SRERC
Spatial & Regional Economics Research Centre

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Data Report on Innovation, Networking and Policy in the Offshore Renewable Energy Sector in Ireland, UK and Western Europe

SELKIE

Tionól Réigiúnach an Deiscirt
Southern Regional Assembly
Cláir Chistí Eorpacha Struchtúrtha agus Infheistiochta na hÉireann 2014–2020
Cómhaoinithe ag Rialtas na hÉireann agus ag an Aontas Eorpach

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Selkie Project

Workpackage 9 – Sustainability and Commercialisation

The Selkie Project [grant number 81874] is funded through the European Union's European Regional Development Fund through the Ireland Wales Cooperation Programme. The primary aim of the Selkie project is to facilitate and contribute to the deployment of Offshore Renewable Energy (ORE) technologies in open sea environments in the most efficient and cost-effective manner for both Ireland and Wales. The project activity will deliver a set of tools for business planning, engineering, and operation of the ORE sector. The aims of the Selkie project include: (i) establishing a cross-border network of Ocean Energy Small and Medium Enterprises (SMEs) and supply chain companies, (ii) conducting industry-academic collaborative R&D projects, (iii) transferring R&D knowledge to wave and tidal industry/SME stakeholders, (iv) advancing the technology sector as a whole and (v) assisting Irish and Welsh SMEs to progress along the path to commercialisation of their products. On this webpage you will find outputs from Workpackage 9 of the SELKIE PROJECT which was led by researchers from SRERC. The overall objective of WP9 is to ensure the sustainability of the Selkie aims beyond the project and the acceleration to commercialisation of Offshore Renewable Energy opportunities in Ireland and Wales.

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Executive Summary.

This report presents data from a unique survey of 214 firms using a sampling frame of 1,342 firms in the Offshore Renewable Energy (ORE) sector across the UK, Ireland, and continental Europe. Many firms in the sector have been operating for more than 15 years and have a workforce of 10 employees or less. The majority of businesses in this industry indicate that more than 80% of their staff have a third level degree or higher, demonstrating the highly educated workforce in this sector. Firms in the ORE sector operate in many subsectors of the renewable energy market (wave, tidal, offshore/onshore wind etc.) and often individual firms operate in more than one market. Networking with other firms and higher education institutions (HEI's) was cited as the main factor to increasing supply into the sector. Whereas the greatest barrier experienced by firms when entering or doing business in the ORE sector is insufficient engagement by government actors. Most firms in the ORE sector are involved in the earlier stages of product development (stages 1-5 on the technological readiness level scale, which involves basic technological principles observed, proof of concept and technology validation in lab and relevant environment). 80% of firms are involved in innovation activities. This high level of innovation activity by firms in the sector should in time translate to improved commercialisation and economic sustainability outcomes for the sector. Relating to innovation, firms cite financial constraints as a significant restriction to the development of new products and services. Innovation is also identified as a primary incentive for collaboration between firms in the sector. Government support was seen as a critical facilitator for the creation of enhanced networking and collaborative opportunities that promote innovation links. However, opinions on how comprehensive the current government policies are for the ORE sector are varied.

Summary Table of the Sector Strengths and Challenges

Strengths
· Many firms are involved in more than one energy sector.
· High proportion of young firms.
· Highly educated workforce in the sector.
· High level of internal and external R&D activity by firms.
· 80% of firms in the sector engage in some form of innovation.
· High level of external collaboration by firms.
· Strong university-industry relations
Challenges
· Most activity is still in the early stages of the TRL.
· Sector is dominated by small firms.
· Limited signs of commercial success.
· Lack of finance is a key impediment.
· Firms have difficulty getting financial support from all sources.
· Initial capital costs act as deterrent to entry.
· Access to finance is a key constraint to R&D investment.
· Lack of support from government and policy implementation.

Part 1: Data Collection and Sample

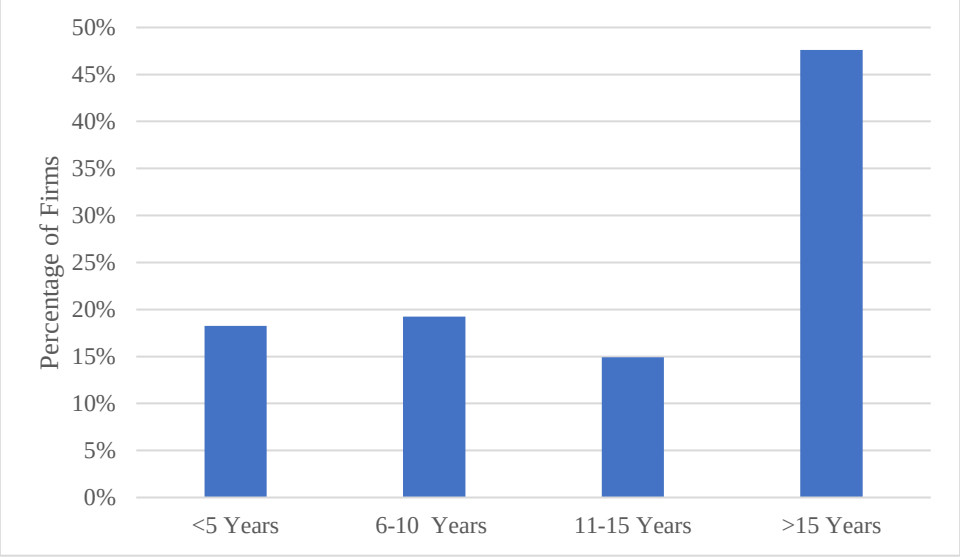
For our report, we use 214 responses from a unique, purpose-built survey for firms engaged in the ORE sector. The Renewable Energy Innovation Survey was initially conducted in 2021. The survey included questions regarding the company's innovation activities, knowledge sourcing activities, networks, resources, and performance for the years 2017 to 2019, and received ethical approval from University College Cork's research ethics board. The 2020 firm activities were not requested in the survey, due to the bias that the COVID-19 pandemic would likely have induced.

The survey's sampling frame was compiled from publicly available online ORE supply chain databases. The sampling frame comprised of 1,342 businesses. A total of 231 replies were received during the data collection, yielding a response rate of 17.2%. After data cleaning had taken place, to account for errors and omissions, 214 responses were used in the report.

Part 2: Firm Characteristics in the Sector

49% of the ORE firms surveyed within our study had their primary base in the UK. 31% were in Ireland while the remaining 20% were based elsewhere in Europe. To further understand the type of firms within the sector, participants were asked several background questions about the characteristics of the firm. 56% of respondent firms are single-plant and 44% are multi-plant firms. Figure 1 outlines firm age of respondents within our study.

