Innovation Investment Fund (UKIIF) provides long horizon investment targeting early

stage enterprises focusing on energy, advanced manufacturing, digital and health sectors. Funds are provided from UK government, European Investment Fund and private matched co-financing investment. After six years of establishment, the UKIIF had invested in over 300 SMEs globally with additional private investment making up over 20 times the original public sector stake (Baldock and North, 2015).

### *Debt finance and lending*

The post global financial crisis period has seen a decline in early stage conventional business bank lending, which underpins the rationale for public sector support to help these potential high growth enterprises to access debt or alternative sources of finance (Polzin, 2017). Many funds may seek to offer subsidized loans with lower interest rates, longer repayment periods and combinations of loans with other support.

Polzin's (2017) review of green innovation finance underlines the lack of lending to early stage businesses and the need for government instruments to address this. While Green Investment Banks (GIBs) have been tasked with investing public funding to leverage private institutional funding into green investment, much of this activity focuses on large-scale infrastructure investment rather than finance for early stage enterprises, as has been found with the UK Green Investment Bank (Corbishley and Donovan, 2015).

Public sector support can go directly from the state into enterprises, through specialised intermediary financial institutions or through mainstream banks. The Turkey Clean Technology Fund programme review revealed 34 energy efficiency projects co-financed through local banks valued at US\$740m (Econoler, 2013). It forms part of the World Bank's \$5.2bn Clean Technology Fund encouraging public and private finance mainly for energy infrastructure projects in Official Development Assistance (ODA) countries (Nakhooda & Amin, 2013).

While there is limited bank lending available, government backed loan guarantee schemes are important instruments. The Global Climate Partners Fund (GCPF) established by the German government in 2010, subsequently gaining investment from other EU countries (BEIS, 2013), includes investments into India, South Africa and East Africa. Overseen by the KfW German state bank, GCPF invests directly (30%) or through local financial institutions (70%) in SMEs in lower and middle income countries specifically to develop lower carbon propositions while also tackling poverty. Investments mainly offer loan guarantee schemes via local banks with oversight from an international credit support arm (Technical Assistance Facility) to develop best practice, sustainable local lending/investment (GCPF, 2012). By 2015 it had invested over US\$360m including 18 underlying funds in 16 countries, leveraging considerable private co-finance (GCPF, 2016).

### *Crowd funding*

As banks retreated from early stage business lending after the global financial crash, crowd funding in a variety of forms (donation, peer-to-peer lending, reward and equity) has increased in use (Harrison, 2013; Lehner, 2014; Vasileiadou et al., 2016). The UK government quickly facilitated crowd funding development through regulatory and tax support, enabling establishment of the pioneering Crowdcube and Seedrs early stage equity platforms. Furthermore, the UK government provided guarantees to support peer to peer lending through the Zopa and Funding Circle platforms. There has also been a growing interest in community shares for community owned renewable energy

projects, with innovative organisational models but using previously developed technology (Holstenkamp and Kahla, 2016). There are examples of tax breaks provided to crowd funding investors, alongside other forms of investors, although in the UK this appears to have skewed investment towards shorter term digitech development (Baldock and Mason, 2015; Cowling, 2016).

. While crowd funding is viewed as an important tool within both developed and developing countries' innovation and finance ecosystems (Best et al., 2013; Lam & Law, 2016), Hörisch (2015) noted that in the context of environmentally oriented ventures, crowd funding's potential is not sufficiently used.

### **Green finance ecosystems**

This paper shows the importance of having a green finance ecosystem approach that not only includes private, public and third sectors working together to provide finance, but also creates an enabling environment for innovative businesses to grow (Hwang & Horowitz, 2012). The ecosystem approach allows for wider recognition of the many pieces to the puzzle which need to be addressed simultaneously. In this way the ecosystem theory addresses demand and supply sides together. In different countries there have been a series of diverse interventions designed to stimulate private investment, address regional inequalities of economic opportunities and reduce poverty (GGBP, 2014; Beltramello et al., 2013; Wilson & Silver, 2013).

