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How to foster climate innovation in the European Union: Insights from the EIB Online Survey on Climate Innovation

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ECONOMICS – WORKING PAPERS 2022/02

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European
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Bank

The EIB bank 

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How to foster climate innovation in the European Union: Insights from the EIB Online Survey on Climate Innovation¹

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Abstract: Using survey data on climate innovation, we map climate innovation patterns across different regions and technologies, and study the cooperation, protection and reach of climate innovation. Our analysis confirms that there is a strong link between climate innovation and firm performance. We nevertheless observe that European firms seem to suffer from the availability of finance. If European policymakers want to create more successful firms in the climate sector, they should strengthen policies that aim to reduce regulatory uncertainty and work actively to improve access-to finance conditions, in particular for start-ups.

¹ We are grateful for the comments and suggestions of Peter Harasztosi. The views expressed in this paper are those of the authors and do not necessarily reflect the views of the European Investment Bank.

Introduction

New green technologies can help the European Union meet the demanding goals of its climate change agenda (World Meteorological Organization (WMO), 2020). The recent IPCC report revealed once more the daunting reality of climate change and its devastating consequences (IPCC, 2021). Technical progress must be made in a variety of sectors, and green innovations, covering a wide array of fields are key. Investing in environmentally friendly technologies and supporting innovation in the private sector are clearly stated ambitions of the European Green Deal (European Commission, 2019).

Where does Europe stand when it comes to climate innovation and what are related barriers? As shown in the Investment Report 2020/2021 (EIB, 2021), Europe is in pole position, but at the same time prone to be overtaken. So far data limitations have made it difficult to assess the impact of regulation and to fully understand the obstacles climate innovators face. Furthermore, firm-level data focus mostly on established firms, whereas young firms are underrepresented, making them generally unsuited to study the contribution of different firm types to climate innovations.

This paper fills some of the gaps by relying on a new data source, the EIB Online Survey on Climate Innovations, which asks firms specifically about their different climate innovations, the motivations and barriers and their views on current regulatory frameworks. The starting point of our data collection effort is the Crunchbase database, an online platform where young firms around the world can present their business, and the Bureau van Dijk Orbis database. 1,600 firms participated in the survey in the second half of 2020, giving us a unique opportunity to compare established firms with young start-ups and scale-ups.

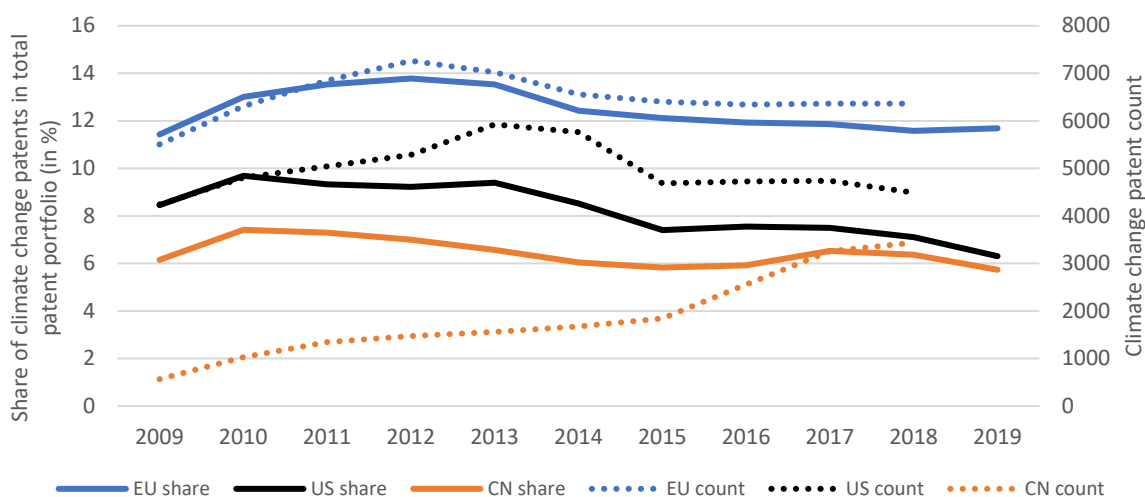
We show that there is a strong link between climate innovation and firm performance. We argue that European firms however suffer from the availability of finance. If EU policymakers want to create more successful firms in the climate sector, they should strengthen policies that aim to reduce regulatory uncertainty and work actively to improve access-to finance conditions, in particular for start-ups.

The paper is organised as follows. The first section will map climate innovation patterns across different regions and technologies. In the second, we study the cooperation, protection and reach of climate innovation. In a third step, we analyse the innovation impact on productivity, competition and sales before looking at Investments, perceived gaps and the investment outlook of climate innovators. The following section look at barriers and the role of regulation. We conclude with a discussion of policy measures that can, in our view, help boost climate innovation in Europe.

Where Europe stands in terms of climate innovation

The European Union is at the forefront in climate change innovation. It is responsible for the highest number of newly introduced green patents (Figure 1).² In 2019, as a share of the total portfolio, green patenting in Europe was more than 85% higher than in the United States. Nevertheless, climate change innovation trends are stagnating and have even been declining over the past years, contrasting with the apparent need for innovations supporting the fight against climate change.

Figure 1: Climate change patents (2009-2019)



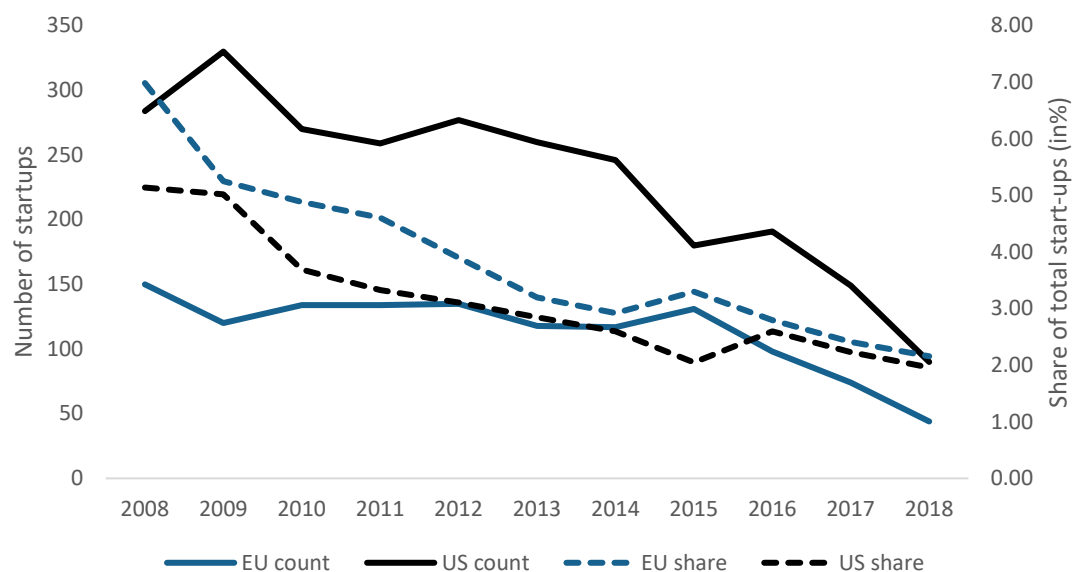
Source: Authors' calculations based upon PATSTAT (PCT) data in collaboration with ECOOM.

Not only do European firms generate more green technologies, the European Union also has a slightly higher share of start-ups in the energy and sustainability sector than the United States (Figure 2)³. While there is a general decrease in the number of energy and sustainability start-ups in the European Union as well as in the United States, it is noteworthy that the gap is shrinking over time. The marked drop-off in the last couple of years is again a sign of worry, as start-ups and scale-ups are important drivers to maintain a dynamic business environment and to foster structural business transformation. The latter is central for achieving a speedy and clean energy transition.

² The green patent classification can be broadly split into two main categories: (1) patents that directly target climate change mitigation technologies; and (2) patents covering technologies that contribute to the issues of climate change indirectly, namely environmental management (air and water pollution, waste disposal, etc.) as well as those directed at adaptation to water scarcity. A breakdown of these different technologies can be found in Chapter 8, EIB Investment Report (2021).

³ Crunchbase uses a "tagging" system, whereby start-ups are classified according to a taxonomy of over 700 labels. Firms can have multiple tags, allowing for a rich analysis of their underlying business strategies. Energy tags are e.g. battery, biofuel, biomass energy, clean energy, energy management, solar, wind energy. Sustainability tags are e.g. CleanTech, energy efficiency, environmental engineering, green consumer goods, pollution control, recycling, sustainability, waste management, water purification.

Figure 2: Start-ups in the energy and sustainability sector, over time



Source: Crunchbase, authors' calculations.

Base: Firms founded from 2008 to 2018 that are still active.

Note: Start-ups self-reporting that they belong to the energy and sustainability sector.

To help an evidence-based debate on where Europe stands when it comes to climate innovation and what are barriers, the EIB conducted a survey with 1,600 firms in Europe and the United States. The survey on climate innovations does not only allow us to get a better understanding of the role of established climate innovators in Europe, but also allows us to compare European start-ups to start-ups in the United States. Further, it allows differentiating between different types of climate innovations, namely those intended to benefit the end-customer or those affecting the internal processes or operations of the company.

Box : How we define climate innovation

The climate innovator classification used in this paper identifies two broad categories of climate innovation, each of which is further subdivided into six specific domains of innovation. The resulting grid aims to capture different types of climate innovation, namely those intended to benefit the end-customer or those affecting the internal processes or operations of the company. In both cases, the survey focused on the result of the innovation, thereby allowing innovations without ‘climate benefits’ as a primary goal to be classified as eco-innovations. In addition, unlike other data sources, such as for example patent data, the survey question also allowed a focus on process innovations.

The two main categories used are products, services or processes that are *intended to generate climate benefits for customers* versus those *affecting internal processes or operations*. Both groups are subdivided into six categories of climate innovation. The following two tables summarize them.