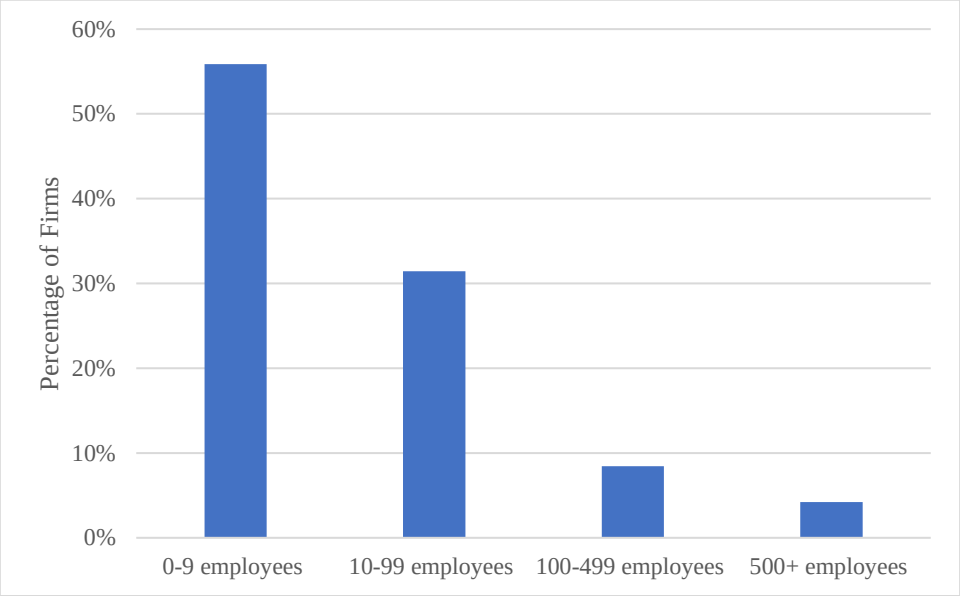
Figure 1: Age of Firms



18% of firms were established less than 5 years ago. 19% of firms surveyed are between 6 to 10 years old, while 15% are aged between 11 to 15 years old. 48% of the firms within our study were established more than 15 years old.

As shown in figure 2, most firms in the survey (57%) are classified as micro businesses as they have less than 10 employees. 31% have between 10 and 99 employees, 8% of firms have between 100 and 499 employees and only 4% are large firms with 500 or more employees.

Figure 2: Firm Size (Number of Employees)



It appears that the renewable energy sector has a highly educated workforce as seen in figure 3. Most firms (61%) reported that 81% or more of their employees have a third level qualification. 13% of firms reported that 20% or less of their employees have a third level qualification. 6% of firms stated that 21%-40% of their workforce have a third level qualification, 11% reported between 41%-60% and 9% stated that 60-80% of their employees have a third level qualification.

Figure 3: Education Level of Firm Employees

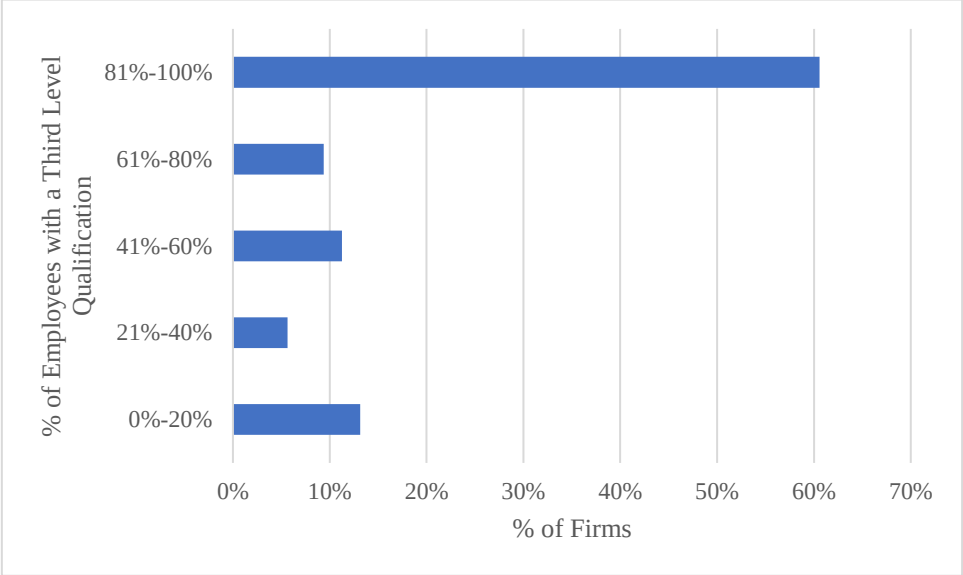


Figure 4 outlines the type of involvement of firms in the renewable energy sector. 7% are asset owner operators while 15% of firms are asset developers. The majority of the firms involved in the renewable energy sector are either suppliers (45%) or providers of external services such as consultancy (57%). Please note that participants were given the option to choose more than one category. 26% of firms were engaged in more than one type of activity in the renewable energy sector.

Figure 4: Type of Firm Involvement in Renewable Energy Sector

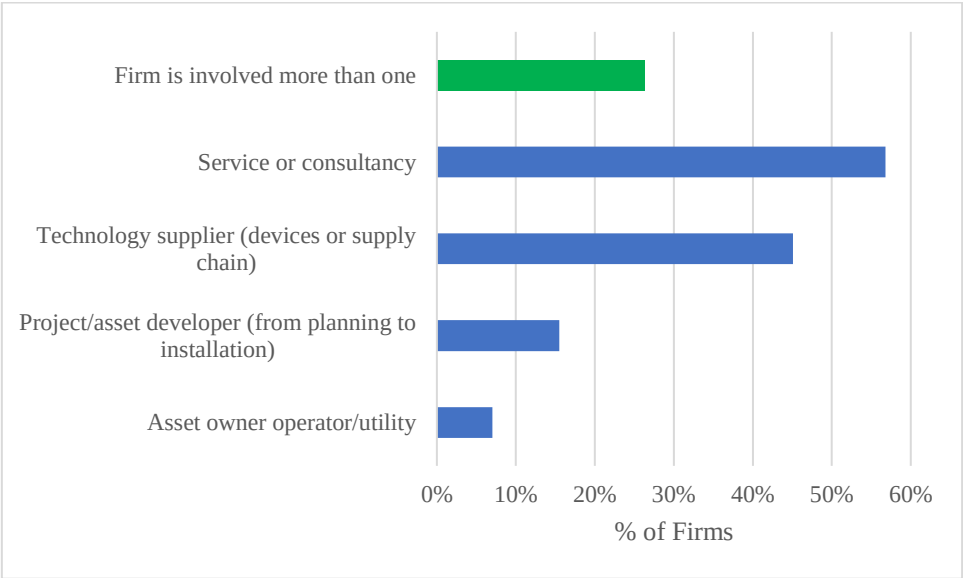
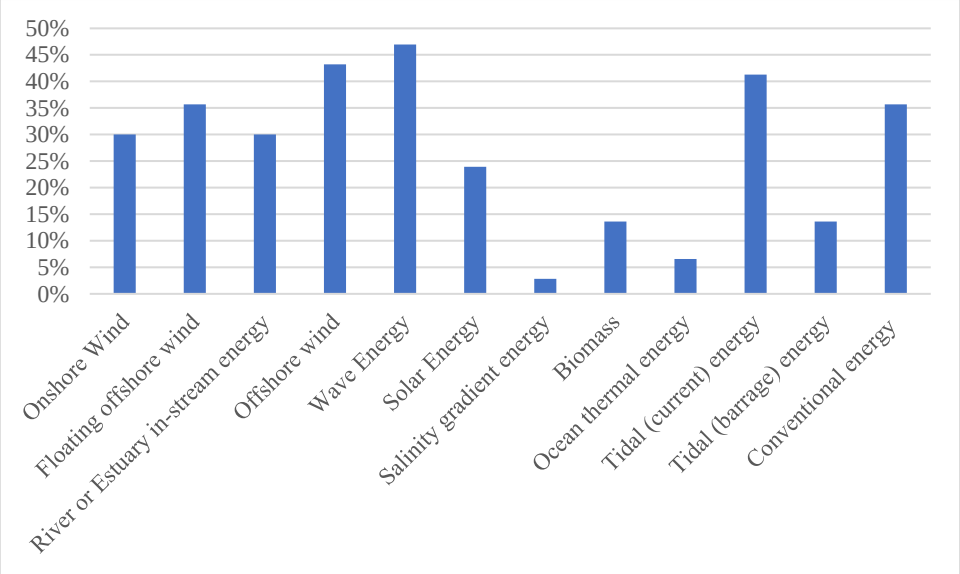


