

University of Wales Trinity Saint David

Doctor of Business Administration (DBA)

Module: Research Principles and Philosophy

Module Code: LCDB7007

Assessment Title:

Strategic Supply Chain Readiness and Investment in UK Marine
Renewable Energy SMEs

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Word Count: 7899 words (including Abstract, excluding References, Tables, Appendices)

Abstract

This study critically examines recent literature on strategic supply-chain readiness, capital allocation and commercialisation among UK marine renewable-energy SMEs. It also considers how philosophical assumptions affect assessments of technical maturity, operational uncertainty, market attractiveness and regulatory conditions.

The review uses a systematised critical approach, drawing on recent studies and selected foundational sources. Selected PRISMA 2020 reporting principles support transparency without presenting the review as fully systematic. Barrett and Crowley's (2025) qualitative multiple-case study of European offshore renewable-energy SMEs is examined from philosophical and methodological perspectives.

The literature indicates that supply-chain and investment readiness are multidimensional. Supply-chain readiness extends beyond manufacturing and logistics to strategic and ecosystem capabilities that influence commercial credibility. Investment readiness includes technical, financial, governance and regulatory evidence together with alignment between venture stage and available capital. Innovation ecosystems, public-private collaboration, long-term finance and phased risk management remain important but are often examined separately.

A pragmatic mixed-methods position is appropriate for the proposed DBA because commercialisation and investment readiness involve both measurable indicators and stakeholder judgements.

Keywords

Supply chain readiness; investment readiness; commercialisation; marine renewable energy; SMEs; innovation ecosystems; research philosophy.

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1. Introduction

1.1 Background

The low-carbon transition makes renewable-energy innovation an industrial, financial and supply-chain challenge as well as a technical one. Commercialisation requires technologies to move beyond prototypes into manufacture, installation, operation and decommissioning at scale. This progression depends on coordinated access to suppliers, skills, infrastructure and finance (Hafner et al., 2020; Mason-Jones et al., 2025).

Wave and tidal technologies remain less mature and more uncertain than established renewables, although they may diversify low-carbon energy systems and support coastal economies (Jin and Greaves, 2021; Proimakis, Hooper and Østergaard, 2021; Noble, Grattan and Jeffrey, 2024). Wave energy still faces a gap between prototype development and commercial implementation (Guo and Ringwood, 2021; Jin and Greaves, 2021).

The UK provides an important setting because Cornwall, Scotland, Orkney and other coastal areas combine test facilities, developers, universities and public innovation programmes (Hannon, van Diemen and Skea, 2017; Jin and Greaves, 2021). Yet technical promise and public support have not produced a commercially viable wave-energy sector; Hannon, van Diemen and Skea (2017) attribute this partly to weak alignment between technological learning, market formation, institutional coordination and scale-up.

These conditions are particularly difficult for SMEs, which face high development costs, long timelines and uncertain revenue. The need to demonstrate performance before attracting the finance required to generate further evidence creates a valley-of-death problem. Progress beyond prototype stages therefore depends on long-term risk-tolerant capital for demonstration, supply-chain development and deployment (Owen et al., 2020; Owen, 2023; O'Reilly, Mac an Bhaire and Greene, 2025; van der Schans, Owen and Hussain, 2026).

Strategic supply chain readiness influences the level of investment attractiveness in marine renewable energy SMEs as well as the timing and continuity of investment (Bucher et al., 2016; Hutcheson, De Andrés and Jeffrey, 2016; Mason-Jones et al., 2025). Marine renewable energy SMEs may develop an innovative device, but they may not have reliable suppliers, optimised logistics and marine infrastructure, certification, insurance and a skilled workforce. These vulnerabilities increase not only costs but also uncertainty, and this makes it difficult for investors to evaluate projects. Wilson, Rowley and Watson (2011) contend that renewable-energy due diligence should extend beyond assessing device technological efficacy; it needs to include grid connection, logistics, strategic asset allocation and supply-chain readiness for successful deployment. Concurrently, research on UK renewable-energy supply chain identifies mutually reinforcing constraints driven by restricted supplier insights, poor policy

transparency, uncertain market opportunities and a lack of readiness to invest (Mason-Jones et al., 2022).

Investment readiness extends far beyond a credible business plan. Investors demand verified technical and commercial evidence as well as the management capability, governance frameworks, commercial pathways, and regulatory continuity. Furthermore, the investors prioritise structural alignment between the marine renewable energy SME's development phase and the available finance in terms of its type, amount and duration. Funding institutions apply different evaluation criteria consistent with their priorities and risk expectations for the same marine renewable energy SME, and this institutional difference has an impact on the timing and distribution of capital flows (Harrer and Owen, 2022; Owen, 2023; O'Reilly, Mac an Bhaird and Greene, 2025; van der Schans, Owen and Hussain, 2026). Bankability provides an analytical lens for examining the evaluations of investors; however, this study treats the terms bankability, investment readiness, and investment flows as distinct concepts rather than synonymous (Bucher et al., 2016; Hutcheson, De Andrés and Jeffrey, 2016). Within the scope of this study, bankability is conceptualised as a stage-dependent and relational evaluation of whether a venture, project and ecosystem demonstrate sufficient institutional credibility for appropriate capital allocation.

