

Diversification Strategies and the Emergence of a new Industrial Value-chain: Challenges and Opportunities for Companies

Cristina Sousa¹, Margarida Fontes² and Oscarina Conceição^{1,3}

¹ Iscte Instituto universitário de Lisboa, DINÂMIA'CET, Lisbon, Portugal

² LNEG - Laboratório Nacional de Energia e Geologia, Lisbon, Portugal

³ Polytechnic Institute of Cavado and Ave - IPCA, Barcelos, Portugal

Abstract: Marine renewable energy technologies (MRET) can contribute to the decarbonization of energy, as well as to the revitalisation of other sectors, but are still an emerging and uncertain area. The development of these technologies entails the construction of a new industrial value chain, requiring the involvement of established firms from a variety of industries. Thus, it is important to understand how established firms can be mobilised to support MRET development, by pursuing diversification strategies. This paper addresses this question by looking at the case of Portuguese firms that expressed willingness to engage with MRET and investigating how they perceive the opportunities for diversification into the new business area, the changes they may need to introduce in their resources and capabilities to exploit those opportunities, and the obstacles they expect to face.

Keywords: New Industrial Value Chain; Diversification Strategies; Marine Renewable Energy Technologies; Firms' Perceptions

1. Introduction

Marine renewable energy technologies (MRET) have the potential to become an important source of clean energy and, simultaneously, contribute to the revitalisation of other sectors (Fontes et al., 2021). Realizing such potential requires the development of a new industrial value chain that combines competencies associated with new technologies with a variety of complementary resources and competencies already existent in established industries (Makitie et al., 2018). However, mobilizing established firms to acting as suppliers or co-developers to a technology that has not yet reached the commercial stage can be problematic.

This paper addresses this problem by investigating how firms from existing sectors perceive the requirements of an early involvement with emerging technologies. For this, it looks at the case of firms that expressed willingness to engaging with MRET and investigates how these firms view: i) the opportunities for diversifying into the new business area; ii) the requirements such move may raise in terms of competences and resources; and iii) the problems to be expected. The research draws on data from a questionnaire survey of firms from sectors that are potential contributors to the development, production, installation, and operation of MRET. It analyses the information obtained from 138 firms that are not yet involved in MRET but declared the intention of entering this area in the future.

The results provide important insights into how to motivate and support established firms – in particular firms that are not the typical “prime mover” – to become involved with emerging technologies, profiting from the opportunities thus created to achieve diversification and innovation. These insights are relevant to assist the formulation of policies targeting firms whose contribution can be critical to the development of sustainable technologies.

2. Literature review

The sustainability transitions literature has shown that the development of a new technology requires the construction of a new system (Bergek et al., 2008). In the early phases, this system is still being formed, and thus highly dependent on the interactions with the context from which it emerges, namely the industrial context that can provide actors and resources (Bergek et al., 2015; Markard, 2020). At this stage, actors are mainly engaged in R&D and experimentation with technologies and their possible applications (Markard, 2020). However, in the case of complex technologies that entail large scale experimentation, such as MRET, production and business capabilities are critical (Bjørgum & Netland, 2017; Makitie, et al, 2018), requiring the early involvement of established firms, acting as suppliers or co-developers (Fontes et al., 2021).

From the standpoint of these firms, involvement in the new technology can effectively correspond to an early process of diversification into a new business area. Firms engage in corporate diversification to pursue growth opportunities in other markets (Wiersema & Beck, 2017). This can be done by introducing their current products in the new market, or by following an innovation strategy, whereby they develop new products for that market. According to the resource-based view, firms diversify strategically to exploit underutilized resources with value-

creating potential in other businesses, profiting from economies of scope (Penrose, 1995). Diversification may entail an expansion of the number/range of businesses in which the firm operates, implying the sharing of resources contemporaneously between existing and new businesses (intra-temporal economies of scope); or entering into new product-markets while partially or completely exiting from old ones, shifting resources from the old to the new business (inter-temporal economies of scope) (Helfat & Eisenhardt, 2004). The latter strategy can be particularly significant for firms whose markets are experiencing slow growth, namely those in mature or declining industries, since redundant competencies and resources can be re-used and upgraded (Helfat & Eisenhardt, 2004; Karim & Capron, 2016).