Figure 5 displays the percentage of firms involved in specific marine/offshore renewable energy sectors. Many respondents indicated they were involved in more than one sector. The most common sector that firms were involved in were: (i) wave energy (47%) (ii) offshore wind energy (43%) and (iii) tidal (barrage) energy (41%). The least common sectors are salient gradient energy (3%) and ocean thermal energy (7%).

Figure 5: Sector of Involvement for Firms

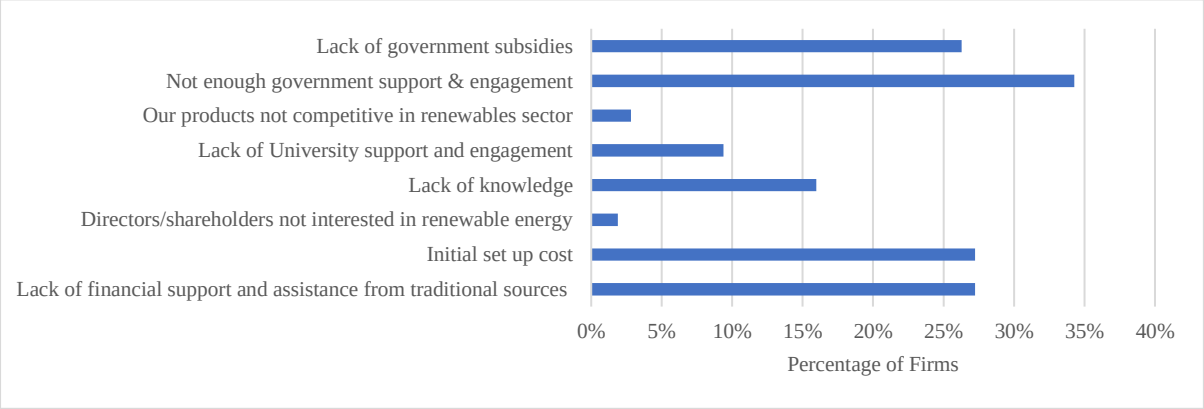


Part 3: Barriers and Enablers for Firms in the Sector

In this section, factors that are perceived as barriers and enablers to firms in the ORE sector are presented. These factors account for both the initial involvement of the firm in the sector and their continued engagement within it.

Figure 6 presents the barriers firms faced when entering or doing business with the renewable energy sector. Respondents were given the option to choose more than one. The most significant barrier reported by firms is insufficient government support and engagement with the sector (34%). A further 26% stated that a lack of government subsidies provided to firms in the renewable energy sector is a further barrier. Both these together reveal that interactions with government bodies, or indeed the apparent absence of such interactions in the sector, is a barrier for firms when considering their engagement in the renewable energy sector.

Figure 6: Barriers for Firms when entering or doing business in the Offshore Renewable Energy Sector.



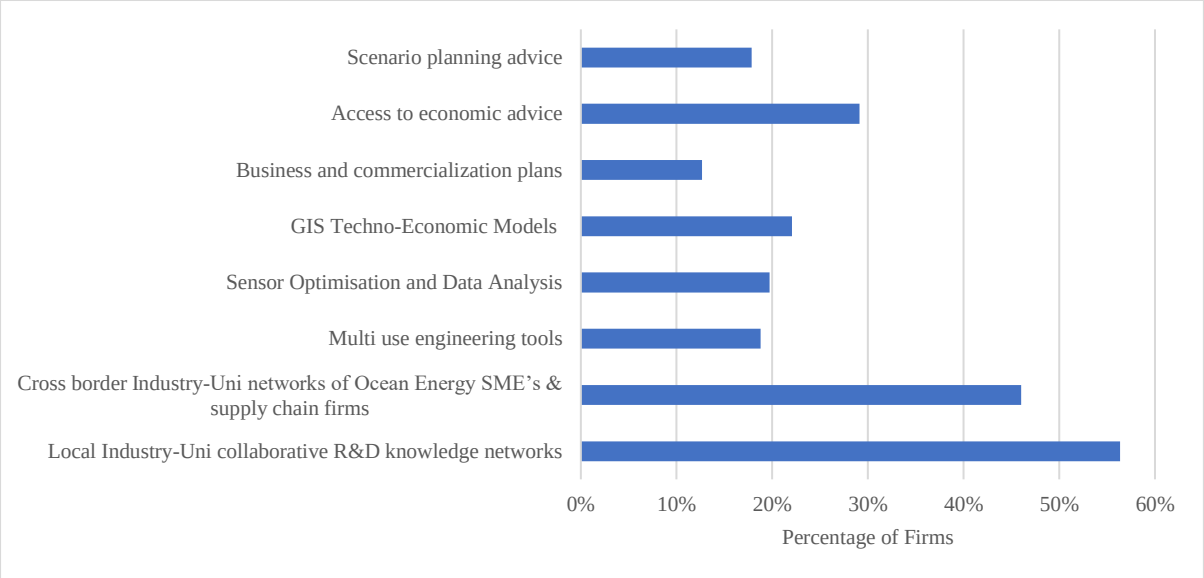
Other significant barriers highlighted by many firms are related to the costs associated with the sector. 27% of firms claimed that a high initial set up cost was a barrier. This is compounded by 27% of firms also indicating that a lack of financial assistance from traditional sources, such as banks, is a barrier. This indicates that the financial costs of entering the sector deters firms and that continued engagement may be amplified by an inability to source credit from institutions. 16% of firms cite a lack of knowledge about the sector as a barrier, while 9% of

firms report a lack of university support as a barrier. These numbers are far lower than issues relating to government and financial costs, implying that knowledge barriers and interactions with HEIs are not as concerning when firms consider all the difficulties they face in the sector.

Firm specific or internal factors are reported as the most insignificant barriers by firms. Only 3% claim that lack of product competitiveness was a barrier for their business while 2% of our sample claim that lack of interest from key stakeholders, such as company directors and shareholders, was a challenge they face.