These issues introduce important methodological and philosophical questions about the conceptualisation and empirical investigation of supply chain and investment readiness. Quantifiable parameters can be employed to measure supply chain readiness, such as manufacturing capacity, costs, lead times, and technical performance; however, investment decisions remain heavily dependent on subjective interpretations of credibility, risk, managerial competence, policy confidence, and future commercial viability. This is exemplified by Harrer and Owen (2022), who demonstrate that funding decisions are shaped by different perceptions among investors and stakeholders, and that these perceptions create informational gaps and directly influence investor decision-making frameworks. Consequently, different research paradigms may use different assumptions and criteria to evaluate industrial readiness, verify empirical evidence and quantify investment risk (Guba and Lincoln, 1994; Morgan, 2007; Saunders, Lewis and Thornhill, 2023). It is therefore important to examine the philosophical and methodological assumptions of existing studies. This helps assess the strengths, limitations and practical value of current research on strategic supply chain readiness and investment flows in UK marine renewable energy SMEs.

1.2 Research problem

Despite policy support and strong strategic importance for low-carbon technological deployment, securing private investment remains a challenge for UK marine renewable SMEs. This funding gap does not arise from the lack of capital; it is due to the criteria that investors

use to assess commercial viability and institutional investability. Current research identifies several interrelated barriers such as technical risk, policy instability, limited revenue credibility, high operating costs, regulatory burdens, inadequate supply-chain capabilities and information asymmetries; nevertheless, these factors are frequently examined in isolation instead of as part of an interconnected system (Leete, Xu and Wheeler, 2013; Polzin et al., 2019; Guo and Ringwood, 2021; Hafner et al., 2020).

The core research problem is the limited explanation of how strategic supply-chain readiness shapes the allocation, timing, continuity and suitability of investment across development stages in UK marine renewable-energy SMEs. Innovation ecosystems and public-private collaboration are treated as important contextual influences rather than the primary focus.

The problem is also philosophical and methodological: studies differ in whether readiness is measured through observable indicators or interpreted through judgements of credibility, risk and future value, which affects both evidence and method choice.

1.3 Purpose of the Report

The purpose of this report is to:

- critically review research on strategic supply chain readiness, investment readiness, investment flows and commercialisation in the UK marine renewable energy SME sector, drawing where relevant on the wider cleantech literature;
- compare the main theoretical, philosophical and methodological perspectives applied in the existing literature;
- examine the ontological, epistemological, axiological and ethical assumptions underpinning current research;
- critically evaluate one empirical study in relation to its research design, reliability, validity, trustworthiness and transferability; and
- identify theoretical, empirical and methodological gaps and assess the suitability of a pragmatic mixed-methods approach for a future DBA study of UK marine renewable energy SMEs.

1.4 Review Questions

The report addresses the following review questions:

RQ1. How has strategic supply chain readiness been conceptualised and investigated in marine renewable energy research?

RQ2. How do philosophical and methodological assumptions shape explanations of the relationship between strategic supply chain readiness, investment readiness and investment flows?

RQ3. What theoretical and empirical gaps remain, and which methodological approach is most appropriate for a future DBA study of UK marine renewable energy SMEs?

1.5 Key Definitions

The following working definitions are used consistently throughout this report.

Concept	Working definition used in this report
Strategic supply chain readiness	The extent to which a marine renewable energy SME and its wider supply network possess, coordinate and adapt the capabilities, relationships, infrastructure, information and capacity required to support technology development, manufacturing, deployment, operation and maintenance.
Investment readiness	The extent to which an SME can provide credible technical, commercial, financial and governance evidence demonstrating that it is prepared to receive and use an appropriate form of investment.
Investment flows	The movement and allocation of capital into marine renewable energy SMEs, including where investment is directed, when it becomes available, whether it continues across development stages and how well it matches the needs of the firm and technology.
Marine renewable energy	Energy generated from marine resources, including wave, tidal-stream, tidal-range and ocean-thermal technologies. In this report, the term does not include conventional offshore wind unless explicitly stated.
Commercialisation	The process through which a technology progresses from research, prototype development and demonstration towards repeatable production, market adoption, revenue generation and sustainable commercial activity.
Innovation ecosystem	The wider network of firms, suppliers, investors, universities, government agencies, intermediaries, infrastructure providers and users that influence innovation, commercialisation and investment outcomes.
Public-private collaboration	Cooperation between public-sector organisations and private firms or investors to support technology development, infrastructure, risk reduction, commercialisation or investment.