It has been shown that firms benefit from diversifying into businesses that are related to the ones in which they already operate - relatedness being understood as having "a common skill, resource, market, or purpose" (Rumelt, 1974:29) - since this enables existing resources or competences to be at least partly redeployed (Adner & Zemsky 2016). Since there are several dimensions along which businesses can be related, the type and combinations of resources that can be redeployed vary, including human capital, equipment, management capabilities, knowledge, among others (Lüthge, 2020).

But firms may nevertheless be required to develop or gain access to new resources and combine them with the existing ones (Nerkar, 2003). The reconfiguration of firms' resource portfolio is described as central for firms' adjustment to a changing environment (Barney, 1991; Penrose, 1959), and can be done by adding resources, creating resources within the firm, or substituting old resources with new ones. Thus, resource reconfiguration may take place internally or externally through networks and alliances, the latter being particularly relevant for smaller firms (Thomas & Douglas, 2022; Lu & Yang, 2019).

These processes may be more complex when they entail engaging with an emerging technology, not only because of its potential novelty, but also due to the high technological and market uncertainty that is associated with the pre-commercial stages of development (Anderson & Tushman, 1990).

However, the literature has pointed out some conditions under which involvement of established firms in the early stages of technology development may occur (Turnheim & Sovacool, 2020). Incumbents threatened by the new technology may attempt to enter in order to follow its development (Ansari & Krop, 2012), or even to shape it according to their interests (Apajalahti et al., 2018). Recent research on the "incubation stage" of new industries (Agarwal et al., 2017) has shown that a variety of actors are involved in experimentation to reduce technological and market uncertainty. These include established firms, not only incumbents from threatened industries profiting from specialized complementary assets, but also firms from related industries leveraging their knowledge through diversification. These firms capture value from their early investment in different ways, not just through product commercialization but also through markets for technology and corporate control (Moeen & Agarwal, 2017).

The focus of this literature has been on the motivations and strategies of firms that attempt to have a prime move into the new industry, tendentially large firms, often powerful incumbents and frequently technology intensive. Similarly, the diversification literature tends to focus on large, often multi-business firms, with enough resources and slack organization to support this strategy. Even in the case of declining markets, less attention has been given to smaller firms, which may also face the problem but may have less margin to address it (Thomas & Douglas, 2022).

However, the development of emerging technologies may also benefit from the resources and competences possessed by a wider range of established firms than those strategic early entrants (Fontes et al., 2021). Therefore, it will be important to motivate a wider and more heterogeneous set of firms, from a variety of industries, to start engaging with the new technology. For this, policies are critical (Janssen & Frenken, 2019).

Policies can give direction – that is signal government strategic interest in the technology - and also provide direct support to actions that firms will need to conduct in order to deploy resources in the new area, including the creation of, or access to, new resources (Andersson et al., 2017; Bush et al., 2017). Policies thus encourage firms to commit under conditions of some uncertainty (Chang & Andreoni, 2020) and offer incentives that address key entry requirements of firms that might be willing to engage but can be deterred by the difficulties perceived.

The objective of this paper is to contribute to understand how to motivate this "second line" of potential entrants to engage with a still emerging technology. For this, it is necessary to gain a better understanding of these firms' views on the conditions in which entry into the new area can take place. Therefore, the paper investigates:

- Which are firms' perspectives regarding entry, i.e., which type of strategy they would be willing to adopt: market diversification (supply existing products to the new market); or product /market diversification (supply new products to the new market).
- How firms perceive the requirements to enter: i) which types of resources they perceive as necessary to change, develop or gain access to; ii) which obstacles they perceive as limiting their ability to enter.
- Whether diverse strategies lead to differences in firms' perceptions on resource needs and obstacles.

3. Methodology

The empirical research is based on a questionnaire survey of Portuguese firms from sectors identified as potential contributors to marine renewable energy technologies (MRET), which in the case of Portugal encompass wave energy and offshore wind energy.

The survey targeted both firms previously identified as active in MRET (e.g., as formal partners in funded projects or as suppliers in experimental activities), and firms with no previous known involvement, but whose area of activity indicated potential to participate in activities related to MRET. The latter included: i) firms that had shown interest in MRET through participation in events related to the area of marine energies; ii) firms from sectors presented in various studies as potential contributors to the to the development, production, installation and operation of MRET, for which there was also evidence of some innovative capacity/orientation, based on: participation in funded research and technology development projects; participation in networks, clusters or other collective activities with innovation and technology development objectives; referencing by sectoral associations, national agencies or studies on their respective sectors.