Next, Firms were asked "*Which of the following university R&D support activities would help you to increase supply into the ORE sector?"*[1] Figure 7 presents the results for this question.

Figure 7: Which of the following university R&D support activities would help you to increase supply into the ORE sector



More than half of all firms surveyed (56%) report that local industry-university collaborative research & development (R&D) knowledge networks would be critical for their ability to increase supply into the renewable energy sector. Similarly, a high number of firms (46%) also claimed that being part of a cross-border network with other industry actors and universities

[1] Participants were given the option to choose more than one option.

for ocean energy SME's and supply chain firms would benefit their output and translate into the increased supply of technologies and goods into the sector. This shows that having networks, both locally and internationally, is important for ORE firms.

Further important university R&D support activities highlighted as enabling engagement with firms in the renewable energy sector include the use of GIS techno-economic modelling (22%), sensor optimisation and data analysis software (20%) and multi-use engineering tools (19%). This indicates that, through the use of modern technologies when working with universities for R&D purposes, firms can increase the supply of their goods in the ORE sector.

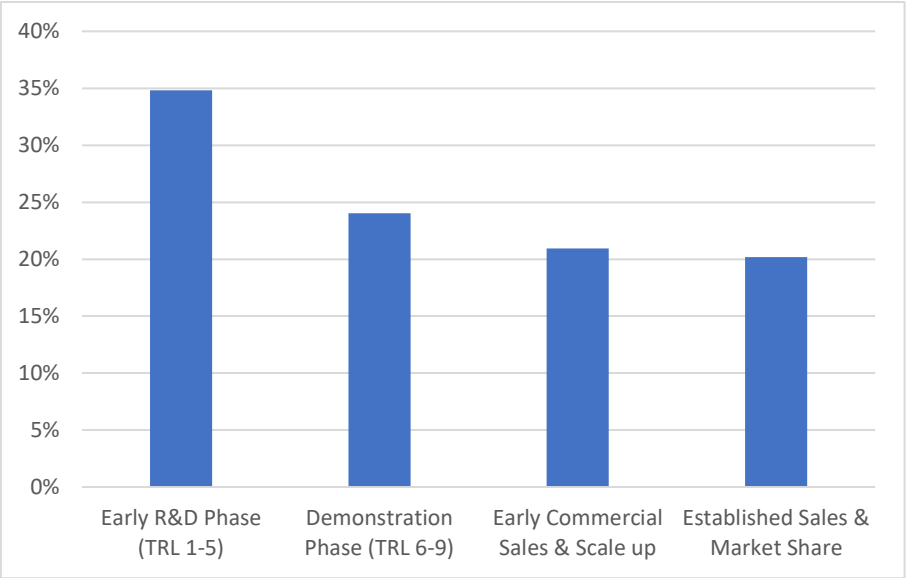
Other enabling factors highlighted by our sample include access to economic advice (29%), scenario planning advice (18%) and having access to business and commercialisation plans (13%). This suggests that these type of consultancy activities can also promote engagement in the ORE sector. However, they are not seen to be as critical as some other activities, such as networking activities.

Part 4: R&D and Innovation in the Sector

Within this section, innovation in the ORE sector is discussed. Different elements of innovation are analysed, including the stage of the innovation process firms are involved in, the type of innovation undertaken, whether firms utilised innovation partners, the importance of different innovation activities, and the barriers to and enabling factors of innovation, by firms in the sector.

Figure 8 displays what stage of involvement the firms within our study were engaged in. In total there were 689 instances of involvement by 213 firms. This arises because firms are engaged in different markets of the renewable energy market and are thus involved at different stages, including more than one stage.

Figure 8: Stage of Involvement for Firms



35% of the sample are involved in the Early R&D Phase, stages 1 through 5 of the Technology Readiness Level. 24% are in the Demonstration Phase which comprises stages 6 to 9 of the Technology Readiness Level.[2] 21% of firms are engaged in the Early Commercial Sales and

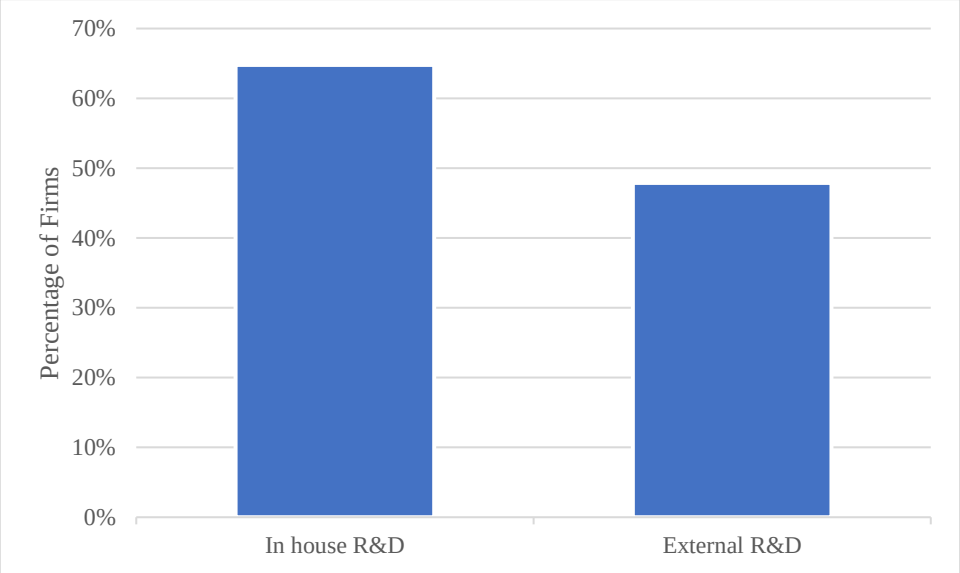
[2] The Technology Readiness Level (TRL) is a method used to measure the maturity of a given technology. The method is uniform across different technology types and allows for progression comparisons to be made. The TRL is measured on a scale of 1-9.

Scale Up of products and 20% are in the Established Sales and Market Share stage. The patterns evident in the graph show that a greater proportion of firms are involved in the early stages of development than the later stages.

Figure 9 shows that 65% of respondents indicate that they undertook in-house R&D. The most common reasons for organizations not undertaking in-house R&D were time constraints, cost issues, and the nature of the firm's operations i.e. service providers (do not supply products).