Concept	Working definition used in this report
Bankability	A stage-dependent assessment of whether an SME or project is sufficiently credible, commercially structured and capable of managing risk to attract an appropriate form of finance. Bankability is treated as related to, but distinct from, investment readiness and investment flows.

Source: Author's own synthesis based on the literature reviewed.

2. Method for Conducting the systematised Critical Literature Review

2.1 Review design

The review uses a systematised critical literature review design. 'Critical' refers to evaluating competing concepts, assumptions, methods and evidence, while 'systematised' refers to explicit search blocks, selection criteria, coding and an audit trail. Unlike a full systematic review, it uses selected systematic procedures without claiming exhaustive retrieval (Grant and Booth, 2009). This design suits a multidisciplinary field in which a narrow meta-analysis would miss conceptual variation and an unstructured narrative review would reduce transparency (Snyder, 2019).

The literature was identified through targeted searches on UK wave-energy bankability, marine-energy finance and funding gaps, with additional searches on renewable-energy supply chains, marine supply-chain readiness and early-stage cleantech finance. Further studies were located through backward citation searching of reference lists and forward citation searching for later publications citing the selected articles. The review includes peer-reviewed journal articles and a small number of authoritative scholarly, governmental and institutional reports where they provide distinctive empirical or policy evidence. Older studies were retained when foundational to resource-based theory, dynamic capabilities, innovation systems, investor preferences, research paradigms or mixed-methods design.

Selected PRISMA 2020 reporting principles were used to improve transparency in search and selection (Page et al., 2021), but the review is not presented as fully systematic because complete reproducible retrieval records were not retained. A summary literature review matrix is provided in Appendix A, and a PRISMA-informed audit trail of the review process is provided in Appendix B.

2.2 Search Strategy

The search strategy used Scopus, Emerald Insight and Google Scholar. Complete platform-specific search histories and export records were not consistently retained. The review

therefore does not claim exhaustive or fully reproducible retrieval. Instead, the available search and selection process is reported transparently in line with the systematised nature of the review.

Search terms were organised into four conceptual blocks:

Search block	Example terms
Sector	marine renewable energy, wave energy, tidal energy, ocean energy, offshore renewable energy, UK
Supply Chain	supply chain readiness, supply chain capability, resilience, procurement, manufacturing, logistics, ports, operations and maintenance, local content
Finance	investment readiness, investor confidence, bankability, financing barriers, patient capital, long-term capital, venture capital, SME finance, blended finance, commercialisation finance
Ecosystem and Policy	innovation ecosystem, technology innovation system, public-private collaboration, policy support, de-risking, net zero

Source: Author's own search strategy.

Boolean combinations included "wave energy" AND "financial barriers", "marine energy" AND "investor confidence", "renewable energy" AND "supply chain readiness", "cleantech SMEs" AND ("SME finance" OR "patient capital" OR "long-term capital"), and "offshore renewable energy" AND "industrial capability". Backward and forward citation searching identified additional studies.

2.3 Inclusion and exclusion criteria

Studies were included when they addressed at least one of the core subject areas defined for the review. The inclusion criteria covered marine or offshore renewable energy; renewable-energy supply chains; investment readiness or bankability; cleantech finance; innovation ecosystems; commercialisation; and public-policy risk mitigation. Sustainability and supply-chain studies were also included where they examined methodological or philosophical issues relevant to the review.

The review focused primarily on peer-reviewed journal articles published between 2021 and 2026. Relevant studies from 2020 and earlier publications were retained where they provided necessary foundational theory, concepts or evidence.

Grey literature was included selectively when it offered distinctive UK policy, industry or programme evidence with clear authorship, provenance and methodological transparency, including Hannon, van Diemen and Skea's (2017) University of Strathclyde report. Purely

technical papers without relevance to the review questions, opaque methods and opinion pieces were excluded.

2.4 Analytical Procedure

The analytical procedure combined thematic coding and critical synthesis informed by Braun and Clarke (2021). Studies were coded by sector, conceptual framework and relevance to the DBA problem, then compared across technology, ecosystem and policy levels. A philosophical reading considered how methods and stakeholder values shaped evidence and claims. The main themes and indicative codes used to structure the synthesis are summarised in Appendix C.

The analysis distinguished stated preferences from observed behaviour: surveys indicate what investors report, funding deals show actual allocation, and interviews explain interpretations of risk and credibility. No single source establishes which capability improves later financial outcomes, and these forms of evidence are rarely integrated longitudinally.