The questionnaire survey obtained 344 answers: 90 from firms currently involved in MRET; 138 from firms not involved but that declared to be intending to enter MRET in the future; and 116 from firms not active and that had no interest in MRET. This research will focus on the case of the 138 potential entrants.

In this group of firms, "micro enterprises" predominate (62%), followed by "small and medium-sized enterprises" (SMEs), which account for 30% of the sample (Figure 1).

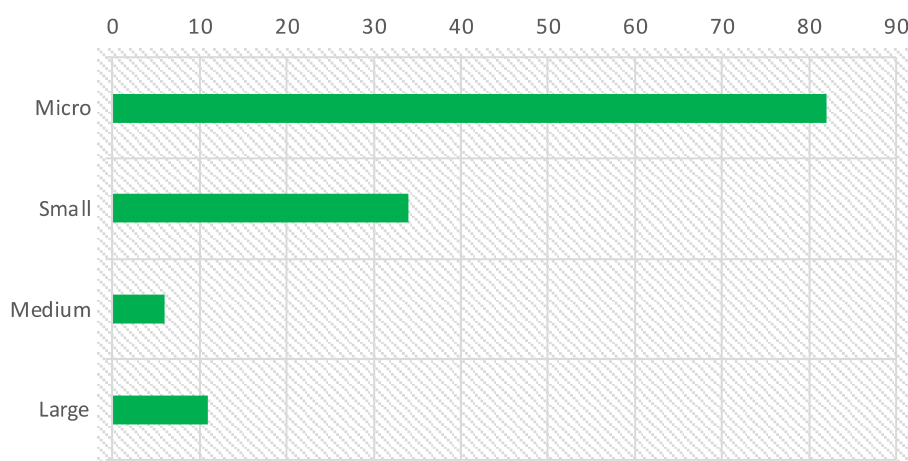


Figure 1: Size of firms willing to enter MRET

Regarding the sector of activity (Figure 2), the majority of these firms are operating in manufacturing sectors (41%) followed closely by service sectors (36%), with particular predominance of R&D and engineering services. There is also a small group of firms in sectors such as construction, retail (often suppliers of imported components and systems) and transport (ports).

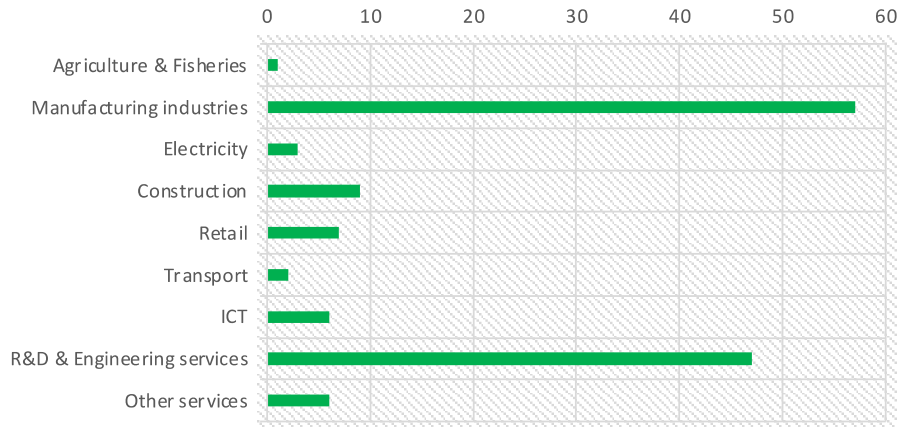


Figure 2: Sector of activity of firms willing to enter MRET

In order to investigate the perspectives and perceptions of firms willing to enter MRET, the research draws on the answers of these 138 firms to survey questions concerning:

- Their readiness to enter, i.e., the expected time horizon for entry;
- Their planned innovation strategy, expressed in the novelty of the products services they expected to bring to the new business;
- The changes in resources and capabilities they expected to be necessary, in order to operate in the new area;
- The main obstacles they foresaw.

4. Results

In this section we present the results on firms' perspectives regarding entry in MRET and their perceptions on the requirements of such strategic decision.