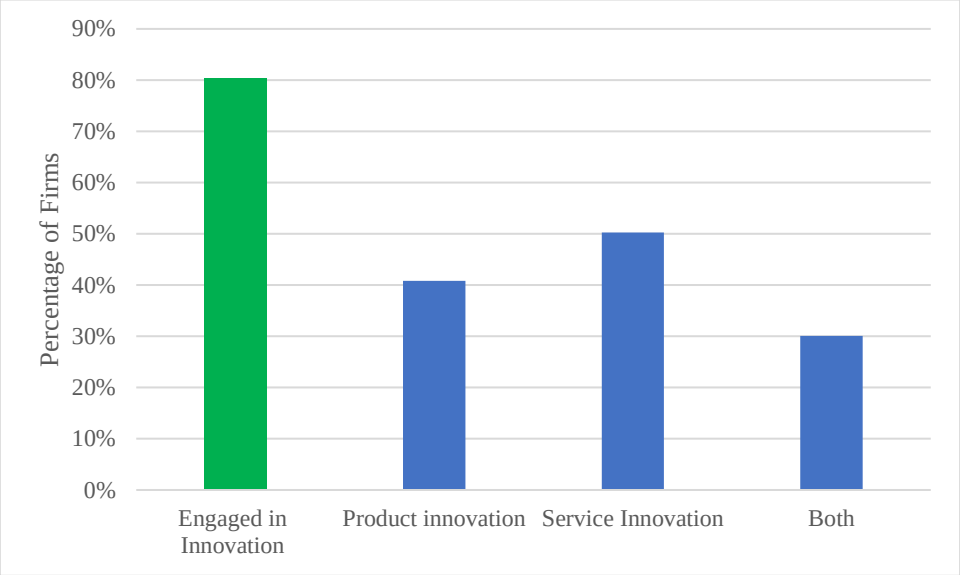
Firms were also asked whether they engaged in external R&D during the period with 48% of respondents indicating that they had. When asked why their firm did not engage in external R&D, the key reason given was due to their own in-house capabilities.

Figure 9: R&D Activities of Firms



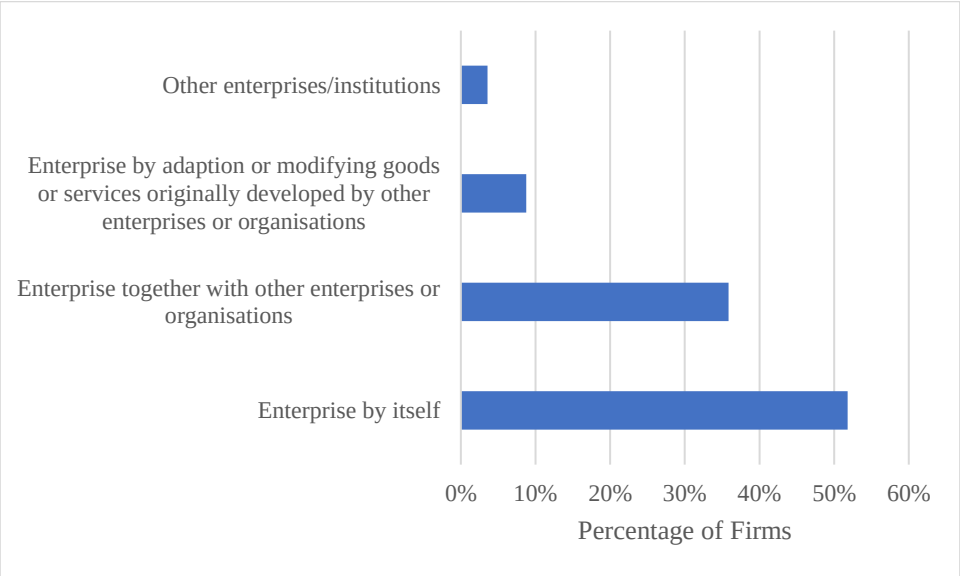
The results in figure 10 show that four out of every five firms are engaged in commercial innovation activities. It is important to note that these may not be specifically related to renewable energy sector commercial activities. However, it does highlight the high commercial potential for new technologies and ideas by firms in the sector. 41% of respondents report the introduction of a product innovation, whereas 50% firms engaged in service innovation. Over the period 2017-2019, 30% introduced both product and service innovations.

Figure 10: Firm Engagement with Commercial Innovation



The majority of firms indicate that they do not engage in collaboration with other industry or public actors when introducing commercial innovation. As presented in figure 11, 52% of innovation activities were conducted by the firm alone. Where collaboration does occur, it is primarily with other firms; this accounts for 36% of innovation activities.

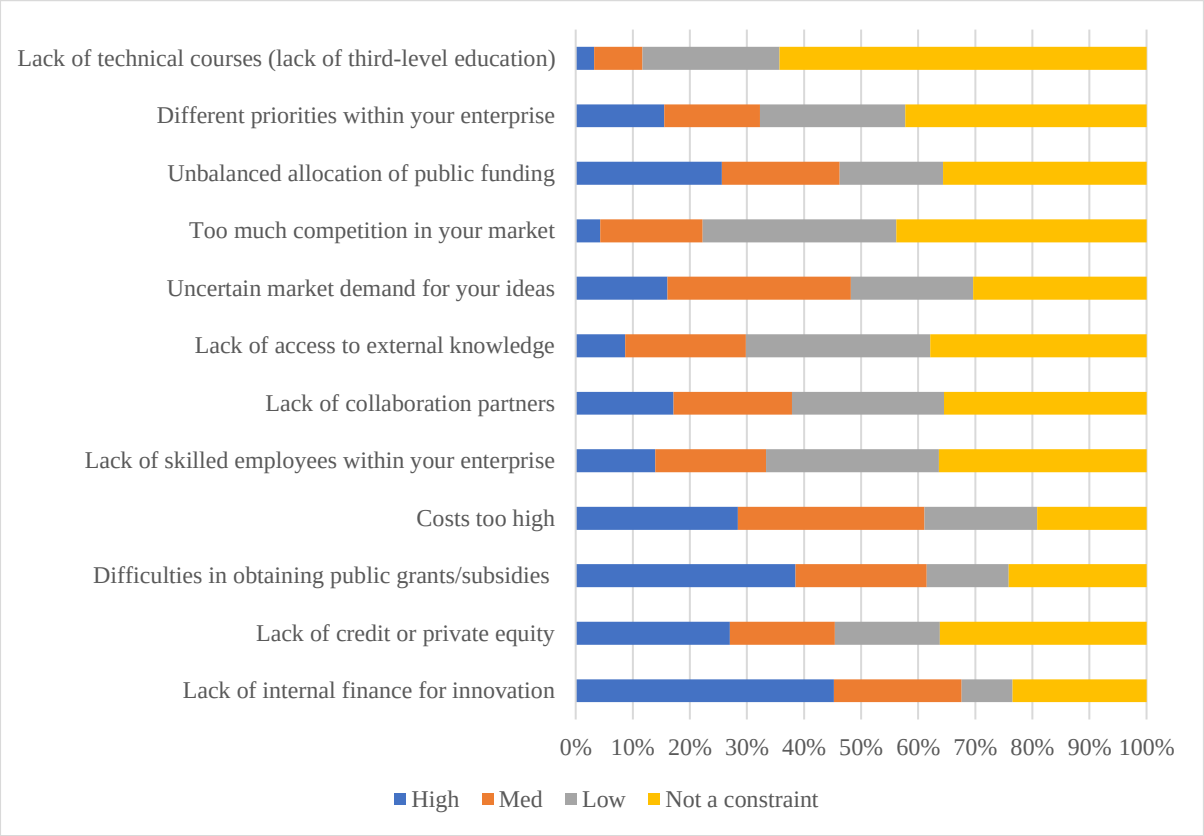
Figure 11: Which Parties Were Involved in Developing Innovation?