2.5 Limitations

The review has several limitations. First, marine renewable energy remains an emerging field and firm-level SME studies are limited; much of the literature focuses instead on technologies, projects, policy systems or innovation ecosystems. Second, the evidence base is primarily UK-focused, limiting transferability to countries with different policy, financial and industrial systems. Third, survivor bias is possible because active firms and visible public programmes are easier to study than failed ventures and rejected funding applications. Fourth, academic studies may underrepresent commercially sensitive information held by investors, developers and supply-chain firms. Fifth, publication bias may favour successful, publishable or policy-visible cases. Sixth, screening and interpretation were undertaken within a single coursework review rather than by multiple independent reviewers, so reviewer-selection and confirmation bias cannot be eliminated. Explicit inclusion criteria, a literature matrix, documented analytical decisions, citation chaining and reflexive attention to contradictory evidence reduce, but do not remove, these limitations.

3. Critical Literature Review

3.1 Supply-chain readiness as a strategic capability

Resource-based and dynamic capability perspectives

The resource-based view treats companies as bundles of resources and capabilities that can generate sustained advantage when they are valuable, rare, difficult to imitate and organisationally embedded (Barney, 1991). Applied to marine renewable SMEs, the perspective directs attention to specialist engineering knowledge, intellectual property, project-

management experience, supplier relationships, data, test access and the ability to attract skilled people. It is useful because it prevents supply chains from being treated as an external procurement function. An SME's supplier relationships and production knowledge may be strategic assets rather than routine inputs.

However, the resource-based view can be too static for an emerging sector. In a volatile industry, the relevant question is not only what a firm owns but how it reconfigures resources as technology, regulation and investor expectations change. Dynamic capabilities address this issue by emphasising sensing, seizing and transforming in changing environments (Teece, Pisano and Shuen, 1997; Eisenhardt and Martin, 2000). For wave-energy SMEs, sensing may involve identifying niche markets, policy windows or suitable suppliers. Seizing may involve securing public-private finance, building a demonstration partnership or redesigning a device for manufacturability. Transforming may involve moving from bespoke prototype production to repeatable manufacturing and service capability.

Dynamic capabilities also link supply-chain readiness to investment readiness because investors assess whether an SME can build and coordinate the network required for scale. Weak alternative sourcing, quality control, knowledge protection or contracting can therefore undermine strategic credibility even when the device itself is promising.

Operational readiness versus strategic readiness

Operational readiness concerns the ability to perform required activities reliably under current conditions, including suppliers, logistics, standards and infrastructure. Marine-energy studies identify specialist suppliers, manufacturing capacity, logistics and capability transfer from mature sectors as key constraints (Thomas et al., 2013).

Strategic readiness extends this view by asking whether the firm can develop and adapt capabilities as markets, technology and institutions change. It therefore concerns both current performance and the ability to build what the next development stage will require.

The difference between operational and strategic readiness is evident in Mason-Jones, Davies and Thomas's (2022) analysis of the UK renewable-energy supply chain, as they identify poor supply-chain readiness, limited sector knowledge and uncertain policy support as interconnected reasons why companies hesitate to enter renewable-energy markets (Mason-Jones, Davies and Thomas, 2022). The finding suggests that firms face more than an immediate shortage of operational capacity. They also lack confidence that future demand will be sufficiently visible and credible to justify investment in new equipment, skills, supplier relationships or production capability. Operational weakness and strategic uncertainty therefore reinforce one another. Mason-Jones et al. (2025) develop this perspective for marine renewable energy through a Future Reality Tree which identifies pathways towards a desired future state, and the Future Reality Tree map should be seen as a strategic hypothesis or

roadmap. Although it illustrates the interaction between limited order visibility, supplier knowledge, finance, skilled labour and policy support, it does not establish the mechanisms that cause investment decisions or improve commercial outcomes.

An SME cannot independently create specialist ports, vessels, or certification systems, so strategic readiness also depends on the wider industrial ecosystem. For instance, the supplier selection of offshore wind is shaped by global value-chain governance, local policies, domestic market size, and the capability of lead firms (van der Loos et al., 2022). This comparison is analytically useful because it demonstrates that industrial development does not simply depend on the local companies but also depends on demand coordination and governance. Nevertheless, offshore wind has a large and mature market than wave energy; its findings should be used to develop research questions for the wave-energy sector instead of direct proof for the operations of the wave energy sector.

For UK renewable-energy SMEs, bankability therefore depends on both operational readiness for the current stage and strategic readiness for the next. An adaptable strategy is insufficient without credible present operations and a pathway to scale.

Internal capabilities versus ecosystem capabilities

Supply-chain readiness can be assessed at firm or ecosystem level. Firm-level analysis identifies managerial practices but may attribute external constraints to SMEs; ecosystem analysis captures institutions, infrastructure and networks but can obscure responsibility. A multilevel approach is therefore preferable.

Marine-energy research strongly supports the ecosystem perspective. Innovation-system studies show that knowledge development, entrepreneurial experimentation, market formation, legitimisation and resource mobilisation depend on interaction between firms, universities, public bodies and intermediaries (Winkel et al., 2006; Corsatea, 2014). Guo and Ringwood (2021) similarly argue that industry-academia-government collaboration is needed to move wave energy through the valley of death. Hannon, van Diemen and Skea (2017) show that a weak innovation system can impose pressures on individual firms, including premature scale-up and the need to secure private match funding before the technology is ready.