Table 1: Climate innovations benefitting the end customer

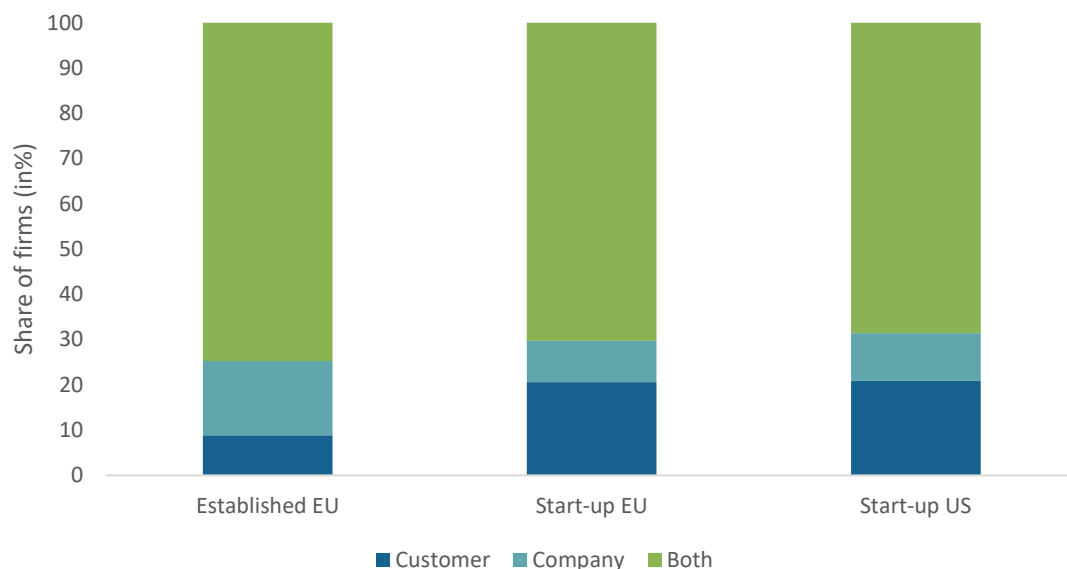
Innovations benefitting end customer	Explanation/Examples
Reduced energy use or carbon footprint	For example, insulating a building allows it to use less heating and cooling energy to achieve and maintain a thermal comfort
Reduced air, water or noise pollution	The goal is to reduce the amount of pollution. Examples to reduce noise levels include replacing older paved roads with smoother asphalt, better management of traffic flow.
Facilitated recycling of product after use	Examples include providing platforms for converting end-of-life plastics into useful high-grade chemicals and oils.
Extended product life	Examples include online sites that act as free repository for users to share repair manuals as well as tips and tools needed to repair items.
Reduced public health risks	Offer products that improve water or air quality. Examples include developing heat warning systems.
Socio-behavioural change	Offer products, services or processes to enable a sharing economy, such as carsharing, reselling of used products, or co-working

Table 2: Climate innovations affecting firm’s internal processes or operations

Innovations affecting firm’s internal operations
Reduced energy use or carbon footprint
Reduced air, water or noise pollution
Reduced material or waste use
Replacing materials with less polluting or hazardous substitutes
Replacing a share of fossil energy with renewable energy sources
Recycle waste, water, or materials

Innovations benefiting the company are more likely to be implemented by established firms than by start-ups (Figure 3). However, this relative share may well be explained by the fact that established firms were working with older technologies in the first place, increasing their need to update existing systems due to regulations and/or market pressure. Start-ups, on the other hand, may have implemented more climate-friendly solutions from the start, decreasing their need to update existing technology. When it comes to the type of innovations introduced, European start-ups do not differ a lot from start-ups in the United States.

Figure 3: Type of innovation



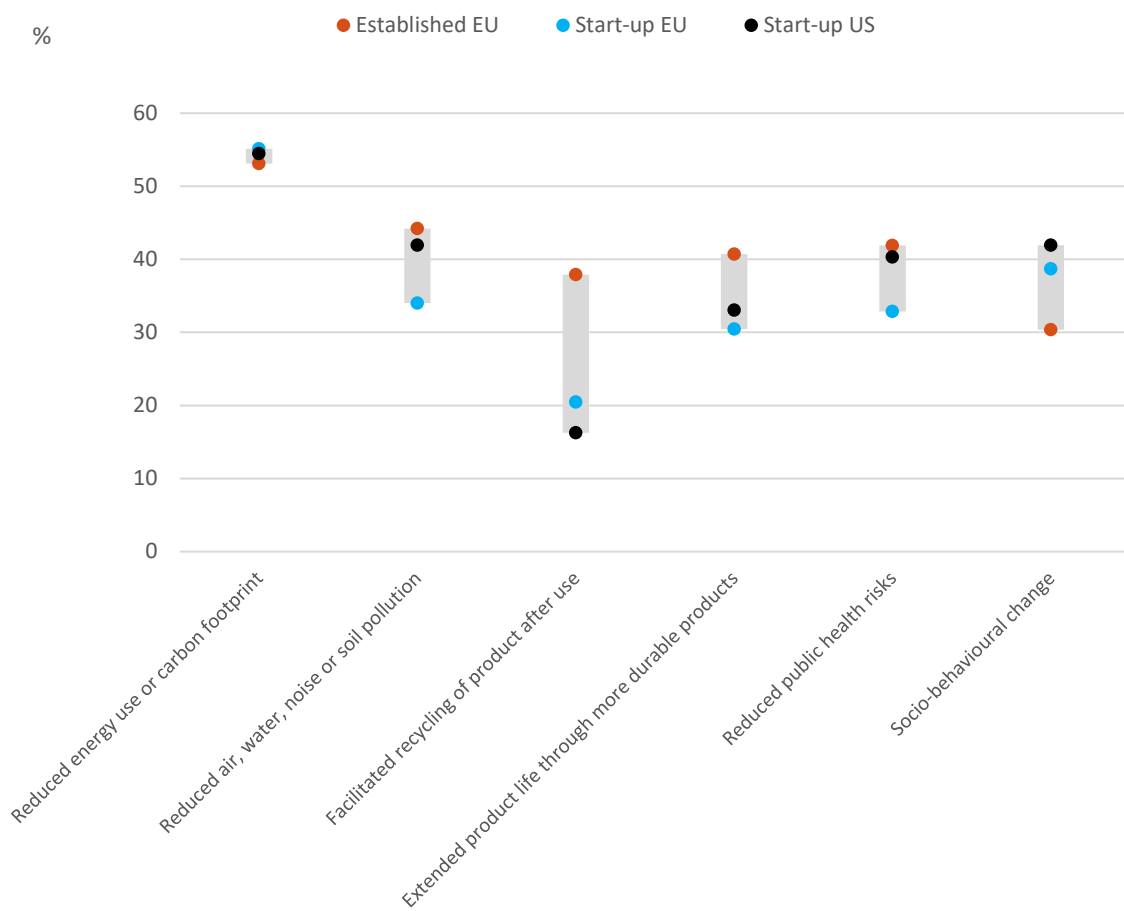
Source: EIB Online Survey on climate innovations.

Base: Climate innovators

Question: Has your company started to offer any products, services or processes that are intended to generate the following environmental impacts for existing or potential customers? Have you generated environmental benefits through changes to processes or operations in your company?

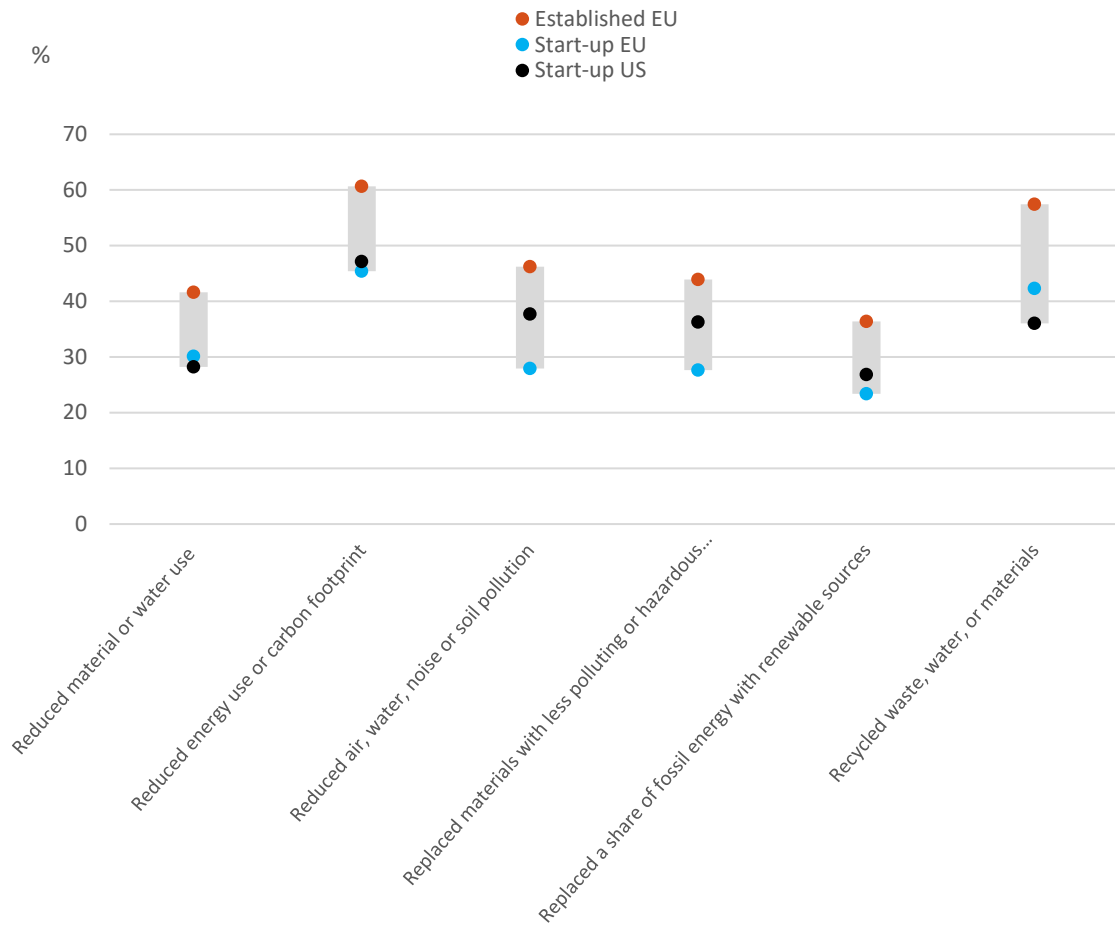
Start-ups seem to focus more on innovations impacting socio-behavioural change than established firms (Figure 4). While established firms seem to have a higher focus on the direct impact of their products or services on the environment, start-ups seem more likely to aim for changing the behaviour of their clients. This is a very important aspect, given that Aghion et al. (2020) have shown that behavioural changes have, on their turn, positive spillover effects on green innovation of other firms. On top of focusing more on the direct impact of their products or services on the climate, established firms are also more likely than start-ups to mention that they made changes to their own processes or operations (Figure 5).