As figure 1 shows, at the heart of the green finance ecosystem are businesses and investment instruments (grants, equity and debt finance) in the private sector, and in public/private partnerships. Grants and subsidies have a key role to play in funding innovations which would not otherwise be undertaken, but there is often a lack of attention to whole life-cycle of innovation development resulting in fragmented and disjointed business development unless different forms of sufficient and appropriate follow on funding are provided.

A major part of the finance ecosystem is the provision of a stable and enabling policy environment for green start ups and early stage businesses that sets a regulatory and tax regime for incentivising long horizon green private investment, and facilitates optimal (from investor and environmental perspectives) exits from investment. Given the inherent regulatory risk perceived by investors in all contexts, the long-term stability of the policy environment is important in ensuring the financing of innovative and risky green ventures (Crisuolo and Menon, 2015).

Access to finance can also be restricted by low quality propositions reaching finance providers due to the lack of entrepreneurial skills (Haselip et al. 2014; Crisuolo & Menon, 2015), and a lack of business 'investment readiness', notably in lower income countries and peripheral economies which lack entrepreneurial culture and innovation clusters (Mueller et al. 2014). A green finance ecosystem can build capacity and investment readiness through having advisory services, incubators, accelerators and mentoring of entrepreneurs that can stimulate the development of ideas and subsequent demand for investment (Mohanty, 2014; Mason & Kwok, 2010; Baldock et al. 2015). Capacity building can also come from having networks of suppliers of different types of early stage finance such as venture capital and business angel investment from local or overseas experienced investors (Lerner, 2010).

Figure 1 The green finance ecosystem



Providers of wholesale finance are also important elements of the green finance ecosystem. There has been much attention paid to the role of Green Investment Banks operating at a national level with the OECD (2015) reporting 15 GIBs, including 5 national (UK, Australia, Malaysia, Switzerland and Japan). In lower income countries, multilateral agencies such as the World Bank have been important funders of green investment tools. Yet, the extent to which they address early stage activities is not evident, despite having a specific mandate to invest government funding into green innovation. Furthermore, such funds face challenges in identifying game changing innovations (Afful-Dadzie & Afful-Dadzie, 2015; Colombo et al., 2016) and developing a pipeline of investments that are viable business propositions while leading to a transition to meet the 1.5°C target. Radical innovation which addresses global sustainability challenges is likely to require going beyond the national scale with funds having a critical mass of investments in each specialist area to justify employing sector specialists. These funds reflect international business ecosystems rather than respecting national boundaries (Baldock and North, 2015; Innovatum, 2016; McDaniels & Robins, 2017).

## Implications and conclusions

### *Filling finance gaps*

This short paper shows the evidence of finance gaps as barriers for innovative businesses seeking solutions for the transition of the economy and society that will limit climate change to 1.5°C while also meeting Sustainable Development Goals (Beltramello et al., 2013; UNCTAD, 2015). There are

specific challenges for the low carbon economy and there is a risk of different elements of green finance not learning the lessons from years of public sector support for SME financing (McDaniels & Robins, 2017).

While there are innovations in private sector green finance at different stages of the finance escalator, there are still many gaps. Public sector support can be used to limit these gaps but is found to be mainly operating as smaller scale pilot programmes, and there is a need for a coherent and fluent transition from one form of finance to another as an early stage business grows. Context matters, with major differences between countries in terms of the investment instruments used and the use of international, state or regional investment banks (EC, 2017; AcSinte & Verbeek, 2015). A distinction can also be made between countries with a 'laissez faire' political culture with minimal public involvement, and the more interventionist countries where the public sector plays a more direct role in investment.