4.1 Perspectives on entry in MRET

Regarding the readiness to enter, the majority of the firms in the sample (70%) have not yet decided to actually enter MRET (Figure 3). The remaining have already identified some opportunities, but only 10% are developing actions to enter in the short/medium term.

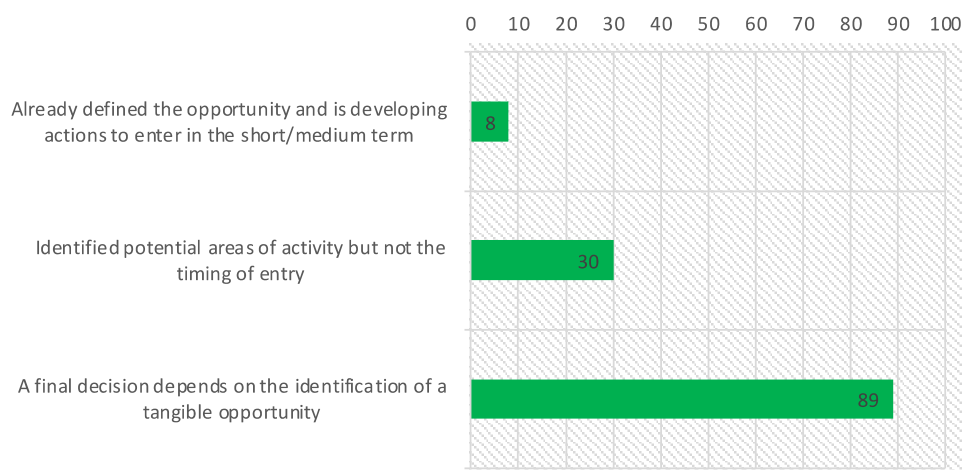


Figure 3: Readiness to enter (number of firms)

Concerning the strategy to be adopted to enter MRET, it is important to highlight that the majority of firms reveal an innovative intent (Figure 4). In fact, 63% of the respondents intend to sell new products or services (whether or not combined with existing ones). Alternatively, 22% intend to adapt existing products and services and 15%

intend only to sell current products or services in the new market. While these results must be considered with care, since they correspond to intentions that may or may not be concretized, they nevertheless suggest a perception of high innovation opportunities in the new area.

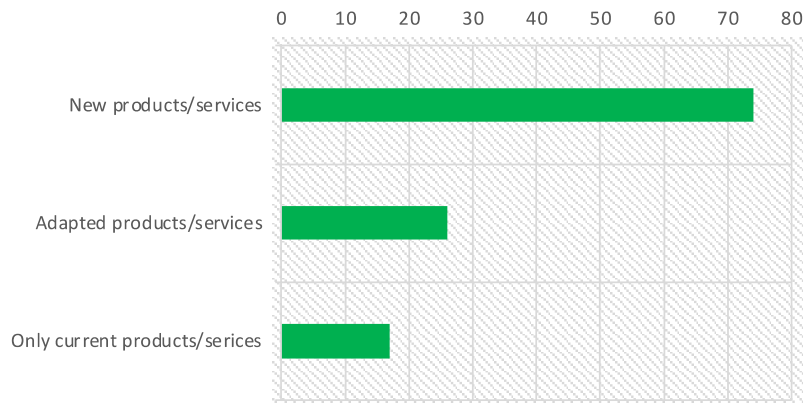


Figure 4: Planned innovation strategy (number of firms)

4.2 Perceptions on entry requirements

Respondent firms are aware that to enter the new area and thus diversify, they must make changes in their resources and capabilities. Only 22% of the firms stated that they did not foresee the need for changes. The establishment of new partnerships, the development of new skills by existing human resources, the recruitment of new human resources, and the purchase of new equipment are the main changes pointed out by the firms (Figure 5).