Figure 4: Share of firms offering products/services that benefit customers



Source: EIB Online Survey on climate innovations.
 Base: Climate innovators
 Question: Has your company started to offer any products, services or processes that are intended to generate the following environmental impacts for existing or potential customers?

Figure 5: Products and services affecting the internal processes or operations



Source: EIB Online Survey on climate innovations.

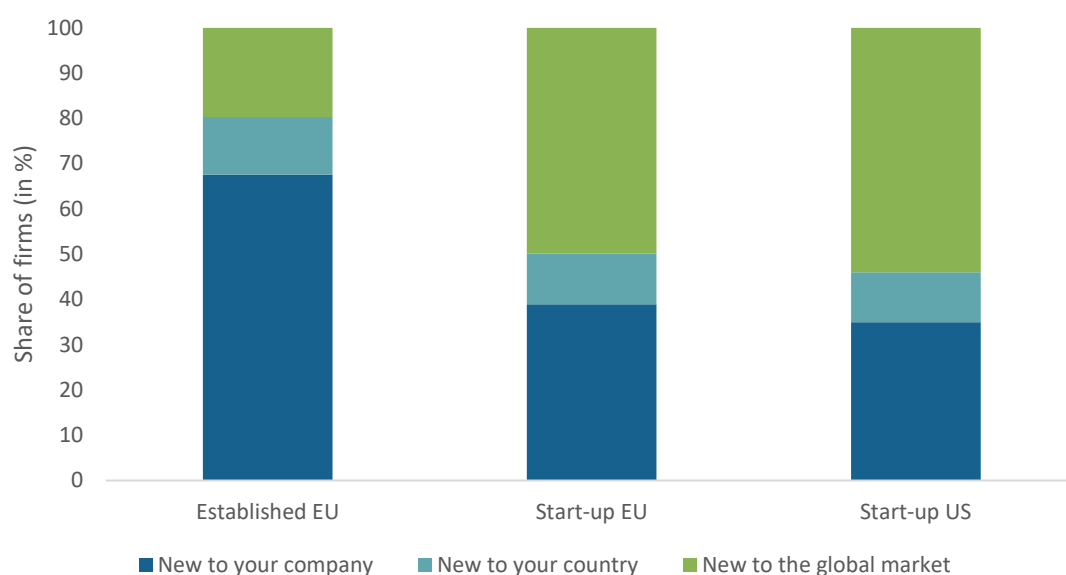
Base: Climate innovators

Question: Has your company started to offer any products, services or processes that are intended to generate the following environmental impacts for existing or potential customers?

Assessing the nature of innovation: newness, cooperation and reach

Start-ups are more likely to introduce climate innovations that are new to the global market than established firms (Figure 6). The share of services or products that are new to the market is often used as an indicator of the extent to which firms create breakthrough innovations. In contrast, the majority of innovations (more than 65%) introduced by established companies in the EU are only new to the company⁴, while this is less than 40% for start-ups. Of course, while this metric could give a first indication of the novelty of innovations of the company, this does not imply that established companies have less impact or reach with their innovations given that we do not know what the level of sales or the actual impact of these innovations is.

Figure 6: Level of innovativeness



Source: EIB Online Survey on climate innovations.

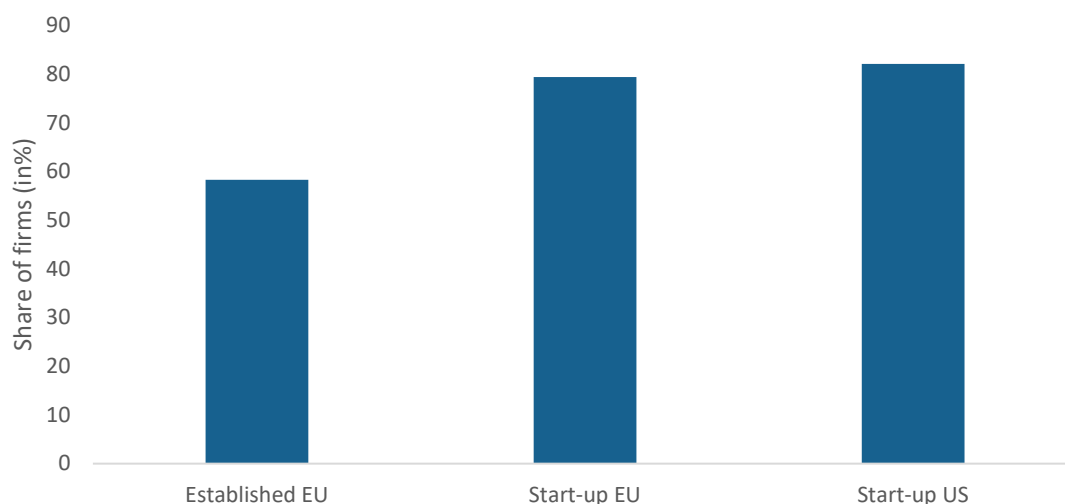
Base: EU climate innovators

Question: Are any of these new to your company, new to your country, new to the global market?

What is more, start-ups are more likely to seek protection for their new-to-the-world climate innovations. When asked about different types of protection (patents, industrial design rights, trademarks, copyrights or trade secrets), close to 80% of start-ups with innovations new to the global market indicate using this (Figure 7). In contrast, less than 60% of established firms indicate doing so for these types of innovations, suggesting that start-ups are more likely to have innovations that give them a competitive advantage. Similarly, more than established firms, start-ups licensed or purchased patents or other IP rights, indicating once more that they are more likely to use or build upon existing novel knowledge. There are no noteworthy differences between the different regions.

⁴ When comparing established climate innovators with firms stating to have introduced new products, processes and services in the EIB Investment Survey, we do not find significant differences in the reach of innovation.

Figure 7: Share of firms with IP protection



Source: EIB Online Survey on climate innovations.

Base: EU climate innovators with new to the world innovations

Question: In relation to any of your climate innovations, which of the following applies?

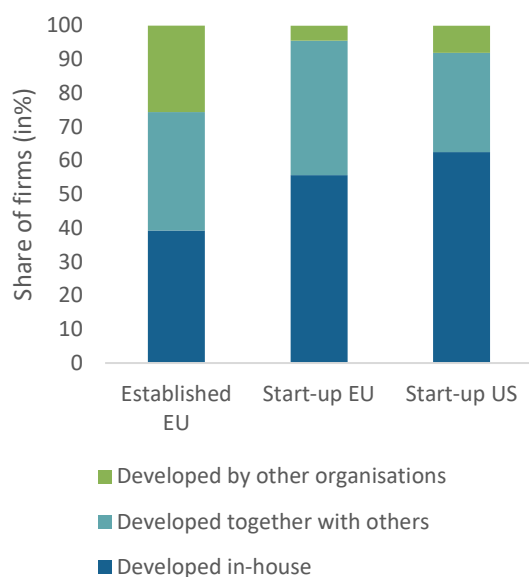
We have applied for a patent, we have registered an industrial design right, we have registered a trademark, we have claimed a copyright

In creating knowledge, collaboration is often considered as key to exploit knowledge complementarities. Collaboration and knowledge transfers widen the pool of available knowledge, may be more cost-efficient and, especially in the case of international collaboration, is considered as profit maximizing through direct access to knowledge relevant for foreign markets.

Start-ups develop a higher share of their climate innovations in-house, either in collaboration with others or independently (Figure 8a). In contrast to established firms, they are less likely to implement climate innovations that are solely developed by other organisations. The majority of companies develop their innovations in-house and do not collaborate with others (Figure 8a). When firms collaborate, start-ups are more likely to collaborate beyond country borders than established firms (Figure 8b).

Start-ups seem to suffer less from home-bias when developing their climate innovations in collaboration with others. This is an encouraging finding given that collaboration beyond country borders and with this, a diffusion of knowledge, is considered to be crucial for technological progress. Knowledge creation, and especially its circulation and exploitation, is crucial for growth in our knowledge-based economies (Griliches, 1998; Cockburn and Henderson, 1998). Learning spillovers in climate-friendly technologies could well be crucial in a rapid provision of technological solutions (Aghion et al, 2019). Bretschger et al. (2017) for example find that knowledge diffusion leads to a “greening” of economies characterized by increased market shares of “clean” sectors and lower emissions intensities. An often-made reproach is that knowledge suffers largely from a strong home-bias whereby knowledge flows remain national. While this argument seems to hold for established firms, this is less the case for start-ups.

Figure 8a: Collaboration activities

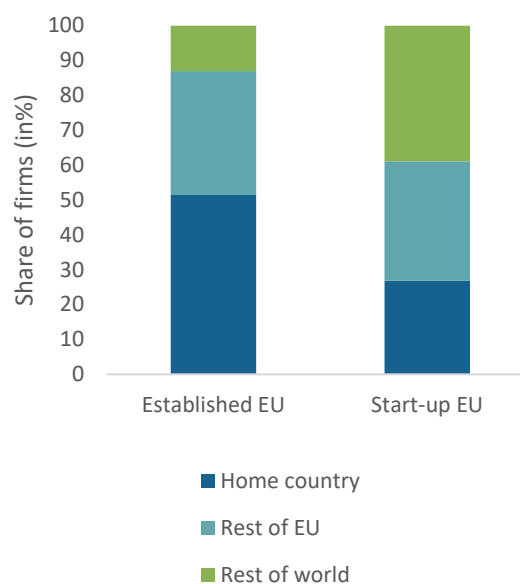


Source: EIB Online Survey on climate innovations.

Base: Climate innovators

Question: Thinking about your products, processes or services that generate environmental benefit for your customers, were these developed in-house, in collaboration with others or were they developed by other organisations?

Figure 8b: Collaboration type



Source: EIB Online Survey on climate innovations.

Base: Climate innovators

Question: What type of organisations did your company collaborate with to develop these products, services or processes? For each, please indicate where the collaborators are located.

