CLIMATE INNOVATION INSIGHTS | Series 1.7
Accelerating the Evolution of Climate Innovation Clusters

Climate Innovation Insights offers a platform for reflections and lessons from renowned climate innovation experts to spark discussion about the process of tackling climate change through innovation. The independent opinion pieces discuss best practices, different methodological approaches towards climate innovation and implications for business, society and politics. The series is supported by Climate-KIC, Europe's largest public–private climate innovation partnership.

Assessing Business Performance in Climate Innovation Clusters

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Key messages

- Research shows that cleantech businesses in climate innovation hot spots outperform non-cleantech businesses across several indicators.
- The returns on research and development are significantly higher for cleantech businesses than for non-cleantech businesses.
- However, cleantech businesses exhibit much higher levels of long-term debt compared to non-cleantech businesses, which makes them more vulnerable to macroeconomic shocks.
- Understanding how well businesses perform in climate innovation clusters can determine how policymakers should support businesses that focus on climate innovation.
- Policies addressing this vulnerability will allow cleantech businesses to plan with more certainty.

Introduction

Policymakers and business executives spend significant resources and use innovation capacity to make business more efficient and less polluting. This is based on the premise that well-designed policies and regulations are good for the environment and will, ultimately, have a positive impact on growth and productivity. These positive outcomes are likely to be more pronounced in industries in which the core activity is pioneering clean technologies – 'cleantech' – that can be adopted and adapted by a variety of mainstream industries.

Metrics relevant to the development and performance[1] of climate innovation clusters at the local, regional and national scale will allow policymakers to compare business performance, despite the many variations between businesses. This *Insight* looks at how well businesses in climate innovation clusters perform, and how policymakers can support businesses that focus on climate innovation.

The advantages of being part of a cluster

Businesses in certain industries, cleantech included, tend to cluster and grow in certain locations. These hot spots of economic activity are geographic concentrations of interconnected businesses, specialised suppliers, service providers and associated institutions. This phenomenon is

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not new; in 1890 Alfred Marshall identified several benefits for businesses operating close to each other in related industries, including being close to intermediate inputs and a skilled labour force.

An even greater potential benefit from agglomerating is the knowledge creation and dissemination within these clusters.[2] Businesses in clusters perform better due to knowledge sharing, which can be explicit or tacit and which leads to clusters outperforming non-cluster regions.

Measuring the performance of cleantech clusters

This research aimed to identify which variables best assess the performance of cleantech businesses and whether this information is of use to policymakers. We collected information on 14,866 companies located in Cambridgeshire and neighbouring counties[3] for the period 2007–2016.[4] Of these companies, 412 were classified as cleantech businesses and operating in the manufacturing, utilities and services sectors. The information collected on the companies included the following: long-term debt; profits before tax; capital; turnover; number of employees; average wage; and labour productivity. The key findings were as follows.

1. As Table 1 shows, cleantech businesses use, on average, more capital and have higher turnover and profits before taxation than non-cleantech businesses. They also employ more workers, pay higher salaries and their workers are more productive than in non-cleantech businesses. This suggests that cleantech businesses increase economic productivity while their activities are reducing the economy's carbon footprint.

2. Cleantech businesses borrow more and accumulate more debt over a longer time frame than non-cleantech businesses; see Figure 1.

3. Cleantech businesses show a clear positive relationship between their investment in research and development (R&D) and profitability, while there is no discernible pattern for non-cleantech businesses. This indicates that the returns on spending on R&D for cleantech businesses are comparatively higher; see Figures 2a and 2b. These findings confirm other recent studies.[5]

Policy implications

These results suggest that supporting or nurturing cleantech businesses can result in environmental gains, an increase in labour productivity, higher employment and higher wages. However, cleantech businesses are more vulnerable to macroeconomic financial shocks because of the much higher long-term debt that they service. The right policies would enable cleantech businesses to be more resilient, and plan for the future without facing higher uncertainty. Notably, government incentives and support for R&D activities for cleantech businesses should be a priority, as this should generate higher returns on R&D and higher productivity levels.

Policy interventions to support cleantech innovation can be justified in two ways: through enabling the creation of new cleantech businesses, and by assisting them to survive and grow beyond their start-up phase. This could be undertaken via:

- direct production subsidies[6]
- consumption subsidies[7]
- incentives for cluster creation.[8]

Due to positive externalities in the production and provision of cleantech products and services, policies should ideally blend the first and third options. Public policy interventions should fill in the gap to bolster business projects that enhance the environment as well as the wider economy. The private sector also needs to be encouraged to undertake cleantech projects, and be helped to recognise the positive externalities arising from cleantech innovation (e.g. reducing environmental pollution).