Only 9% of firms introduce innovations by adapting or modifying goods or services originally developed by other enterprises or organisations. 4% of firms report that their innovations are completed by other enterprises/institutions.

When asked what barriers to innovation firms face, financial barriers were identified as the biggest barrier. Figure 12 shows that 45% of ORE firms indicated that the lack of internal finance for innovation is a severe (high) constraint. In contrast to this, only 9% of ORE firms report that lack of finance is a low-level constraint. However, 23% responded that it is not a constraint for them.

Figure 12: Barriers for Firms Engaging in Innovation



The second major financing obstacle focuses on firms' difficulties in obtaining public grants/subsidies. As figure 12 shows, it is one of the main hurdles for innovation for firms in the ORE sector, as 39% cited it as a high constraint. However, 24% of firms claim that it is not a constraint for them. This was complemented by the firms' views on the "Unbalanced

allocation of public funding". 26% of firms consider it as a high constraint, however, 36% indicate it is not a constraint for them.

Firms were asked to indicate to what extent high costs act as a financial barrier. Figure 12 shows that 28% of ORE firms responded that "costs too high" were a high barrier with a further 33% indicating it was a medium barrier. Another financial constraint focuses on the lack of credit/private equity available for firms. 36% of respondents indicate it is not a constraint. However, 27% of respondents highlighted it as a high constraint.

Firms were also asked to indicate what other hampering factors they encountered aside from financial difficulties. ORE firms consider "uncertain market demand for your ideas" as a constraint to varying degrees with 16% of respondents saying it is a high constraint with a further 32% indicating it is a medium constraint. 30% of firms responded that it was not a constraint.

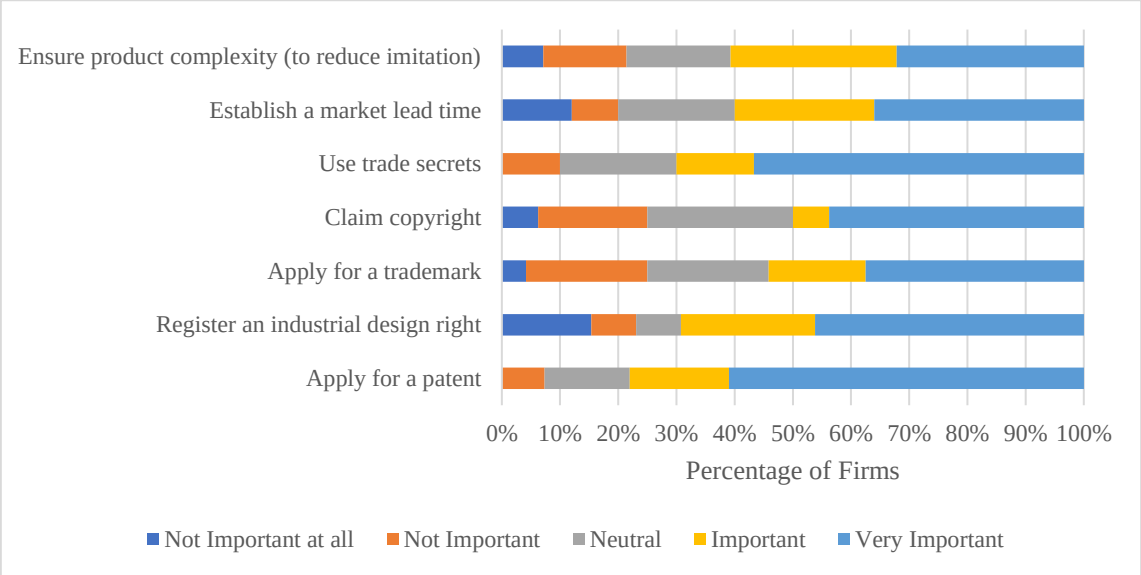
The results show that firms do not consider a lack of skilled employees as a significant barrier to innovation. 66% of respondents indicate that they either do not consider it a constraint or it is low barrier to innovation. This is an intriguing finding as often when studies are conducted on other industries, a lack of skilled employees is often cited by firms as a key constraint. This is perhaps due to the fact that many are micro businesses and working in a narrowly defined area. Future research should examine why skilled personnel are not a constraint in the ORE sector.

Firms were also asked whether a lack of collaborative partners represented a barrier to their innovative efforts. Again, most respondents report it was either not an obstacle at all (36%) or at least not a significant one (27%). The next barrier relates to lack of access to external knowledge. It also represents an insignificant barrier, as most of the firms consider it as either "not a constraint" or a "low constraint". Several other barriers, such as too much competition,

different priorities within the enterprise, and lack of technical courses, were also reported as "not a constraint" or a low constraint by most firms.

Figure 13 illustrates the importance of innovation protection activities undertaken by firms. 78% of firms cite applying for a patent of their innovations as either important or very important. Patent applications appear to the most important innovation protection activity undertaken by firms when compared to other intellectual property rights mechanisms such as registering an industrial design right (69%), applying for a trademark (55%) and claiming copyright (50%).

Figure 13: Importance of Innovation Protection Activities Undertaken by Firms

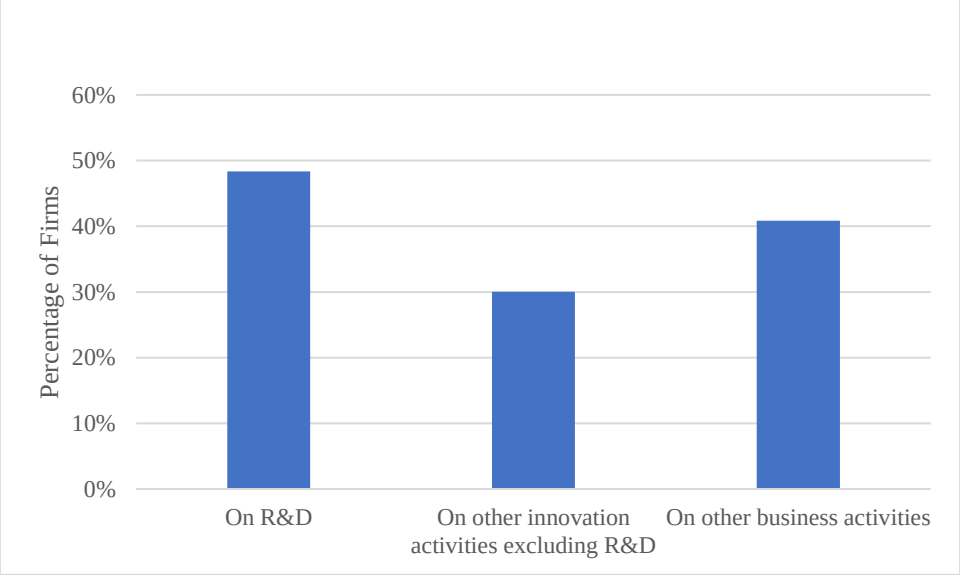


A significant number of firms (70%) report that the use of trade secrets is important or very important to protect their firm's innovation activities. Establishing a market lead time and ensuring design complexity (to reduce imitation) were highlighted by firms as important or very important by over 60% and 61% of respondents respectively. These results indicate that firms within the sector do not solely rely on formal intellectual property rights mechanisms to protect their innovation activities.