The strongest synthesis is therefore multilevel. Supply-chain readiness should be assessed through at least three layers:

- firm capability, including management, finance, procurement and learning;
- network capability, including supplier relationships, collaboration and knowledge exchange; and
- ecosystem capability, including policy, test infrastructure, skills, standards, ports and market formation.

Bankability weakens when these layers are misaligned; a technically capable firm may still be unfinanceable if suppliers cannot meet required quality or if future demand is too uncertain to justify supplier investment.

3.2 Investment readiness and commercialisation of marine renewable SMEs

Investment readiness and the transition from public to private capital

Investment readiness is relational and stage-specific rather than a fixed property. An SME is ready for a particular form of capital when its evidence, risk profile and expected returns align with that provider's requirements. A firm may therefore be suitable for grants, angel or strategic investment before it is ready for project or institutional finance.

Early-stage marine renewable-energy SMEs often require substantial external finance before revenue is established, while environmental value does not necessarily generate immediate investor returns. Conventional SME finance can therefore be poorly aligned with high capital needs and long development periods (Gaddy et al., 2017; Cowling and Liu, 2023).

Public and private capital can perform complementary roles during these long development periods (Owen et al., 2020). Publicly backed finance may also provide market knowledge, investor connections and learning that develops over time (Owen, 2023).

Equity can help cleantech SMEs cross the 'valley of death' when finance is aligned with development milestones (O'Reilly, Mac an Bhaird and Greene, 2025). Long maturation periods also strengthen the case for patient capital in green technology (van der Schans, Owen and Hussain, 2026). Readiness therefore depends on what the SME can demonstrate at a given stage and what the relevant provider requires.

Technology readiness versus investment readiness

Technology and investment readiness are related but distinct. Technology Readiness Levels describe technical maturity, not economic viability; a wave-energy device can reach a high TRL yet remain commercially unattractive because of cost, reliability or performance (Guo and Ringwood, 2021).

Investment decisions therefore require more than technical maturity: investors also need evidence of future cash flow and capacity to manage the next development stage. Relevant evidence includes:

Technical evidence

- reliable performance data across relevant operating conditions;
- credible cost and maintenance assumptions;
- a route to certification, consent and grid connection (Wilson, Rowley and Watson, 2011).

Commercial and market evidence

- evidence that suppliers can meet quality and volume requirements;
- credible customer or offtaker (such as energy buyer) relationships;

- revenue certainty sufficient to support projected cash flow (Bucher et al., 2016).

Organisational evidence

- an experienced management and engineering team;
- financial controls, governance and reporting (Mason and Kwok, 2010).

Financial evidence

- a financing plan that matches the stage of development.

Marine-energy studies reinforce this multidimensional assessment. Investor confidence depends on technology risk, policy credibility, revenue certainty and array-scale evidence (Bucher et al., 2016; Bucher and Bryden, 2016), while due diligence should also consider grid, logistics, resources and supply-chain risk (Wilson, Rowley and Watson, 2011). Hutcheson, De Andrés and Jeffrey (2016) further highlight trade-offs between projected cost, design difficulty and resources.

Venture capital, public funding and blended finance

Public and private finance are not simple substitutes. Public finance can reduce early risk, support infrastructure and generate evidence, while private finance adds commercial discipline and networks. The key issue is sequencing support so that it crowds in appropriate private capital as risks become measurable.

Polzin et al. (2019) find that private renewable-energy finance is more readily mobilised when uncertainty and risk-return conditions improve. Public development banks can invest, co-invest, refinance and make markets (Geddes, Schmidt and Steffen, 2018), while Geddes and Schmidt (2020) treat finance as part of the socio-technical transition itself.

The UK wave-energy experience illustrates poor sequencing: firms were pushed towards large demonstrations and private match funding before sufficient technical maturity and commercial learning had developed (Hannon, van Diemen and Skea, 2017). Support should therefore match the evidence and capability requirements of each development stage.

Blended finance can combine grants, concessional loans, guarantees, strategic investment, equity and revenue support. It does not remove risk but reallocates it, so contracts must identify responsibility for technology, construction, policy, operational and market risks. Private investors may remain cautious where support is unstable or risks are not measurable.

Investor confidence and information asymmetry

Investor confidence reflects both risk and the interpretation of available evidence. Harrer and Owen (2022) show that information asymmetries persist because entrepreneurs and investors combine financial and environmental objectives differently. Environmental indicators may communicate value but also create ambiguity, which is important for marine SMEs presenting technical, environmental and strategic evidence.