*US not shown due to limited number of observations

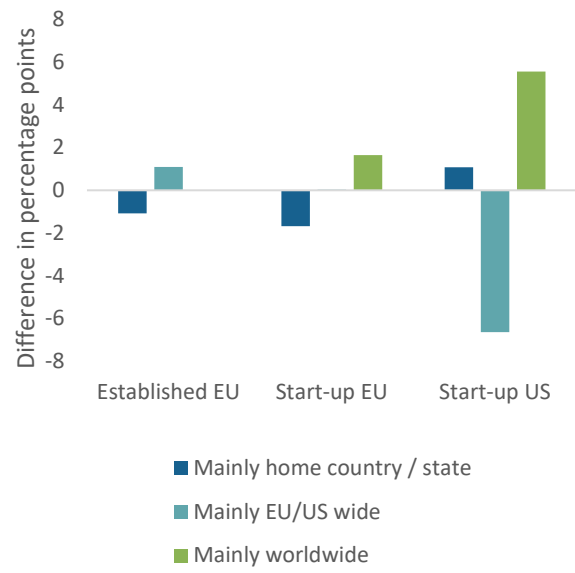
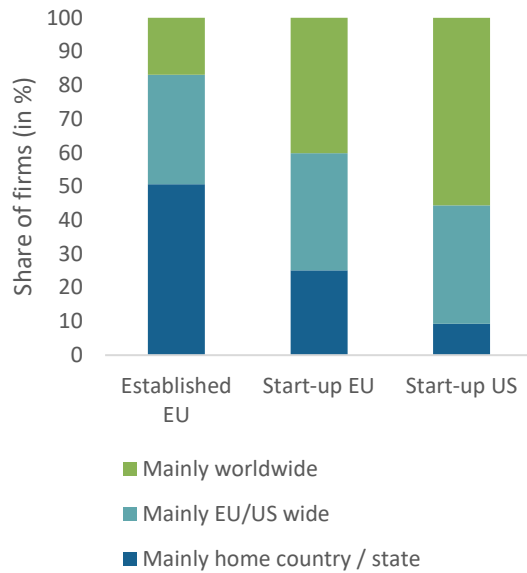
In addition, start-ups are more likely to introduce climate innovations with a global reach, confirming once more that they suffer less from home-bias (Figure 9a). Established firms, on the other hand, are more frequently introducing climate innovations for their home country or state. Taken together with the findings above, this suggests that start-ups are important catalysers of climate innovations. This is in line with literature claiming that innovation decreases with firm age (Balasubramanian and Lee, 2008, Huergo and Jaumandreu, 2004).

Noteworthy, start-ups in the United States claim that they mainly operate worldwide for their products, services or processes intended to generate climate benefits for customers, more than European start-ups. In addition, especially US start-ups have a higher reach of their climate innovations compared to other products they produce or services they provide (Figure 9b).

These findings suggest that European start-ups have a tougher time to scale their climate innovations. Europe's strong position in terms of introduction of climate innovations is not directly translated in a higher reach of these innovations. In other words, Europe's position seems to be less fortunate than initially suggested by innovation data. Unlike the United States, the European Union seems less able to reach beyond national and European borders to implement their innovations.

Figure 9a: Reach of climate innovations

Figure 9b: Reach of climate innovations vs other products/services



Source: EIB Online Survey on climate innovations.

Base: Climate innovators

Question: In which geographical markets do you mainly operate for your products, services or processes intended to generate environmental benefits for customers?

Source: EIB Online Survey on climate innovations.

Base: Climate innovators

Question: In which geographical markets do you mainly operate for your products, services or processes intended to generate environmental benefits for customers? For all products/services?

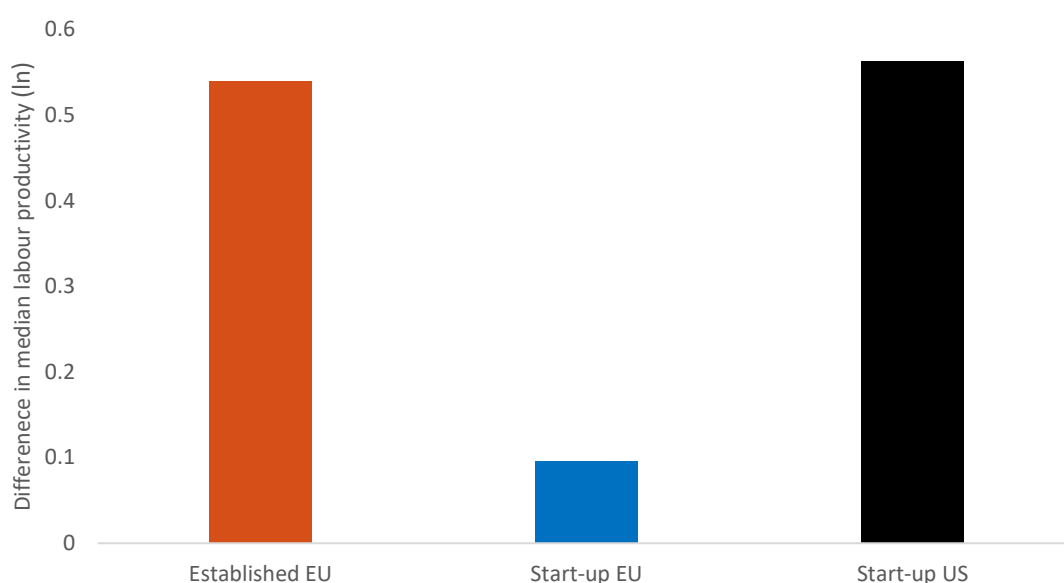
With market reach not being one of the European Union’s ‘fortes’, it is important to outline what is holding back firms, but also what the contribution of climate innovations to firm activity is – this in order to set the stage for European firms to not miss out on this opportunity to leverage upon their pole position in terms of innovation.

Climate innovation impact on firm performance

It is by now a common understanding that climate innovations should be fostered from a climate change perspective. It is, however, less obvious whether individual market players will reap benefits from this. If investments in these type of innovations are not paying off, private players will have less incentives to maintain their pole position or extend the reach of these type of innovations. Therefore, it is important to assess what the private benefits actually are or seem to be.

Climate innovators report a higher labour productivity than other firms. Figure 10 shows the difference in mean labour productivity (turnover per employee, in logarithm) of climate innovators versus other firms for established firms and start-ups. For EU established firms, EU start-ups, as well as US start-ups, climate innovators are more productive than their peers.⁵

Figure 10: Difference in labour productivity of climate innovators versus other firms

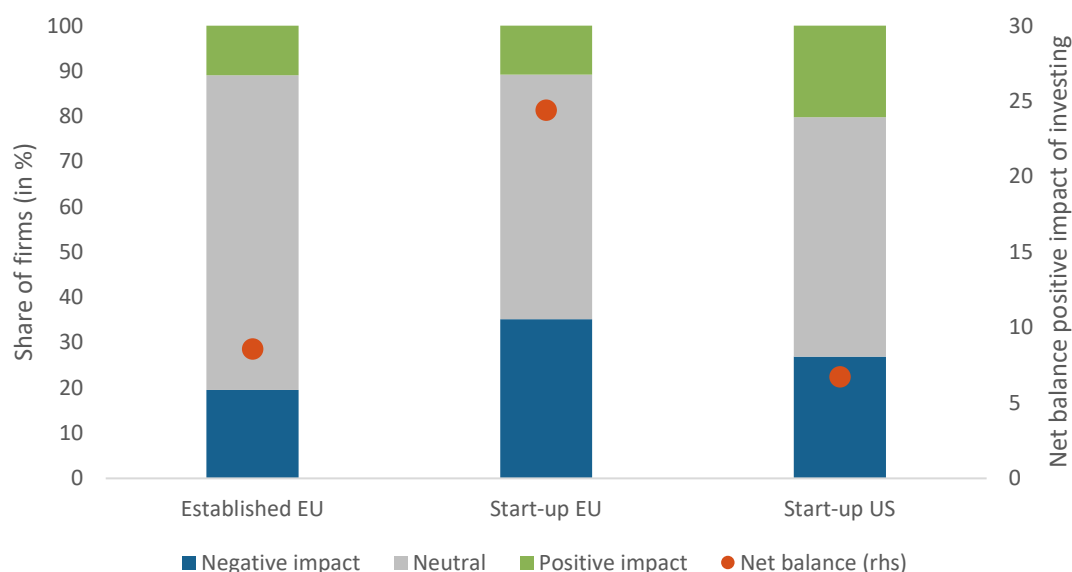


Source: EIB Online Survey on climate innovations.
Base: All firms
Note: Labour productivity is turnover per employee.

At least part of the difference in performance is “causal”. When asked about what climate innovation had had on their sales level (compared to a situation in which firms had not innovated in that field), firms generally reported a positive effect of climate innovation: specifically, more than 24% of EU start-ups and 8% of established firms state that their net sales level would have been lower had they not innovated (Figure 11). Overall, the highest positive impact on sales is reported by EU start-ups. This finding seemingly stands in high contrast with the fact that they are less inclined to target more global markets and seem more conservative in their collaboration activities.

⁵ The boost in productivity for established firms appear to be stronger for climate innovation than for innovators in general. When looking at established firms in the EIB Investment Survey, the difference in labour productivity of innovators in general compared to non-innovators is smaller than for climate innovators.

Figure 11: Impact on sales if firms would not have invested in climate innovations



Source: EIB Online Survey on climate innovations.

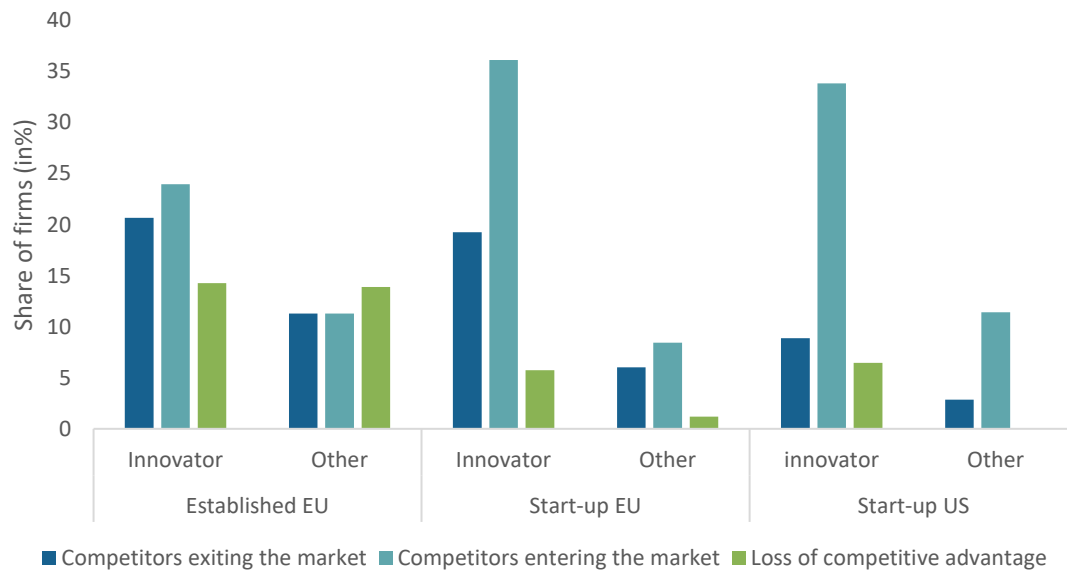
Base: All climate innovators.