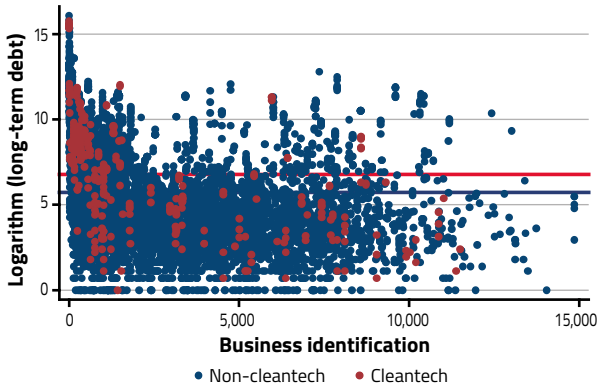
Challenges

Establishing the best public policies for climate innovation clusters is challenging, however, not least because the metrics for the success of a clean innovation need to be defined and disseminated. This has many different

Table 1. Descriptive statistics for cleantech and non-cleantech companies (mean averages)

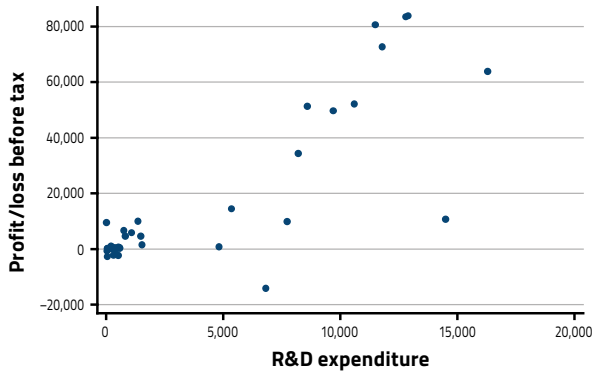
	Capital (£ '000)	Turnover (£ '000)	Profit before tax (£ '000)	Number of employees	Average wage (£)	Labour productivity per worker (£ '000)
Cleantech	34,836	51,391	6,099	477	39,735	714
Non-cleantech	6,357	45,304	3,487	276	35,261	340

Figure 1. Long-term debt for cleantech and non-cleantech businesses



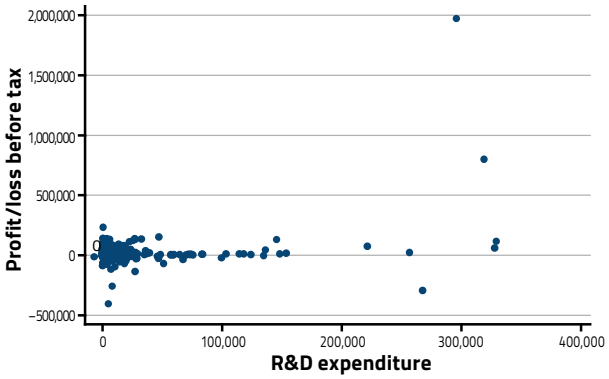
Source: Authors' calculations using Orbis data

Figure 2a. Cleantech businesses



Source: Authors' calculations using Orbis data

Figure 2b. Non-cleantech businesses



Source: Authors' calculations using Orbis data

elements that need to be considered. Should only economic criteria be incorporated, or is a blend of economic, environmental and social criteria more suitable? If all three – arguably the optimal solution – the question is then around the importance of each one (i.e. weighting).

It is difficult to reach a consensus among business practitioners, government policymakers and scientific communities, and ensure that the metrics are accepted by all stakeholders and have value in policymaking and management. The Eco-Innovation Scoreboard is one attempt to establish such measurements (see Box 1).

Company-level data – about financial variables, employment, production techniques and emission levels – need to be made more widely available. There are several databases that provide information about innovation at a national[9] or company level, such as the EU Industrial R&D Investment Scoreboard and the Organisation for Economic Co-operation and Development's Innovation Microdata project. These are very helpful datasets, but either focus on a relatively small number (and less representative sample) of companies[10] or they are surveys, which tend to be problematic when the research is attempting to assess the causal impact of policy support and the performance of climate innovation clusters.

Information on the dynamic nature of, and relationships between, businesses in a cluster is also crucial, but currently lacking. This could include information on suppliers, collaboration networks and other R&D institutions with which a business engages and benefits from. Government agencies and research institutions are ideally placed to develop new metrics to maximise the potential of evidence-based policies.[11]

Box 1. The Eco-Innovation Scoreboard

The Eco-Innovation Observatory collects and analyses an extensive range of eco-innovation information, gathered from across the European Union (EU). Its Eco-Innovation Scoreboard assesses five different dimensions: (1) eco-innovation inputs; (2) eco-innovation activities; (3) eco-innovation outputs; (4) resource efficiency; and (5) socio-economic outputs.