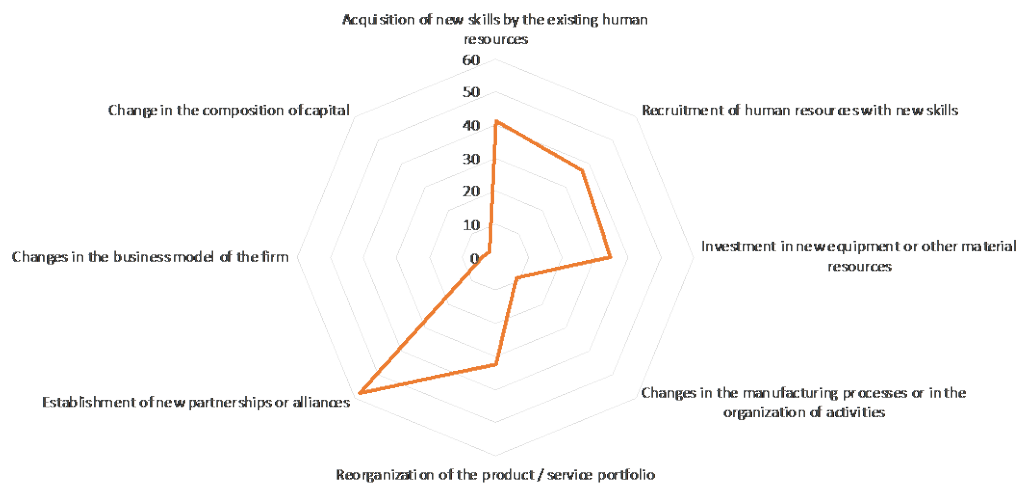


Figure 5: Entry requirements: changes in resources and capabilities

But are these changes equally important for all firms? The results show that they are not. Indeed, statistically significant differences emerge between groups of firms, when we take into account their planned innovation strategy and their "readiness to enter".

Considering the planned innovation strategy, the Kruskal-Wallis tests (Table 1 reports only the significant tests, $p < 0.1$) reveal significant differences in the perception of the importance of the following changes:

- Recruitment of new human resources with new skills: firms that intend to develop new products/services feel more frequently the need to make this change. Firms that intend to maintain their offer are the ones that feel less frequently the need to hire new employees.

- Reorganization of the product/service portfolio. Companies that intend to develop new products/services feel more frequently the need to make this change. Companies that intend to maintain their offer are the ones that feel less frequently the need to reorganize their product/service portfolio.
- Establishment of new partnerships/alliances: the need to develop new alliances/partnerships is least felt by firms wishing to adapt their products/services and is felt with the same intensity by firms wishing to develop new products/services and by those wishing to maintain their offer.

Table 1: Changes: Differences between groups according to the planned innovation strategy

	Planned innovation strategy	N	Mean Rank
Recruitment of human resources with new skills Kruskal-Wallis H = 4,499 p<0,1	Expects to have new products or services	74	63,01
	Expects to have adapted products	26	54,25
	Only expects to offer current products/services	17	48,82
	Total	117	
Reorganization of the product / service portfolio Kruskal-Wallis H = 14,704 p<0,001	Expects to have new products or services	74	66,38
	Expects to have adapted products	26	48,50
	Only expects to offer current products/services	17	42,94
	Total	117	
Establishment of new partnerships / alliances Kruskal-Wallis H = 5,270 p<0,1	Expects to have new products or services	74	62,16
	Expects to have adapted products	26	47,50
	Only expects to offer current products/services	17	62,85
	Total	117	

Considering the readiness to enter in the MRET area, the Kruskal-Wallis tests (Table 2 reports only the significant tests, p<0.1) also reveal relative differences in the perception of the need to make changes in the manufacturing processes or in the organization of activities, which is more frequently felt by firms that intend to develop new products/services and less frequently felt by firms that intend to maintain their offer.

Table 2: Changes: Differences between groups according to the readiness to enter MRET.

	Readiness to enter	N	Mean Rank
Changes in manufacturing processes or in the organization of activities Kruskal-Wallis H = 7,027 p<0,05	Already defined the opportunity and is developing actions to enter in the short/medium term	8	74,38
	Has identified potential areas of activity but not the timing of entry	30	69,08
	A final decision depends on the identification of a tangible opportunity	89	61,35
	Total	127	

The respondent firms are also conscious of the existence and need of overcoming some obstacles to diversify. The results show (Figure 6) that the most prominent obstacles are: lack of opportunities to develop skills in the area due to the scarcity of projects; absence of direct support policies for activities in this area; and the need to develop new skills and/or acquire new resources.