Question: If you had not invested in projects that are intended to generate environmental benefits, what impact would that have had on your overall level of sales?

In addition, markets for climate innovations are perceived as very dynamic. Especially start-ups in the environmental and sustainability sector across all regions consider their market environment as competitive (Figure 12). Companies that have already introduced an innovation with climate impacts are more likely to say that they think competitors will exit or enter the market than non-innovating firms. In addition, they feel – slightly more than other firms – that they may face a loss of competitive advantage. These concerns show that climate innovators perceive their markets as more dynamic. There is a large literature following Aghion et al. (2005) that shows firms’ fear of being left behind by (new) competition is an important driver for them to seek ever new ways of becoming more productive and innovative. The assertion that competition is a potential trigger for innovation is also supported by Aghion et al. (2020), who found that the combination of sustainable consumer behaviour and competition has increased innovative activity in the automotive sector.

Overall, the active climate innovators do not seem to suffer from a lack of competition, often criticized as a catalyst for companies to profit from winner-takes-all dynamics (for example in the digital sector, see e.g. Calligaris et al., 2018, De Loecker et al., 2020, Diez et al., 2018, McMahon, M., 2021). Especially the dynamism perceived by European start-ups would suggest that there is still a lot of market potential which seems unfortunately not answered by a strong global reach of European start-ups.

Figure 12: Climate innovation and competition



Source: EIB Online Survey on climate innovations.

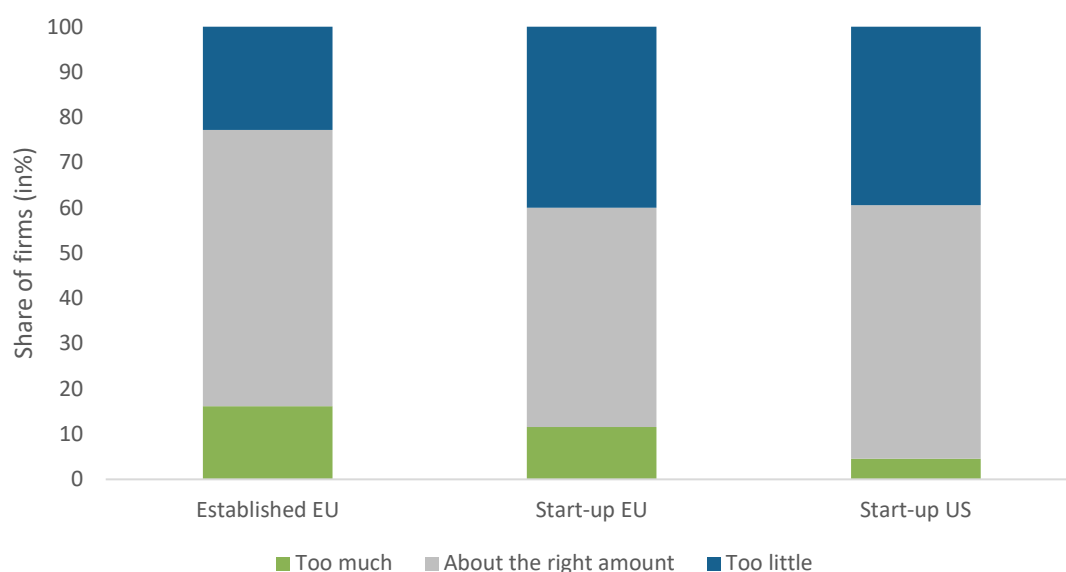
Base: All firms.

Question: Looking ahead over the next five years, do you think the transition to a carbon-neutral economy will impact your company in any of the following ways?

Investment outlook

In spite of an apparent positive link between climate innovations and performance, nearly 40% of start-ups consider their past investment activities related to climate innovation to have been too low. Looking back to their climate innovation investment activities over the past three years, 23% of established firms in the European Union⁶ and 40% of start-ups in the European Union state that they invested too little (Figure 13). For start-ups, we find that a similar share of US and EU start-ups that consider their investment activities too low. What is more, established firms in the European Union are more likely to state that their investment was too high (16%) when compared to European start-ups (12%). Only 5% of US start-ups consider that they invested too much.

Figure 13: Past investment in climate innovation



Source: EIB Online Survey on climate innovations.

Base: All climate innovators.

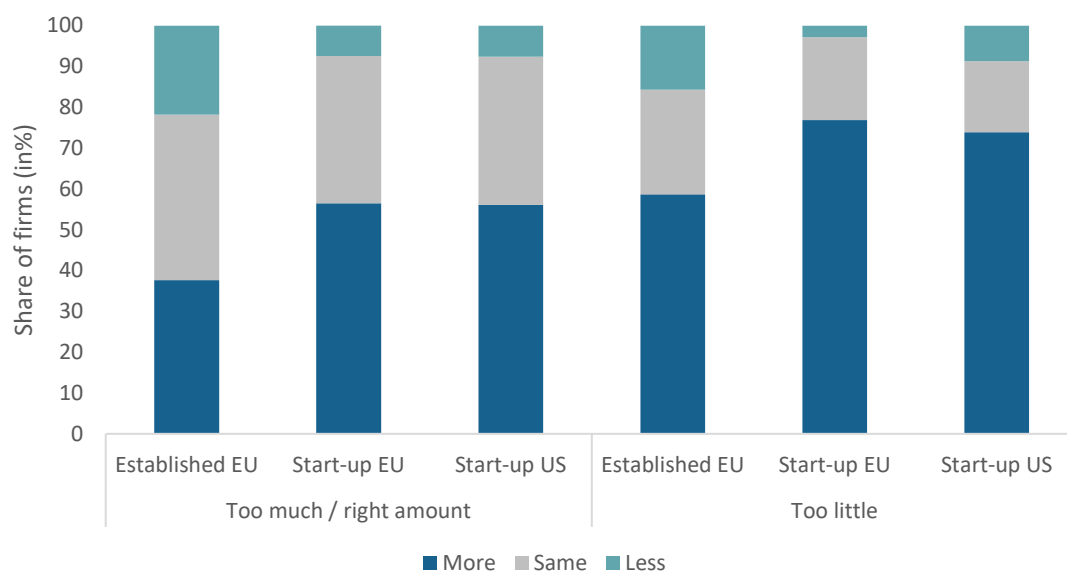
Questions: Thinking about investment you already made in environmental innovation, was the investment too much, too little, or about the right amount to ensure the success of your business going forward?

Firms' past investment is reversely mirrored in their investment plans (Figure 14). When asked whether they expect their investment spent on climate innovation to increase, decrease or stay around the same over the next three years, the answer depends on previous investments. Firms that invested too little, are more likely to state that they will increase investment than others.

Especially start-ups plan to invest more in climate innovations in the future, irrespective of how they perceive their past investment activities. More than half of EU and US start-ups that stated that their past investment was too much or the right amount, also plan to invest more in the next three years. For EU established firms, this is the case for less than 40% of firms.

⁶ 15% of EU firms in the EIB Investment Survey 2020 state that their investments over the last three years was too little, compared to 3% of firms stating that they have invested too much (EIB, 2020).

Figure 14: Investment outlook



Source: EIB Online Survey on climate innovations.

Base: All climate innovators.

Questions: Looking ahead to the next three years, do you expect your company to invest more, less or around the same amount compared to current levels, in projects that are intended to generate environmental benefits for either your own company or customers?

These results suggest that climate innovations do pay off – and this seems to be especially the case in Europe. What then is holding back these firms from further reaching out beyond their country and EU borders? Or in other words, what can the European Union do in order to maintain its pole position when it comes to the introduction of climate innovations? In order to get a better understanding, we should also get a better view on differences in motivations, but also on what is holding back firms in spite of the apparent dynamic markets and positive impact of climate innovations on productivity and sales.

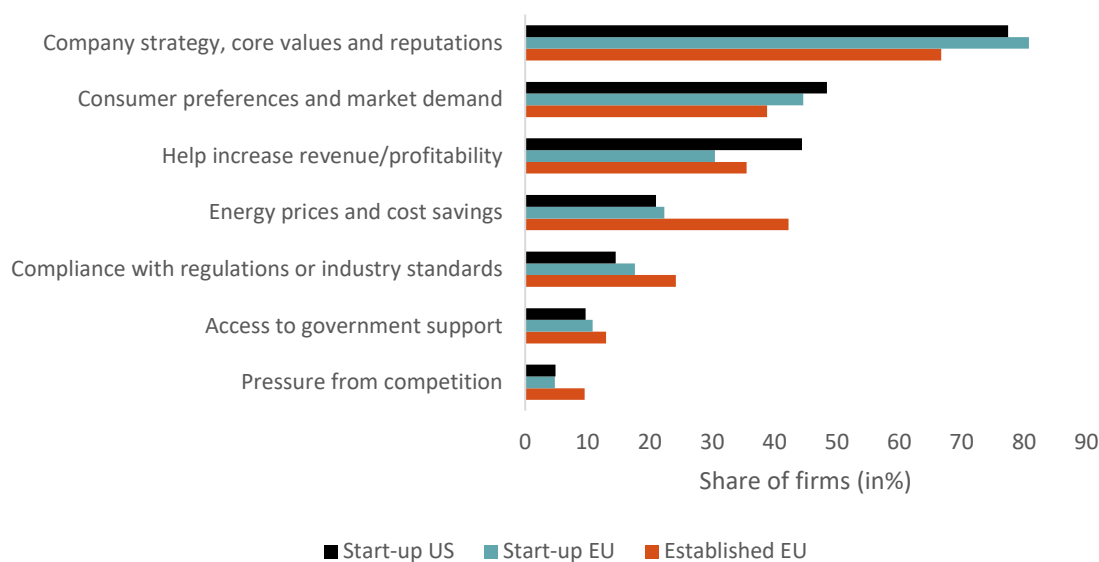
Differences in motivation and barriers to the introduction of climate innovations

Climate innovation activities are primarily motivated by strategy, core value and reputation – especially for start-ups (Figure 15). When asked about the main reason for innovating in climate goods and services nearly 80% of start-ups in Europe as well as in the United States state that it is due to the firm’s core strategy and value. Even though still more than 60% of established firms mention this as a motivation, start-ups clearly innovate more for strategic reasons. Also market demand is mentioned more frequently as a motivation by the younger players.