Since 2009 the Scoreboard has provided an overall comparison of each EU Member State's performance in different dimensions of eco-innovation compared to the EU average, thereby characterising strengths and weaknesses across these five dimensions. The main drawback is the lack of data at the company level, however; this needs to be addressed for a better measurement of cleantech impacts more broadly.

A further cluster scoreboard analysis[12] identified several key performance indicators to enable the comparison of local business clusters in high-tech sectors across developed countries, prior to the global financial crisis and in the immediate aftermath. The indicators that were used included:

- the share of businesses that had been started in the past five years, to capture entrepreneurialism in the cluster
- employment growth
- turnover growth
- three financial indicators: profitability growth; liquidity ratio growth; and solvency ratio growth.

Despite the study's strength in benchmarking and ranking each cluster according to these indicators, the analysis would have been enhanced with more detailed company-level information. Disaggregated data from interdisciplinary fields hold the answers to the many difficult questions surrounding climate change policies and impacts.

Conclusions

Assessing business performance in climate innovation clusters entails the identification and collection of policy-relevant indicators and metrics. These could come from at least two company-level sources. The first is input variables for all companies, such as R&D investment, product and process innovation, patents, human resources. Due to the nature of cluster interactions, the second source would include the forward and backward supply-chain links, collaborations with other businesses and institutions around knowledge transfer, social and environmental indicators, and policy incentives and support mechanisms.

To do this, there needs to be a step change in the way that data are collected and considerable investment in the development of appropriate metrics. Within the UK, a first step would be to merge administrative data from HM Revenue & Customs regarding subsidies and/or tax credits for cleantech R&D with financial datasets for companies. This would help us to investigate the causal relationship between financial incentives and the innovation of cleantech clusters.

Endnotes

1. We use company profitability to measure performance. Alternative metrics include total factor productivity or the number of patents a company has registered, which captures its innovation output.
2. Porter, M.E. (1990). *The Competitive Advantage of Nations*, New York: Free Press
3. Bedfordshire, Buckinghamshire, Hertfordshire, Northamptonshire and Oxfordshire.
4. The choice of Cambridgeshire as the centre of the analysis rests on the fact that Peterborough Council, which lies in Cambridgeshire, created and supported the EnviroCluster. See: http://www.opportunitypeterborough.co.uk/envirocluster-supplier-event-will-provide-chance-to-invest-in-varialift-airship
5. See: Dechezleprêtre, A., Einiö, E., Martin, R., Nguyen, K. and Van Reenen, J. (2016) *Do Tax Incentives for Research Increase Company Innovation? An RD Design for R&D*, CEP Discussion Paper 1413, London: Centre for Economic Performance. This study finds a causal effect on innovation outcomes in the UK from a tax incentive for R&D.
6. For example, see: Carley, S. (2009) 'State renewable energy electricity policies: an empirical evaluation of effectiveness', *Energy Policy*, 37 (8), 3071–81; and Murray, B.C., Cropper, M.L., de la Chesnaye, F.C. and Reilly, J.M. (2014) 'How effective are US renewable energy subsidies in cutting greenhouse gases?', *American Economic Review*, 104 (5): 569–74
7. Barnes, D.F. and Halpern, J. (2000) 'The role of energy subsidies', in World Bank, *Energy and Development Report*, Washington DC: World Bank, 60–6
8. Porter, M.E. (2007) *Clusters and Economic Policy: Aligning Public Policy with the New Economics of Competition*, ISC White Paper, Boston: Harvard Business School; and Delgado, M., Porter, M.E. and Stern, S. (2014) 'Clusters, convergence, and economic performance', *Research Policy*, 43 (10), 1785–99
9. For example, the OECD Main Science Technology Indicators, the Science, Technology and Industry Scoreboard and the Science, Technology and Industry Outlook.
10. The EU Industrial R&D Investment Scoreboard only considers the 2,500 largest firms globally in terms of R&D expenditure, and the 1,000 largest EU firms in the same category.
11. There are some recent studies that use confidential company-level data for the UK; see: Dechezleprêtre et al. (2016) Op. cit.
12. Temouri, Y. (2012) *The Cluster Scoreboard: Measuring the Performance of Local Business Clusters in the Knowledge Economy*, OECD Local Economic and Employment Development Working Papers 2012/13, Paris: OECD Publishing

Climate-KIC UK and Ireland

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Our partnership consists of dynamic companies, the best academic institutions and public authorities. We drive innovation in tackling climate change through creative partnerships large and small, local and global, and between the private, public and academic sectors. The UK and Ireland is a core geographic region within Climate-KIC and is home to some of the most energetic climate innovation clusters and businesses in Europe.

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