Confidence is also shaped by demonstrations, networks, reputation and institutional signals. Shared expectations and prior failures influence how evidence is interpreted; Guo and Ringwood (2021), for example, describe reduced confidence after a prominent wave-energy company failure and argue for a different development trajectory.

3.3 Innovation ecosystems and collaborative networks

Technology Innovation Systems

Technology Innovation Systems (TIS) provide a useful framework for analysing emerging sectors because they examine the networks of institutions that support the development and diffusion of a technology. The framework usually considers functions such as knowledge development, knowledge exchange, entrepreneurial experimentation, resource mobilisation, market formation, and legitimation (Bergek et al., 2008). Hannon, van Diemen and Skea (2017) apply this logic to the UK wave-energy system and find strong performance in knowledge development but weak performance in entrepreneurial experimentation and market formation.

TIS explains why strong technical activity may coexist with weak commercialisation, but it can become descriptive unless system functions are linked to firm-level funding and commercial decisions.

Triple Helix and industry-academia-government collaboration

The Triple Helix frames innovation as interaction among universities, industry and government rather than one-way knowledge transfer (Etzkowitz and Leydesdorff, 2000). In marine energy, test centres, research, public funding and demonstrations make these relationships visible. Guo and Ringwood (2021) and Corsatea (2014) show how industry-academia-government collaboration can support commercialisation by combining knowledge, coordination and engineering capability.

Collaboration versus competition

Supply-chain readiness is shaped by supplier capacity and also by the sector's ability to exchange knowledge and learn collectively. This creates a tension for marine-energy SMEs because protecting commercially sensitive information and intellectual property is a necessity to preserve competitive advantage, while excessive secrecy can restrict knowledge exchange and lead to repeated mistakes. Hannon, van Diemen and Skea (2017) identify developer secrecy and weak knowledge exchange as barriers to progress in the UK wave-energy sector. Similarly, Winskel (2007) describes a tension between financial capital, which is associated with competition and market efficiency, and social capital, which supports collaboration and interactive learning.

Regional innovation clusters

Marine renewable energy is strongly regional because test sites, ports, skills, universities and communities are locally embedded. Regional networks can reduce transaction costs and support learning, but small markets and weak local capability can limit scale. Community marine-energy research shows local learning benefits alongside technical and regulatory constraints (Proimakis, Hooper and Østergaard, 2021), while Hoicka et al. (2025) emphasise links across the value chain rather than proximity alone.

Regional ecosystems may improve credibility through trusted relationships, infrastructure and community acceptance, yet investors may remain cautious if demand or wider deployment is unclear. Regional capability therefore needs connection to national and international value chains.

3.4 Supply-chain resilience, sustainability and net zero

Resilience versus efficiency

Resilient supply chains persist, adapt or transform under disruption (Wieland and Durach, 2021). In marine renewable energy this involves supplier diversity, materials, ports, vessels, skills, maintenance and weather resilience, but redundancy can raise short-term costs. A coordination problem follows because suppliers invest when future demand is credible, while credible deployment also depends on supply-chain readiness.

Recent supply-chain research in offshore wind shows that local content policies can influence supplier selection (van der Loos et al., 2022), and this is relevant to the wave energy sector because local-content requirements are likely to create jobs and industrial activity, but they cannot create competitive suppliers. If local firms are not ready, strict local-content rules may increase cost and could weaken the bankability.

Sustainability and responsible procurement

Responsible procurement must consider marine ecosystems, communities, labour, materials, safety, lifecycle planning and decommissioning. These requirements can be costly for small developers (Greaves et al., 2016), while decommissioning costs and responsibilities should be incorporated into project planning and finance from the outset (Mackie and Velenturf, 2021). Financial attractiveness can conflict with environmental or regional value. This matters philosophically because SMEs, investors and public institutions may apply different goals and indicators when judging the same project.

Local content and industrial policy

Local-content strategies can support skills, employment and resilience, but effectiveness depends on market scale and technological maturity. Policy should therefore connect local

content with supplier development, shared testing and certification, procurement, finance and credible deployment signals rather than treating locality itself as evidence of competitiveness.

3.5 Research philosophy in supply-chain and sustainability research

Research philosophy concerns assumptions about reality, knowledge and values. Ontology addresses what exists, epistemology how knowledge is produced and justified, and axiology the role of values and ethics (Guba and Lincoln, 1994; Saunders, Lewis and Thornhill, 2023). These assumptions shape how readiness is defined and evidenced.

Positivism and post-positivism

Positivist and post-positivist approaches operationalise aspects of a problem for measurement. Surveys, regression, cost models and investment data can test associations or predictions; for example, Cowling and Liu (2023) examine factors associated with external capital demand. The emphasis on measurable evidence and hypothesis testing is consistent with a post-positivist orientation (Saunders, Lewis and Thornhill, 2023).

Their strengths are transparency, comparability and larger-sample testing, but measurement does not remove conceptual ambiguity. Readiness and investor-confidence measures may capture different meanings or stated opinions, and cross-sectional associations do not explain how capabilities produce funding over time.