Established firms’ introduction of climate innovations are more often motivated by energy prices, as well as compliance with regulation, when compared to start-ups. This confirms that established firms and start-ups do differ in their ‘raison d’être’ as to why they introduce climate innovations. More than start-ups established firms are thus innovating for economic reasons and with regulation in mind.

The main difference between start-ups across the Atlantic is that US start-ups state more often that increasing revenue or profitability was a motivation to introduce climate innovations. Our data suggests that European start-ups have a lower market reach with their climate innovations – the fact that they are also less likely to use the increase of revenue as a motivation seems to be aligned with this. However, this could at the same time also be a confirmation that it is more difficult to scale in the EU and thus that further increase in revenue or profitability is difficult in any case.

Figure 15: Main motivation for climate innovations



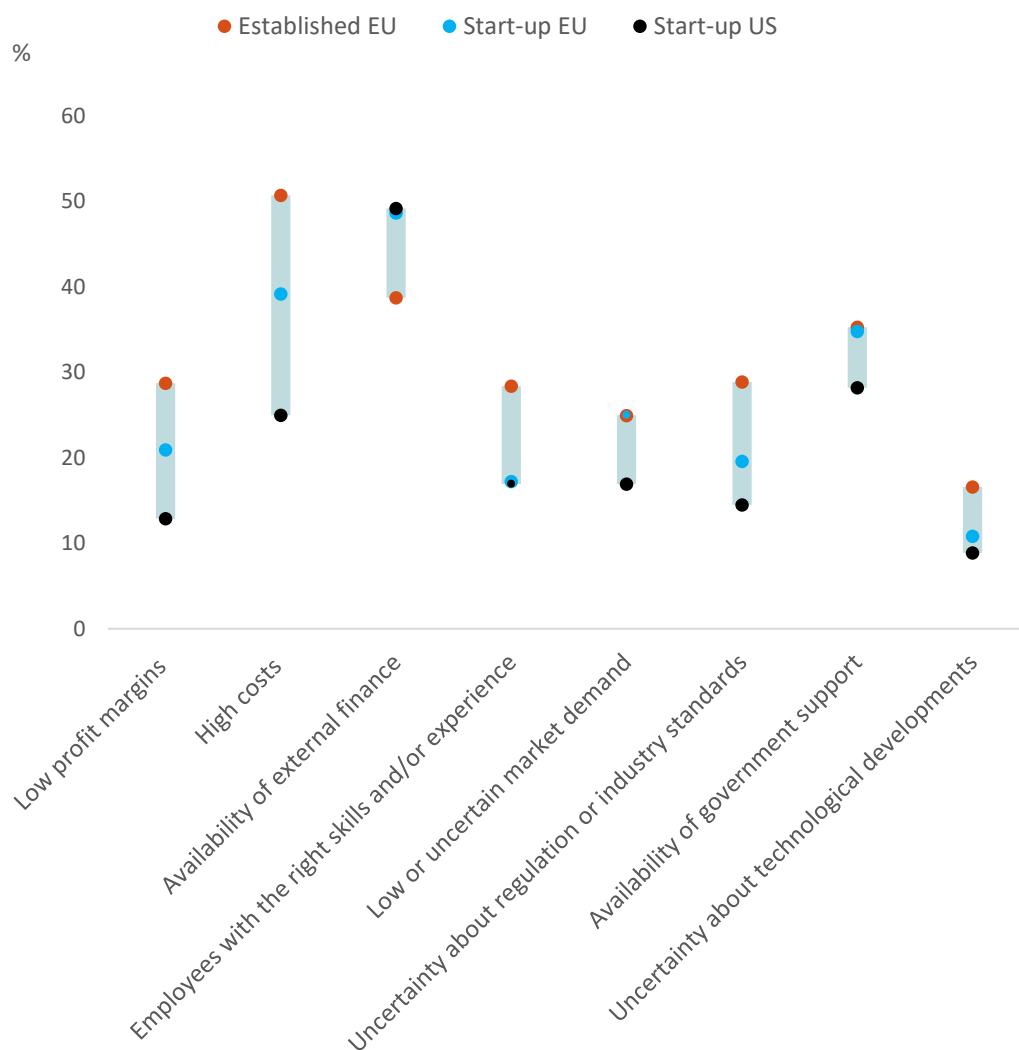
Source: EIB Online Survey on climate innovations.

Base: All climate innovators, multiple answers possible.

Question: What were your company’s main motivations for making these changes and for offering these products, services or processes to generate environmental impacts for your customers?

Looking into the barriers, ‘high cost of making changes’ as well as ‘access to finance’ are the most frequently mentioned from a list of potential obstacles to implement climate innovation (Figure16). As part of the survey, we asked firms what challenges they face for their investment activities related to making changes in their own company to respond to climate impacts as well as offering products, services or processes intended to generate climate impacts for their customers. The answers to that question are plotted below. High cost of making those changes is the barrier most often cited as major obstacle by established firms (51%, compared to 39% of EU start-ups). ‘Availability of finance’ is reported by 49% of EU start-ups as major barrier to investment, and 39% of established firms.

Figure 16: Major obstacle to introducing climate innovation



Source: EIB Online Survey on climate innovations.

Base: All climate innovators.

Questions: To what extent, if at all, are each of these obstacles to implementing changes in your company and for offering products, services or processes intended to generate environmental impacts for your customers?

Overall, European start-ups seem to face more barriers than start-ups in the US (see also EIB 2019 and Delanote et al. 2020). Only when it comes to the availability of finance for climate innovations, one in two start-ups, independent of the region, complain. Established firms perceive this less as a barrier,

suggesting that their scale puts them in an advantage when seeking resources (see section on availability of finance below for a more detailed analysis).

Next to the availability of finance, the high cost of making changes is the biggest obstacle for start-ups, especially in Europe. Not only start-ups but especially established firms complain about cost as an obstacle, in spite of having less issues with the availability of finance. This may thus be more related to a potential non-alignment of climate innovations to their core strategies, in spite of financial markets being seemingly more eager to support these firms when implementing these type of innovations.

In spite of being one of the main major obstacles to investment for firms in general, the availability of skills seems to be less of an issue for climate innovations. The EIB Investment Survey (EIBIS 2021) revealed that both uncertainty about the future and the availability of skilled staff are the main major obstacles to investment for firms in general. This suggests that start-ups active in climate innovations, and even the established firms, face less issues finding people with the right skills to implement these innovations. This is an encouraging finding given that a lack of skills is a barrier for which a short-term solution is difficult to find and might relate to employer attractiveness in these sectors.

In addition, uncertainty about regulation or about technological developments seems less of an issue. In spite of being somewhat higher for European firms, this is an important finding given that regulation is already a lot more stringent than in other regions. For example, the EU was the first region to implement the EU ETS, amongst others such as the Effort-Sharing regulation. Nevertheless, the US recently re-joined the Paris Climate Agreement and has set new climate goals.

Especially European start-ups complain about uncertainty in market demand. This suggests that, independent of their ambitions in terms of going global or staying more local, they may have more difficulties to scale in the fragmented European market. This finding seems well aligned with the findings above, showing that European start-ups have a smaller reach with their climate innovations.

For all other cited obstacles, on the other hand, established firms have a tendency to complain more. Above, we saw that the climate innovations of established firms differ in scope and reach from those from start-ups. In addition, established firms are more inclined to state that they invested already too much in climate innovations and seem to perceive less of a positive impact on their sales from these type of innovations. The fact that they perceive more obstacles for investing in these type of innovations may thus be related to these factors.

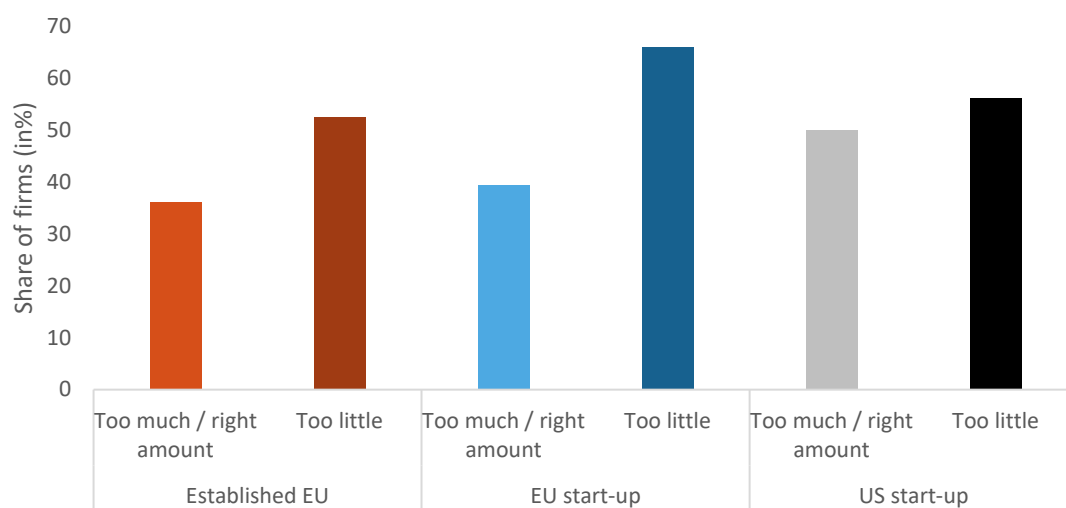
Investment in climate innovation are hampered by high costs and a lack of support (external finance and government support). Respondents of the online survey mention these barriers the most frequently (Figure 16). Furthermore, respondents signal that regulation and industry standards are real obstacles to introducing innovations intended to generate environmental changes.

Access to finance

Overall, we have seen an appetite for investment in climate innovations, but at the same time an important share of firms, especially start-ups, feel that they invested too little. In addition, the availability of external finance and high costs were the most cited barriers to the implementation of climate innovation. This triggers the question as to how firms perceive the access to finance.

In line with expectations, availability of finance concerns predominantly firms with investment gaps, whereas firms that made investment in line with, or even exceeding, investment needs over the last three years are less often mentioning access to finance as major barrier (Figure 17). We find that 66% of European start-ups that under-invested in climate innovation in the last three years, and 53% of established firms respectively, state that the availability of finance is a major obstacle. This suggests a link between successful climate innovation and access to finance. Compared to US start-ups, European start-ups that invested too little seem to suffer more from a lack of access to finance.