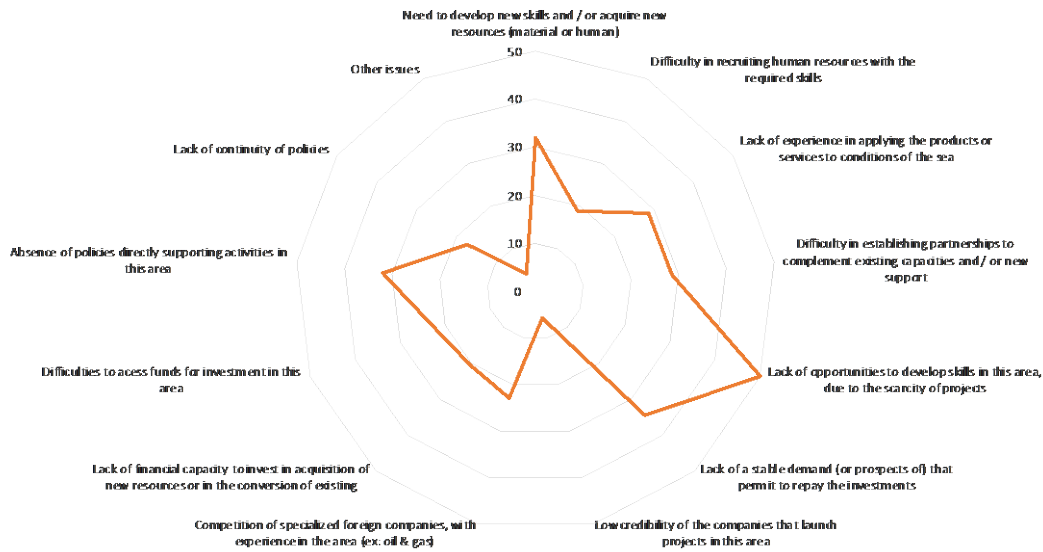


Figure 6: Entry requirements: Obstacles

Again, at the level of obstacles, we found statistically significant differences between groups of firms, according to the planned innovation strategy and readiness to enter the field.

Considering the planned innovation strategy, the Kruskal-Wallis tests (Table 3 reports only the significant tests, $p < 0.1$) reveal significant differences in the perception of the importance of the following obstacles:

- Need to develop new skills and / or acquire new resources (material or human): firms that intend to develop new products/services feel more frequently this obstacle. Firms that intend to maintain their offer are the ones that feel less frequently the need to renew skills and resources.
- Lack of prospects of a stable demand that allows to repay the investment: Firms that intend to develop new products/services feel more frequently this obstacle. Firms that intend to maintain their offer are less worried about the level of demand and its effects on the return of investment: they are investing less and thus facing a lower level of risk.
- Competition from specialized foreign companies, with experience in the area (e.g., oil & gas): firms that intend to maintain their offer feel this obstacle more frequently. Firms that intend to develop new products/services are less worried about competition from established foreign companies: innovation prospects seem to protect them from this competition threat.

Table 3: Obstacles: Differences between groups according to the planned innovation strategy

	Planned innovation strategy	N	Mean Rank
Need to develop new skills and / or acquire new resources (material or human) Kruskal-Wallis H = 5,736 $p < 0,1$	Expects to have new products or services	74	61,55
	Expects to have adapted products	26	61,25
	Only expects to offer current products/services	17	44,44
	Total	117	
Lack of prospects of a stable demand that permit to repay the investment. Kruskal-Wallis H = 6,306 $p < 0,05$	Expects to have new products or services	74	63,51
	Expects to have adapted products	26	54,75
	Only expects to offer current products/services	17	45,88
	Total	117	
Competition of specialized foreign companies, with experience in the area (e.g., oil & gas) Kruskal-Wallis H = 6,711 $p < 0,05$	Expects to have new products or services	74	55,28
	Expects to have adapted products	26	60,75
	Only expects to offer current products/services	17	72,53
	Total	117	

Finally, the Kruskal-Wallis tests (Table 4 reports only the significant tests, $p < 0.1$) also reveal significant differences in the perception of the importance of some obstacles, according to the readiness to enter in the new area:

- Difficulty to access funds for investment in this area: firms that have defined the opportunity and are developing actions to enter in the short/medium term feel more frequently this obstacle. They are seeking money to invest, and this is a critical issue for them. Firms that have not yet found a tangible opportunity give less relevance to this obstacle.
- Difficulty in establishing partnerships to complement existing capacities and/or support entrance in the new area: firms that have already identified potential areas of activity but not the timing of entry feel this obstacle more frequently. This suggests that securing access to complementary resources is critical at this stage. Firms that have not yet found a tangible opportunity give less relevance to this obstacle.