Part 5: Networking and Strategic Development Link Activities in the Sector

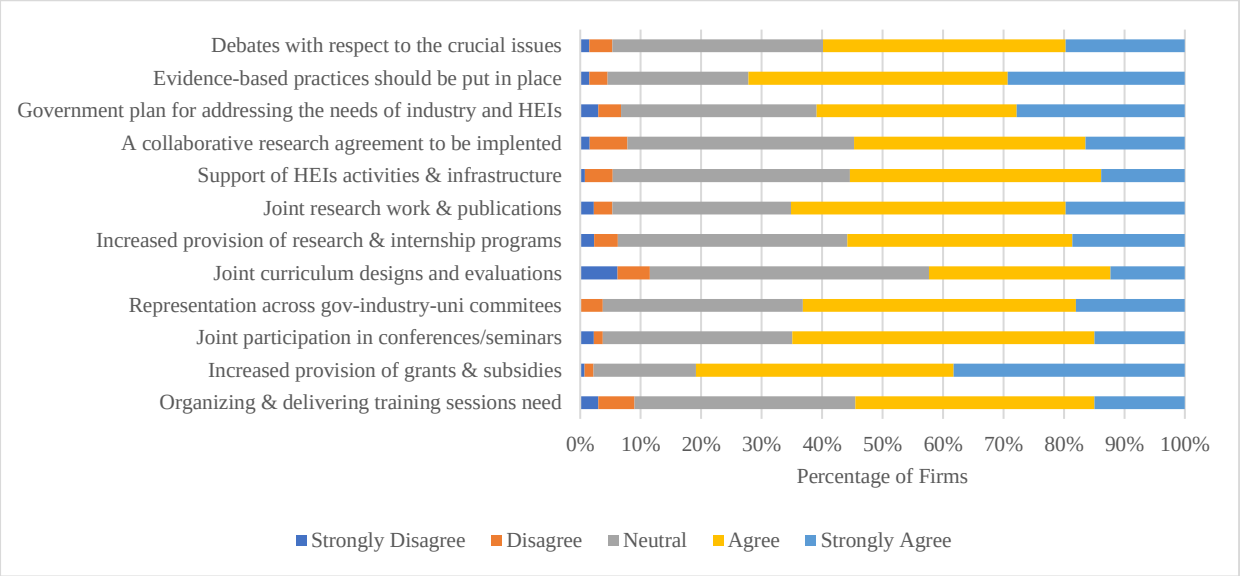
Networking activities of firms in the ORE sector are considered in this section. Figure 14 displays the activities that firms in the ORE sector network with each other on. Firms network primarily for the purposes of R&D, with 48% of our sample highlighting this. This is followed by networking for other innovation activities, accounting for 30%. 41% of the firms within our study networked with other firms on other business activities. It should be noted that within our survey, firms were given the choice to choose more than one option. However, still it emerged that firms mainly engaged with one another for R&D or other business activities.

Figure 14: Activities Firms Network with others on



Firm opinions on factors facilitating strategic networking links are displayed in figure 15. The results show the importance of government and regulatory support; 81% of firms either agreed or strongly agreed that increased provisions of grants and subsidies helped their networking opportunities. Implementing evidence-based practices into policy was another factor that most firms stated was beneficial to their ability to develop strategic links (72%). 61% believe that a government plan for addressing the needs of industry and HEIs would facilitate the development of strategic links.

Figure 15: Facilitating Factors for Developing Strategic Networking Links.

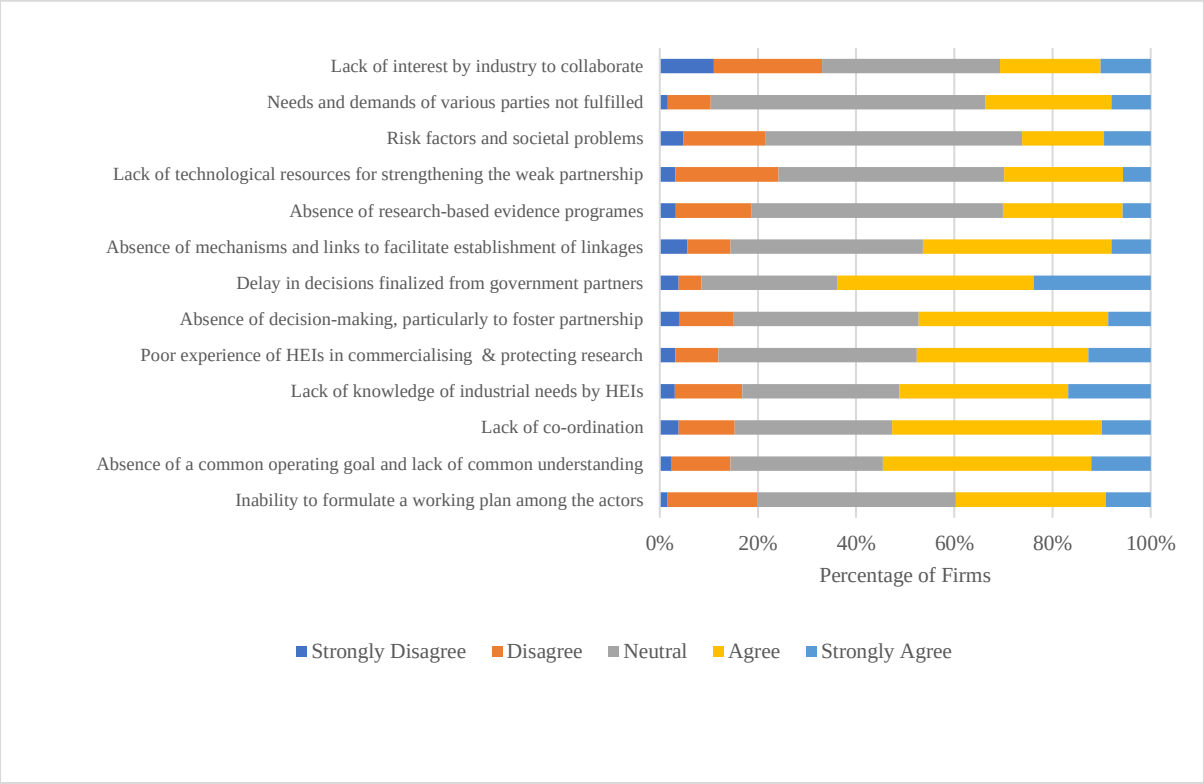


Participation on committees and seminars along with increased representation in decision making committees were also important factors for networking possibilities highlighted in our findings. 65% of firms claimed that joint participation in conferences/seminars would benefit networking opportunities and 63% highlighted the importance of having representation across government-industry-university committees. Debates with respect to the crucial issues was also seen as beneficial to the development of strategic links, with 60% of firms claiming it to be a facilitating factor.