Figure 17: Availability of finance as major obstacle to investments in climate innovation, by investment gap



Source: EIB Online Survey on climate innovations.

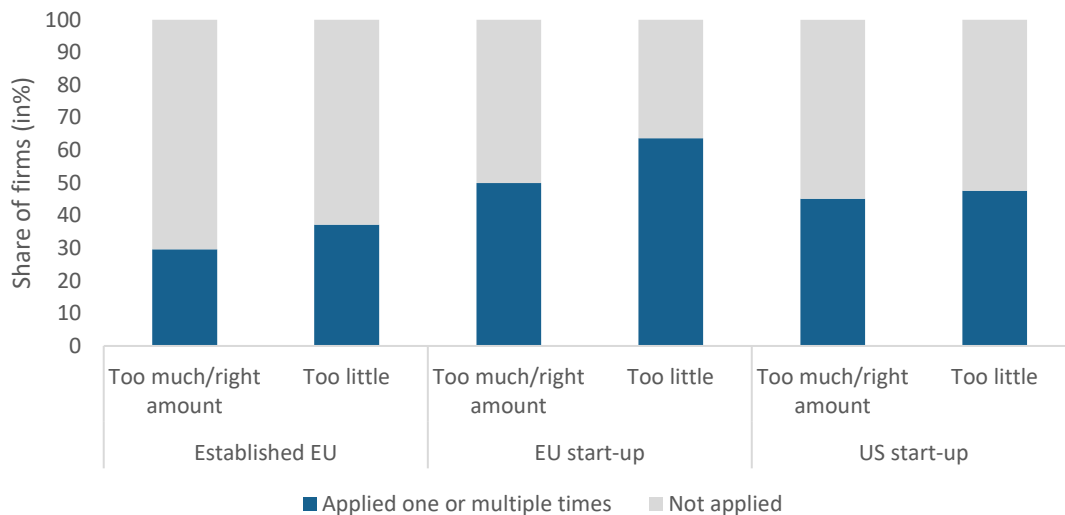
Base: Climate innovators.

Questions: Thinking about investment you already made in environmental innovation, was the investment too much, too little, or about the right amount to ensure the success of your business going forward? To what extent is the availability of finance an obstacle to environmental innovation?

In addition, if we look at who applied for external finance, we find that firms with investment gaps did so more often. When asked about whether and how often firms applied for external finance for making changes in their own company to respond to environmental impacts or offering products, services or processes intended to generate environmental impacts for their customers, we find that firms that invested too little state more often that they applied for financing than firms that invested in line or above needs (Figure 18).

Especially European start-ups seem to suffer from a feeling of underinvestment, while applying for funding. In the European Union, 63% of start-ups that do not feel their investment in climate innovations to be sufficient applied one or multiple times, compared to only half of start-ups that invested sufficiently.

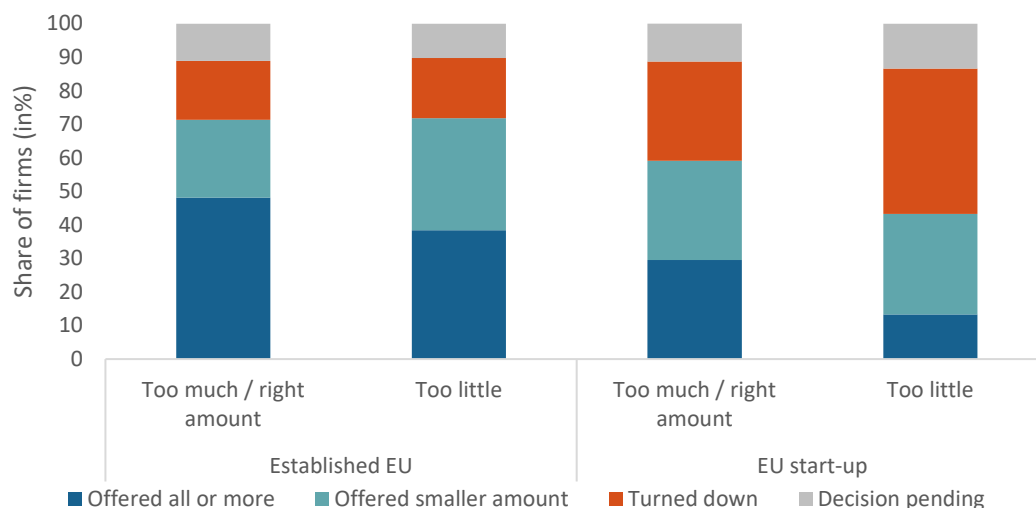
Figure 18: Application for finance, by investment gap



Source: EIB Online Survey on climate innovations.
 Base: All firms.
 Questions: Thinking about investment you already made in environmental innovation, was the investment too much, too little, or about the right amount to ensure the success of your business going forward? Has your company applied for external finance for environmental innovation?

Especially for European start-ups, the outcome of their applications for finance is worrisome. When we plot the share of firms that either was offered a smaller amount or were turned down, we see that established firms are less likely to fall into this category than start-ups in the European Union (Figure 19). Further, the share of firms that were not offered all the finance they asked for is higher for firms that under-invested in the last three years. As a result, not having access to finance to fund climate innovation for many start-ups may discourage such activities from the beginning.

Figure 19: Funding of firms in the European Union, by investment gap

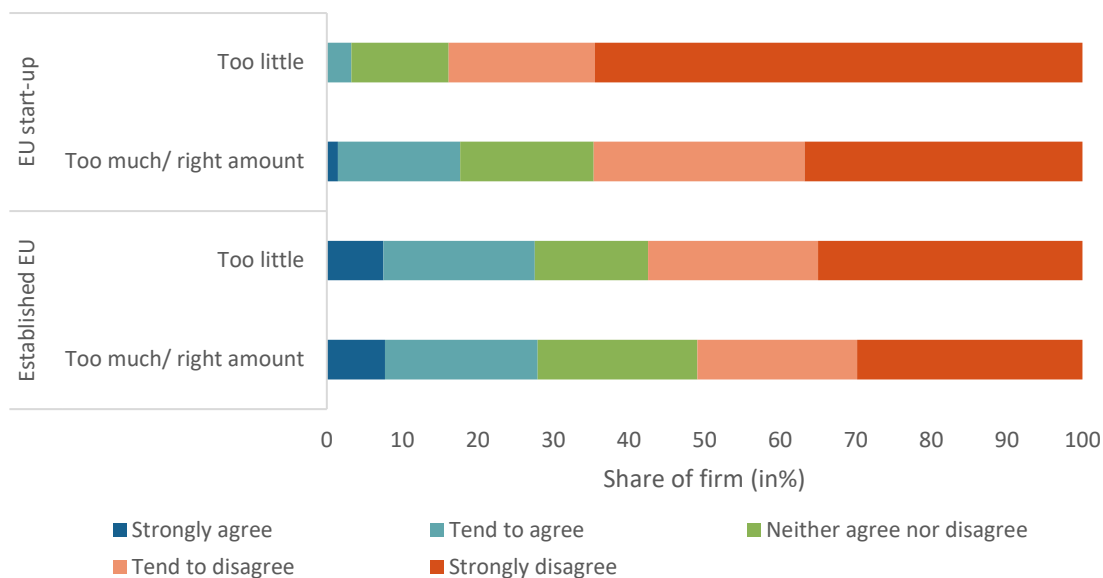


Source: EIB Online Survey on climate innovations.
 Base: Climate innovators. **US not shown due to limited number of observations.**
 Questions: Thinking about investment you already made in environmental innovation, was the investment too much, too little, or about the right amount to ensure the success of your business going forward? What was the outcome of your application for external finance?

Also when asking firms directly, start-ups seem to suffer more than established firms when it comes to borrowing activities. 65% of start-ups in the European Union that invested too little over the last years strongly disagree with the statement that their company was able to borrow as much as it would

like for climate-related projects, compared to 37% of EU start-ups with no investment gap. The difference in availability in finance for start-ups and established firms affects their ability to scale up their projects. It seems that more traditional lenders/investors hesitate to get involved in start-up funding. As a result, not having access to finance might discourage activities from the outset.

Figure 20: Borrowing possibilities for climate-related projects, by investment gap



Source: EIB Online Survey on climate innovations.

Base: Climate innovators. US not shown due to limited number of observations.

Questions: Thinking about any investment your company has made in projects to generate environmental benefits, to what extent to you agree or disagree with the following? Our company is able to borrow as much as it would like for climate-related projects.

Policy recommendations

Keeping in mind the barriers that were discussed above, as well as the access to finance constraints, policymakers should create incentives for private investors to develop and adopt climate-friendly innovations. Because the negative effects of pollution and climate change are not priced into markets, private investors (consumers included) have very little incentive to take sufficient action. As long as the market failure for these innovations remains unaddressed, it will be difficult to make progress.

The importance of consumer preferences and market pressure clearly motivates firms to introduce climate innovations (Figure 13). A large share of firms react to consumer preferences, market demand, energy prices and cost savings. Firms that introduce a climate-friendly innovation most often state that they have done so because of their company's strategy, core values and reputation. This focus is likely related to consumer preferences and market opportunities.

At the same time, scientific policy should push companies to invest in innovation. Even if innovations address a sufficiently big market, private investors may still hold back for fear of spillovers. In addition, the possibility of other companies benefitting from the technology and the high sunk costs of R&D investments could make it extremely difficult for firms to find the necessary funding. These so-called knowledge market failures are not new in the innovation literature and can be addressed by a variety of measures. Nevertheless, the novelty and often experimental nature of green innovations suggest that they may be more prone to these failures (Rodrik, 2014; Dechezleprêtre et al., 2017).

The direction of innovation may be even more important than its pace – notwithstanding the pressing need to deal with climate change. Even though innovation is a top priority on policymakers' agendas, additional innovation in technologies that do not necessarily contribute to carbon neutrality may actually make the problem worse (Acemoglu et al., 2016). It is fundamental to have well directed innovations introduced to the market that reduce the costs of clean technologies to a level below those of environment-harming technologies.