### *Scaling up and demonstration effects*

There is much attention to pilot projects and a need now for scaling up successful interventions. The pilot projects supported by grant finance (rather than repayable finance) are the most expensive investment instrument and therefore should be reserved for socially desirable green innovations which would not otherwise be undertaken or where all other instruments fail (Olmos et al., 2012). The review identifies those public sector interventions that have aimed to enter newer markets and create a demonstration effect that will encourage other finance providers to become more aware of new markets, products and services and as they learn about what works, they will therefore be more willing to provide investment in early stage innovations. The demonstration effect is also vital in less developed economies where local private sector investors and banks are unlikely to have the specialist knowledge on green innovation (Haslip et al, 2014). As providers of finance aim to scale up they also have to be sensitive to the risks of 'mission drift' and moving away from long term investment in early stage businesses. Short term lending to more established propositions may appear less risky and hence be more politically attractive but can displace private finance. Such use of public funds would have much less additional impact on scaling up green finance.

### *Assessing effectiveness*

A key gap identified in this international literature review was the lack of evaluations looking at additionality and the demonstrator effect, in order to effectively assess whether public sector support is crowding out or crowding in investment. This requires the development of assessment methodologies that address displacement of private investment and the counterfactual questions such as: how much co-financing from the private sector would have occurred without public sector support. This evidence of the impact of public sector funded interventions is needed – alongside a greater focus evaluating the green innovation impact on the wider economy - to identify where public funding can have the biggest impact on the transition to a low carbon economy.

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## **Annotated bibliography of recent key articles- Investment for transition to a low carbon economy**

\* Bak, C. (2017) *Generating Growth from Innovating the Low Carbon Economy: Exploring Safeguards in Finance and Regulation*. Centre for International Governance Innovation (CIGI) Working Paper 117, January, Waterloo, Canada. Available from: [https://www.cigionline.org/sites/default/files/documents/Paper%20no.117\\_WEB.pdf](https://www.cigionline.org/sites/default/files/documents/Paper%20no.117_WEB.pdf)

Government investment in funds for early stage innovations but despite the investment over a decade, enterprises still struggle to commercialisation. Provides evidence from Canada.

\*\*Colombo, M.G., Cumming, D.J. and Vismara, S. (2016) Government venture capital for innovative young firms. *Journal of Technology Transfer*. 41, 10-24.

For government supported Venture Capital there is a challenge of identifying game changing innovations, especially when there are multiple objectives beyond purely financial goals (ie equality, social goals, local benefit. Identifies the risk of displacing private investment. Provides evidence from Australia.

\* Criscuolo, C. and Menon, C. (2015) Environmental policies and risk finance in the green sector: Cross-country evidence. *Energy Policy*, 83, 38-56.

Greater challenges for green risk finance. Examines emerging markets where there may be a lack of VC experience and mentoring. Long term policy such as Feed in tariffs important for stability.

\*\* Holstenkamp, L., and Kahla, F (2016) What are community energy companies trying to accomplish? An empirical investigation of investment motives in the German case. *Energy Policy* 97,112–122

Examines motives for community investment in renewables from German data . The financial return is more important for limited partnerships compared to cooperatives

\*\* Hörisch, J. (2015) Crowdfunding for environmental ventures: an empirical analysis of the influence of environmental orientation on the success of crowdfunding initiatives. *Journal of Cleaner Production*, 107, 636-645.

While crowd funding has the potential to finance environmental projects, there is not correlation between environmental orientation and success in getting the funding. Non-profit

enterprises more likely to be successful so suggests Public policy to help identify environmental oriented enterprises

\*Lam, P. T.I., and Law, A.O.K. (2016) Crowdfunding for renewable and sustainable energy projects: An exploratory case study approach. *Renewable and Sustainable Energy Reviews*, 60, 11-20.

Crowd funding as a prelude to other forms of finance. It also helps the build public legitimacy of sustainable development projects in local areas at early stages.

\*\*McDaniels, J. and Robins, N. (2017) Mobilizing Green Finance for Small and Medium Sized Enterprises in the G7. UN Environment Inquiry: Design of a Sustainable Financial System.

Overview of financial ecosystem for green SMEs as they scale up. Reviews current practice in G8 countries. Highlights the lack of links between green finance and SME finance more generally