Interpretivism

Interpretivism treats organisational reality as shaped through language, relationships and shared meanings. Interviews, cases and documents can therefore examine how actors understand readiness; Harrer and Owen (2022) illustrate this in early-stage cleantech finance, where financial and environmental indicators are interpreted differently (Guba and Lincoln, 1994; Saunders, Lewis and Thornhill, 2023).

This is relevant because supply-chain capability is judged through relationships as well as assets. A smaller firm with trusted partners may appear strategically capable, while a larger firm may still lack a credible route to scale. The limitation is that interview evidence can explain such judgements without showing how widespread they are or whether they predict investment.

Critical realism

Critical realism is useful where observed outcomes are produced by mechanisms that are not directly visible. A funding failure attributed to cost may also reflect policy uncertainty, information asymmetry or a weak supplier ecosystem. The approach therefore develops contextual explanations of how mechanisms operate (Fletcher, 2017).

A critical-realist design could combine documents, interviews and investment events to explain why similar firms receive different responses. It accepts measurable indicators without treating

them as complete causal explanations, although this requires careful movement between observation, interpretation and explanation and strong reflexivity.

Pragmatism

Pragmatism begins with the research problem and selects evidence according to usefulness. Mixed-methods studies may therefore combine surveys, investment records, interviews, cases and policy documents when integration provides a better answer (Morgan, 2007; Creswell and Plano Clark, 2018).

This suits the proposed DBA because supply-chain and investment readiness contain observable indicators, such as funding, suppliers and delays, alongside interpretive dimensions such as confidence, collaboration and policy credibility. Neither form of evidence needs to replace the other.

The risk is philosophical incoherence: quantitative and qualitative techniques do not become pragmatic merely by appearing together. Their connection, priority, treatment of conflicting findings and contribution to conclusions must be explicit, with integration planned across sampling, data collection, analysis and interpretation (Fetters, Curry and Creswell, 2013).

3.6 Literature synthesis and research gaps

Five gaps emerge: First, supply-chain and investment readiness are rarely integrated: supply-chain studies emphasise infrastructure, supplier capability and resilience, while finance studies emphasise information asymmetry, investor confidence, policy risk and capital structure, even though investors may use supply-chain evidence to judge commercial credibility.

Second, marine renewable-energy SMEs remain under-researched because many studies focus on technologies, projects or public support rather than how individual firms build capability, secure investment and form partnerships.

Third, ecosystem capability is weakly operationalised: innovation-system research identifies functions and institutional failures but rarely links them to specific investment flows.

Fourth, objective investment data and managerial perceptions are seldom combined, making it difficult to distinguish stated preferences from actual investment behaviour.

Fifth, methodological reflection remains limited because many studies leave philosophical assumptions implicit, despite their influence on whether readiness is treated as measurement, judgement or both.

The proposed DBA can address these gaps through six connected dimensions: technical credibility, supply-chain readiness, revenue credibility, policy credibility, ecosystem coordination and staged finance fit.

4. Philosophical and Methodological Analysis of One Selected Study

Selected Study: Barrett and Crowley (2025), *Offshore Renewable Energy SMEs' Innovation Interactions across the Triple Helix: A Management as Practice Perspective*

Alignment with the literature review and rationale for selection

The selected study is connected with the literature review section 3.3, "Innovation ecosystems and collaborative networks", especially with the subtheme of Triple Helix and industry-academia-government collaboration. The Triple Helix model of innovation created by Etzkowitz and Leydesdorff (2000) refers to a set of interactions among industry, universities and government because these three groups would be more efficient in terms of value creation than companies acting independently. In marine renewable energy, these relationships are crucial for SMEs because they do not have all the resources or skills internally, so they may collaborate with universities for technical knowledge, consult government authorities for policy support and collaborate with industry partners to access skills and other resources.

Barrett and Crowley (2025) examine European wave- and tidal-energy SMEs through a management-as-practice framework and qualitative multiple-case design. Although the study does not directly measure supply-chain readiness, investment readiness or commercial outcomes, it is relevant because it shows how ecosystem relationships provide knowledge, expertise and external capability and therefore offers a useful basis for philosophical and methodological analysis.

4.1 Overview of the Study

Purpose and research question

Barrett and Crowley (2025) focus on the "human element" of technology transfer through the question: "How do ORE SME leaders manage interactions for innovation across the triple helix?" They use Whittington's (2006) management-as-practice framework, distinguishing praxis, practices and practitioners, to examine what leaders do, how they manage collaboration and how their experience and backgrounds shape those activities.