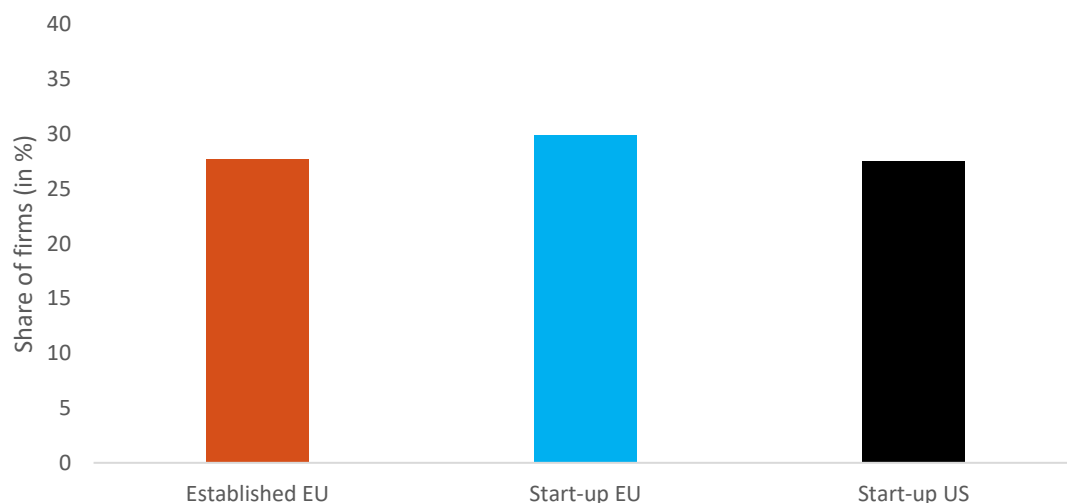
For early-stage technologies, policies are needed to help cross the bridge from research and development to market launch (Howell, 2017). In this context, the European Union's flagship research and innovation programme Horizon Europe will direct EUR 100 billion to research and innovation, making it one of the biggest initiatives in the world. Climate-related projects will account for 35% of Horizon Europe. In addition, specific innovation programmes and prize-based challenges could benefit innovation. Palage et al. (2019) find supporting evidence that advanced biofuel patenting increases after investments in demonstration projects in EU countries. In addition, extending technology transfer and lab-to-market programmes could help European companies push promising early-stage technologies. Similar initiatives would also make research and innovation an integral part of the European Green Deal, which could itself have an important signalling effect.

The probability of success in the green transformation depends largely on finding the ideal policy mix. It is critical that the full set of available policies is employed to encourage innovators to act throughout the entire value chain of technologies. In addition, the different policies, such as carbon prices, should be extended to different sectors – albeit in different formats.

Companies that feel affected by environmental legislation or regulations are more likely to innovate. Nearly one in three companies mention that regulation and legislation had stimulated innovation (Figure 21). These findings are in line with the literature (Aghion et al., 2016 and Cael and Dechezlepretre, 2016). At the same time, firms indicate that the current legislative and regulatory framework is creating a lot of uncertainty and excessive burdens while lacking consistency across

countries and sectors, which may therefore hamper or restrict a firm's activities. Even if policy measures are going in the right direction, they should tilt more towards stimulating innovation.

Figure 21: Regulation stimulated innovation



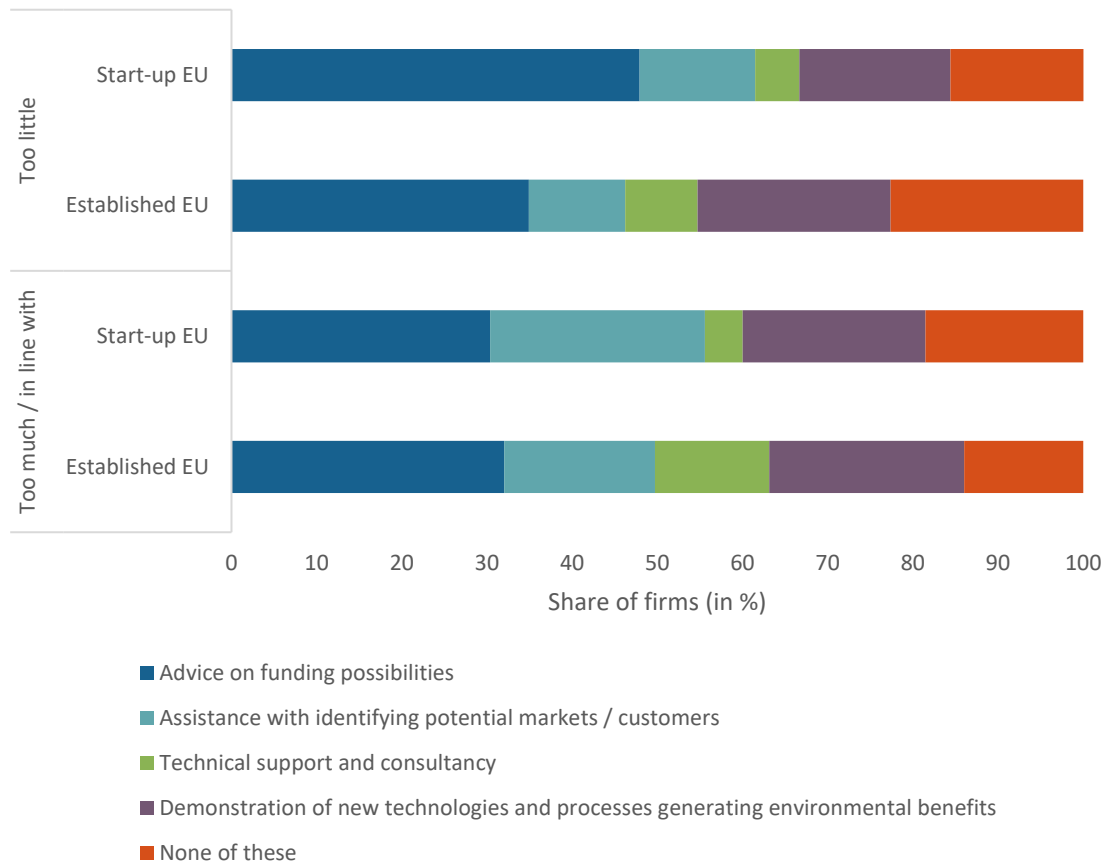
Source: EIB Online Survey on climate innovations.

Base: Climate innovators.

Questions: Has environmental legislation or regulation affected your company?

Advice on funding is particularly helpful for start-ups that invested too little in climate innovation. Firms say that advice on funding possibilities and the demonstration of new technologies and processes provide them with the most support. In the online module on climate innovations, we asked companies if there was one type of support that would encourage them to introduce or develop environmental projects. The respondents clearly signalled that they need advisory support, advice on funding possibilities and demonstrations of new technologies and processes (Figure 22).

Figure 22: Advice



Source:

EIB Online Survey on climate innovations.

Base:

*Climate innovators. **US not shown due to limited number of observations.***

Questions:

Thinking about any investment your company has made in projects to generate environmental benefits, to what extent to you agree or disagree with the following?

From the following, which one type of support would encourage you the most to introduce or develop projects intended to generate environmental benefits for either your own company or customers?

Conclusion

In spite of the undeniable importance to tackle climate change (IPCC, 2021), a lot still has to be done. The development of new technologies is an integral part of this and while Europe seems to be at the forefront, its position is not cast in stone and European firms, especially start-ups, seem to have a lower reach with their innovations. Nevertheless, investing in climate innovations does seem to pay off – and an important share of companies show an appetite for investment.

Investment in climate innovation are hampered by high costs and a lack of support (external finance and government support). Respondents of the online survey mention these barriers the most frequently (Figure 16). Furthermore, respondents signal that regulation and industry standards are real obstacles to introducing innovations intended to generate environmental changes.

The European Union is a leader in the development of climate related technologies. But nothing should be taken for granted. European policymakers will have to do everything it takes to ensure that this dominant position is not rapidly lost. The strong position of the US and China in the development of new technologies could make it difficult for Europe to remain on top in climate-change related areas in which it currently excels.

Climate innovation represent a major economic opportunity for the European Union. The European Green Deal is a cornerstone of the recovery plan for Europe. Combined with the national recovery and resilience plans, the initiatives present a unique opportunity to transform the European economy and make it greener and more innovative.

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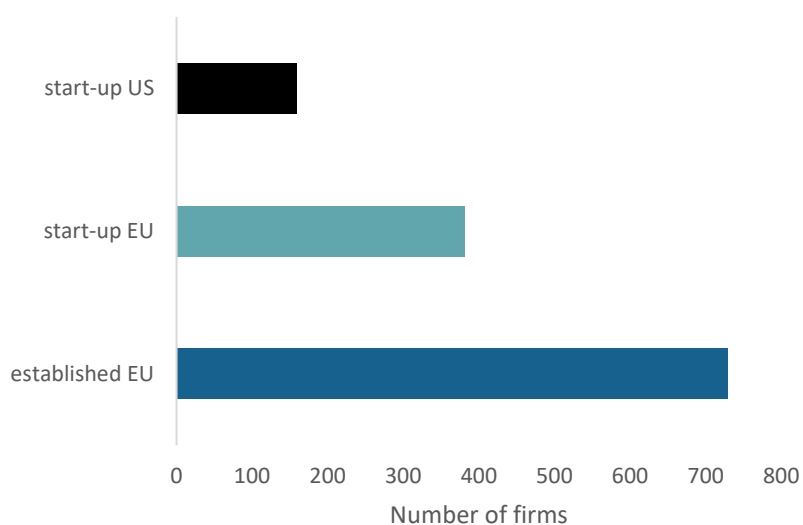
Appendix : EIB Online Survey on climate innovations

The EIB, together with Ipsos Mori, administered an online survey. This Online Survey on Climate Innovations collected 1 609 firm-level responses on the introduction of climate innovations, the motivations to do so and the obstacles encountered. In addition, the survey asked companies about the current policy designs and regulations in place, as well as about the financing and impacts of the climate innovations.

Eligible companies were sampled from Crunchbase (43% of respondents) and Orbis (57% of respondents) in the EU27, the United Kingdom and the United States. It took respondents approximately 15 minutes to complete the survey and the setup was automatically adjusted depending on whether firms introduced climate innovations or not. The fieldwork was completed in Autumn 2020.

Overall, we identified 80% of the firms as being climate innovators. However, we refrain from interpreting this result at face value given that the survey presumably suffers from selection bias. The online set-up and voluntary nature of the survey make it very likely that climate innovators are more likely to self-select into the survey.

Figure 25: Survey respondents and analysis grouping



Source: *EIB Online Survey on climate innovations.*

This is a joint publication of the EIB Economics Department and Crunchbase.



The mission of the EIB's Economics Department is to provide economic analyses and studies to support the Bank in its operations and in its positioning, strategy and policy. The department, a team of 40, is headed by Debora Revoltella, Director of Economics.

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How to foster climate innovation in the European Union:

Insights from the EIB Online Survey on Climate Innovation



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