Factors that were centred around interactions with academia were of a lower priority to firms, however, most were still identified as beneficial to firms. Organizing & delivering training sessions was highlighted as beneficial by 55% of firms. 56% believe that both the increased provision of research and internship programs and the support of HEIs activities and infrastructure would help create more strategic links. 65% of firms claim that joint research work and publications are facilitators of strategic link creation. Having a collaborative research agreement to be implemented was highlighted as a benefit by 54% of firms studied. The only factor that had less than 50% of participating firms not "agree" or "strongly agree" with was having a joint design of curriculum and evaluations in university courses; only 42% of firms claimed this would be a factor facilitating the development of strategic networking links.

Participants were then asked what they feel were the greatest barriers to developing strategic links within the ORE sector, the results of which are given in figure 16.

Figure 16: Barriers to Developing Strategic Networking Links.



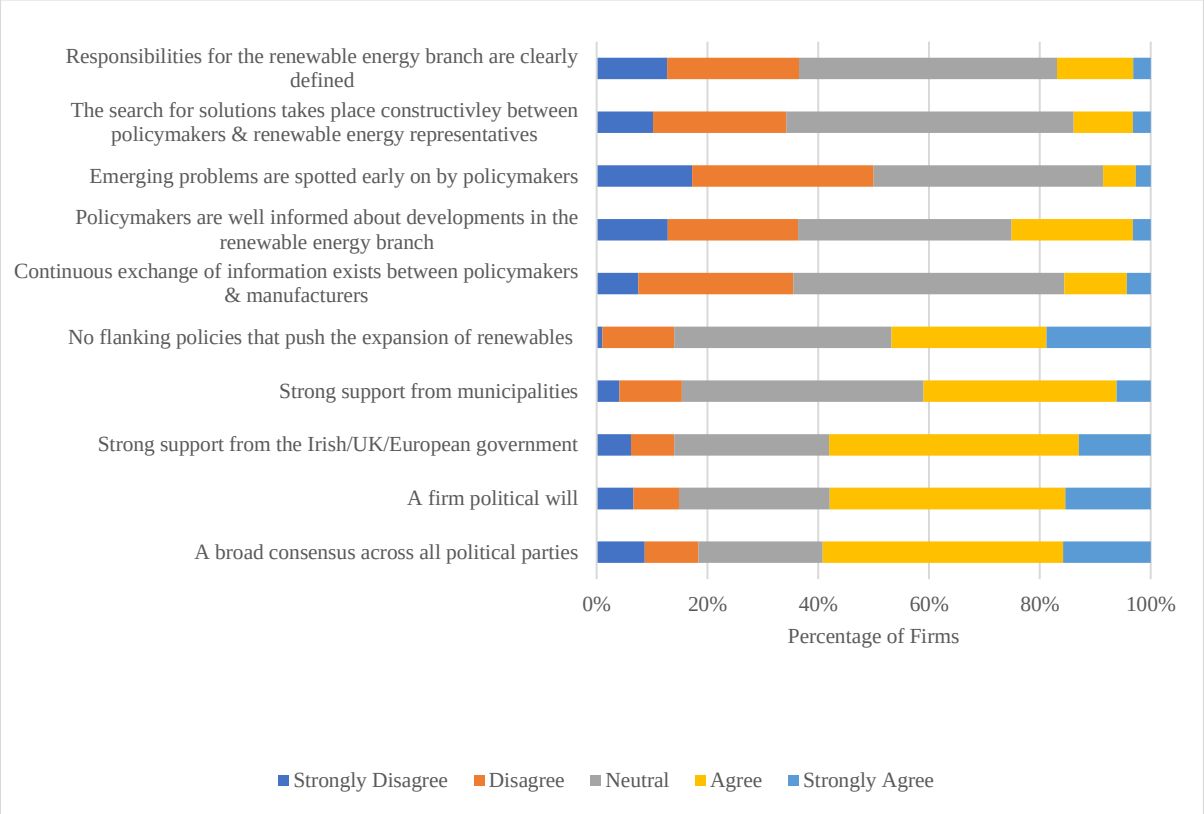
The largest barrier highlighted by firms was related to working with government partners. 64% of respondents indicated that delays in the finalisation of decisions by government partners is a barrier. Respondents were asked several questions related to co-ordination with other parties when engaged in collaboration projects. 54% of firms claimed that an absence of a common operating goal and lack of common understanding was a barrier, with a similar number of firms (53%) highlighting that an overall lack of co-ordination between parties is a difficulty when collaborating. An absence of decision making was seen as a barrier to strategic link development by 48% of firms. 51% of firms claim that the lack of knowledge of industrial needs by HEIs was a difficulty. Poor experience of HEIs in commercialising and protecting research was also recognised as a barrier to developing strategic links (48% of firms).

Part 6: Reflections on Government and Policymaking in the Sector.

In this section the place of government in the ORE sector is examined. Here, the opinions of firms in the sector on several different topics related to the role of governmental bodies within the renewable energy sector is presented.

Firms within our study were asked about the role of government intervention in the ORE sector, the results of which are shown in figure 17.

Figure 17: Firm Sentiment on Government Involvement in the Renewable Energy Sector.



The first question asked participants whether there is "a broad consensus across all political parties" with respect to increasing ORE generation. Most firms (69%) indicate their agreement with this statement. Participants were asked whether they believe there is a firm political will to increase ORE generation; 68% of ORE firms indicate their agreement that there is. 58% of Irish and European ORE firms believe they get strong support from government. Finally, with respect to the credibility of the policy mix, firms were asked whether they received strong

support at the sub-national level. 41% of ORE firms agree that they receive strong support from municipalities/local/regional government.

The next element addressed is the comprehensiveness of the policy mix. Participants were asked whether "flanking policies are missing that push the expansion of renewables"; 47% of respondents either agree or strongly agree with this statement which suggests the need for policy makers to reflect on the policies in place to support the expansion of renewable energy. To assess the coherence of the policy mix targeting ORE generation, respondents were asked whether there is continuous exchange of information between policy makers and manufacturers. 36% of firms disagree or strongly disagree which suggests there is an incomplete flow of information between policy makers and manufacturers in ORE firms. Participants were also asked whether they believe policy makers are well informed about developments in renewable energies. A considerable number of respondents (37%) say that they disagree, to varying degrees, that policy makers are well informed about developments in ORE sector. The final element assessing the coherence of the policy mix is whether emerging problems are spotted early on by policy makers. 50% of respondents either disagree or strongly disagree with this claim, which suggests firms believe that policy makers do not identify emerging problems in a timely fashion. This may lead to a delay in adapting existing policies to cope with these problems and could cause operating issues for firms within the sector.

Part 7: Conclusions - Sustainability and Commercial Viability of the Sector

This report highlights various strengths and challenges in the offshore renewable energy sector. The strengths of the sector are primarily related to the ability of ORE firms to innovate using internal resources and in their co-operation with external actors. The challenges that were highlighted in this study are primarily related to financial constraints and interactions with government. It is important to note that the market challenges experienced by firms largely represent the industries emerging state. The sustainability and commercial viability of the sector will be dependent on ORE firms building on the current industry strengths, whilst working with external stakeholders to overcome the current market challenges around finance and government assistance. The strengths and challenges identified in this data report can serve as evidence-based leverage to prepare and initiate industry and policy actions.