Table 4: Obstacles: Differences between groups according to the readiness to enter MRET

	Readiness to enter	N	Mean Rank
Difficulty to access funds for investment in this area Kruskal-Wallis H = 5,063 $p < 0,1$	Already defined the opportunity and is developing actions to enter in the short/medium term	8	83,25
	Has identified potential areas of activity but not the timing of entry	30	64,20
	A final decision depends on the identification of a tangible opportunity	89	62,20
	Total	127	
Difficulty in establishing partnerships to complement existing capacities and/or support entrance in the new area Kruskal-Wallis H = 7,758 $p < 0,05$	Already defined the opportunity and is developing actions to enter in the short/medium term	8	64,38
	Has identified potential areas of activity but not the timing of entry	30	76,02
	A final decision depends on the identification of a tangible opportunity	89	59,92
	Total	127	

5. Conclusions and policy implications

This paper addressed the conditions in which firms from existing sectors can be motivated to an early engagement with emerging technologies, to whom they can provide critical competences and resources. The goal was to go beyond the case of the typical prime movers – e.g. threatened incumbents attempting to gain some hold in the new technology, or large multi-product business firms exploring opportunities to expand the business range – and address the less known case of other, often smaller companies, that may see the demand from the new technology as an opportunity to redeploy or reconfigure their production or business capabilities, but may face greater obstacles.

The analysis, conducted on a group of 138 firms that expressed willingness to become involved with a new sustainable technology – marine renewable energy -, showed that an early engagement with the new technology may prove to be an opportunity for business diversification and innovation. But because such strategic decision entails investments (for changing resources or creating new ones), which are greater for more innovative strategies; and because of the uncertainty still surrounding the technology, firms perceive several obstacles that may restrain them from making the move. Thus, policies are required to motivate firms to effectively diversify into the new field.

The results suggest the need for a policy mix, combining a set of instruments traditionally used in the framework of industrial policy and innovation policy. This would allow to reduce risk perception and support the process of resource deployment.

The results also suggest that this policy mix should include both measures to accelerate the entry of established firms into the new area; and measures to promote the development of new products/services, which demands more changes and involve a higher level of risk.

In order to accelerate the entry of established firms, promoting the development of a domestic value chain, policies should:

- Support changes in manufacturing processes.
- Support access to funding.
- Support partnerships that facilitate entry.

In order to induce the development of new products/services targeting the new area, policies should:

- Support the development/access to new skills and resources (with particular emphasis on human resources).
- Support reorganizations in product/service portfolios.
- Support development of new partnerships.
- Support dealing with market demand uncertainty.

References

- Adner, R., and Zemsky, P. (2016). Diversification and performance: Linking relatedness, market structure, and the decision to diversify. *Strategy Science*, 1, 32–55.
- Agarwal, R. Moeen, M. and Shah, S.K. (2017) Athena's Birth: Triggers, Actors, and Actions Preceding Industry Inception. *Strategic Entrepreneurship Journal*, 11: 287–305
- Andersson, J., Vico, E.P., Hammar, L. and Sandén, B.A. (2017) The critical role of informed political direction for advancing technology: The case of Swedish marine energy. *Energy Policy*, 101 (2017) 52–64.
- Anderson, P. and Tushman, M. L. (1990). Technological Discontinuities and Dominant Designs: A Cyclical Model of Technological Change. *Administrative Science Quarterly*, 35, 604–633. <https://doi.org/10.2307/2393511>
- Ansari, S. and Krop, P. (2012) Incumbent performance in the face of a radical innovation: Towards a framework for incumbent challenger dynamics. *Research Policy*, 41: 1357–74.
- Barney, J. B. 1991. Firm resources and sustained competitive advantage. *Journal of Management*, 17: 99–120.
- Bergek, A., Hekkert, M., Jacobsson, S., Markard, J., Sandén, B. and Truffer, B. (2015). Technological innovation systems in contexts: Conceptualizing contextual structures and interaction dynamics. *Environmental Innovation and Societal Transitions*, 16: 51–64. <https://doi.org/10.1016/j.eist.2015.07.003>.
- Bergek, A., Jacobsson, S., Carisson, B., Lindmark, S. and Rickne, A. (2008). Analyzing the functional dynamics of technological innovation systems: a scheme of analysis. *Research Policy*, 37, 407–429. <https://doi.org/10.1016/j.respol.2007.12.003>
- Björgum, O. and Netland, T.H. (2017). Configuration of supply chains in emerging industries: a multiple-case study in the wave-and-tidal energy industry. *International Journal of Manufacturing Technology and Management*, 31, 133-152. <https://doi.org/10.1504/IJMTM.2017.082007>
- Busch, J., Foxon, T.J. and Taylor, P.G. (2018) Designing industrial strategy for a low carbon transformation. *Environmental Innovation and Societal Transitions*, 29, 114-125
- Chang, H.J and Andreoni, A. (2020) Industrial Policy in the 21st Century. *Development and Change*, 51(2): 324–351. DOI: 10.1111/dech.12570
- Eeva-Lotta Apajalahti, Armi Temmes and Tea Lempiälä (2018) Incumbent organisations shaping emerging technological fields: cases of solar photovoltaic and electric vehicle charging. *Technology Analysis & Strategic Management*, 30:1, 44-57, <https://doi.org/10.1080/09537325.2017.1285397>
- Fontes, M., Bento, N. and Andersen, A.D. (2021). Unleashing the industrial transformative capacity of innovations. *Environmental Innovation and Societal Transitions*, 40, 207–221. <https://doi.org/10.1016/j.eist.2021.07.004>
- Helfat, C. E., & Eisenhardt, K. M. (2004). Inter-temporal economies of scope, organizational modularity, and the dynamics of diversification. *Strategic Management Journal*, 25(13), 1217–1232.
- Janssen, M.J. and Frenken, K. (2019). Cross-specialisation policy: rationales and options for linking unrelated industries., *Cambridge Journal of Regions, Economy and Society*, 12(2), 195–212.
- Karim, S., and Capron, L. (2016). Adding, redeploying, recombining and divesting resources and business units. *Strategic Management Journal*, 37(13), 1–20. <http://doi.wiley.com/10.1002/smj.2537>
- Liu, H., and Yang, H. (2019). Managing network resource and organizational capabilities to create competitive advantage for SMEs in a volatile environment. *Journal of Small Business Management*, 57(2), 155–171. <https://doi.org/10.1111/jsbm.12449>
- Lüthge, A. (2020). The concept of relatedness in diversification research: review and synthesis. *Review of Managerial Science*, 14, 1–35.
- Makitie, T., Andersen, D.A., Hanson, J., Normann, H.E. and Thune, T.M., 2018. Established sectors expediting clean technology industries? The Norwegian oil and gas sector's influence on offshore wind power. *Journal of Cleaner Production*, 177, 813–823. <https://doi.org/10.1016/j.jclepro.2017.12.209>
- Markard, J. (2020). The life cycle of technological innovation systems. *Technological Forecasting and Social Change*, 153, 119407. <https://doi.org/10.1016/j.techfore.2018.07.045>

- Moeen, M. and Agarwal, R. (2017) Incubation of an industry: Heterogeneous knowledge bases and modes of value capture. *Strategic Management Journal*, 38: 566–587
- Nerkar, A. (2003). Old is gold? The value of temporal exploration in the creation of new knowledge. *Management Science*, 49(2):211–229. <https://doi.org/10.1287/mnsc.49.2.211.12747>
- Penrose, E.T. (1995) *The Theory of the Growth of the Firm*. Oxford University Press, Oxford.
- Rumelt, R.P. (1974). *Strategy, Structure, and Economic Performance*. Harvard Business School Press: Boston, MA.
- Thomas, G.H. and Douglas, E.J. (2022) Resource reconfiguration by surviving SMEs in a disrupted industry. *Journal of Small Business Management*, <https://doi.org/10.1080/00472778.2021.2009489>
- Turnheim, B. and Sovacool, B.K. (2020). Forever stuck in old ways? Pluralising incumbencies in sustainability transitions. *Environmental Innovation and Societal Transitions*, 35, 180–184. <https://doi.org/10.1016/j.eist.2019.10.012>.
- Wiersema, M.F., and Beck, J.B. (2017). Corporate or Product Diversification. In *Oxford Research Encyclopedia of Business and Management* (Issue June, pp. 1–20). Oxford University Press.