Research design and data collection

The authors used a qualitative multiple-case design over one year within a wider three-year programme. Eight SMEs - five tidal and three wave - were purposively selected from the 92-firm SELKIE network across Denmark, France, Ireland, Scotland and Spain. All were involved in Triple Helix interactions and operated at TRL 6-9. Evidence centred on one semi-structured interview with a senior representative from each case, conducted between March 2022 and April 2023. Interviews averaged 60 minutes and were supplemented by follow-up communications, company and industry material, and government publications (Barrett and Crowley, 2025).

Data analysis

The researchers developed case narratives, a codebook and two coding cycles, using within-case and cross-case tables and meta-matrices. Because Whittington's (2006) framework shaped the question, interview domains and interpretation, the analysis is iterative and theory-informed rather than wholly inductive (Barrett and Crowley, 2025).

Principal findings

The findings describe fragmented governance, bureaucratic delays and different university-SME timescales and incentives. SME-to-SME relationships were often easier, while partner selection, agreements, outsourcing, networks, pragmatism and adaptability supported access to complementary capabilities (Barrett and Crowley, 2025). These findings illuminate commercialisation conditions but do not establish a tested readiness model.

4.2 Ontology

Relational and processual reality

Ontology concerns assumptions about what exists (Crotty, 1998). Barrett and Crowley (2025) do not state an ontological position, but capability is presented relationally through partner selection, trust, routines and responses to institutions rather than only as a fixed firm attribute. The account is not purely constructionist because technology maturity, finance, equipment, funding rules and regulation are treated as real constraints. This combination of material conditions and socially mediated capability is useful for the proposed DBA, where supplier capacity may exist independently of opinion but its commercial significance is still judged.

Critical-realist interpretation

Sayer's (2000) critical realism offers a useful reading: external dependence, bureaucratic authorisation and multi-level governance may operate as mechanisms behind delay. Barrett and Crowley (2025) suggest such mechanisms but do not use retroduction, trace causal sequences or compare cases systematically by outcome, so causation remains provisional.

4.3 Epistemology

Interpretive, theory-informed knowledge

Epistemology concerns how knowledge is produced and justified (Crotty, 1998). The study is mainly interpretive because evidence comes from leaders' situated accounts, while the multiple-case design supports contextual comparison (Yin, 2018). Whittington's (2006) management-as-practice perspective reinforces this focus on praxis, practices and practitioners.

A limitation is the gap between interest in what managers do and retrospective interview evidence about what they remember. Documents add context but do not capture practice as

it unfolds; observation, diaries or contemporaneous project records would reduce recall and self-presentation effects.

Epistemological tensions

The paper also combines interpretive aims with terms such as inter-coder reliability, saturation, robustness and generalisability. These can imply stable, reproducible categories that sit uneasily with reflexive qualitative interpretation (Braun and Clarke, 2021). Co-author discussion improves discipline but does not establish a single correct interpretation.

Alternative epistemological approaches

Alternative epistemologies would produce different evidence. A positivist survey could test associations among partner diversity, supplier capability and milestones; a critical-realist design could combine accounts with project records; and pragmatism supports selecting methods for the problem (Morgan, 2007). For the DBA, interviews could therefore be integrated with surveys, funding data and operational indicators (Creswell and Plano Clark, 2018).

4.4 Axiology and Researcher Positionality

Axiology concerns the role of values in research. Barrett and Crowley (2025) frame ORE as important to decarbonisation and commercialisation barriers as problems requiring intervention. This is understandable, but not value-neutral. The desirability of renewable energy does not mean every device, firm or form of public support is commercially, environmentally or socially sound. Marine ecology, lifecycle materials, community interests and decommissioning receive little attention, narrowing the value frame used to assess commercialisation.

The policy perspective is largely industry-centred and SME leaders may benefit from the support they advocate. Investors, employees, suppliers, universities, government and civil society were not interviewed, while SELKIE involvement may have normalised shared assumptions. More explicit reflexivity would improve transparency (Finlay, 2002).

4.5 Methodological Quality

Design fit, validity and generalisation

The qualitative multiple-case design fits an exploratory 'how' question, so statistical reliability and psychometric validity are not the primary criteria. Quality is better judged through conceptual alignment, analytical generalisation and trustworthiness. The frameworks provide coherence but not construct validity, and broad concepts such as successful interaction and commercial progress are not independently measured. Causal claims must therefore remain limited, and eight purposively selected SMEs cannot statistically represent the ORE population (Yin, 2018).

Credibility and transferability

Lincoln and Guba's (1985) criteria of credibility, transferability, dependability and confirmability provide an appropriate framework for assessing trustworthiness. Credibility is supported by substantial interviews, follow-up communication, documentary material, case narratives and cross-case comparison. Participants were also invited to correct factual gaps. The main limitation is one senior informant per firm, creating possible elite and single-informant bias. Employees, suppliers and partners were not interviewed to corroborate or challenge leaders' accounts.

Transferability is limited because all cases came from the SELKIE network, were already involved in Triple Helix interaction and operated at TRL 6-9. The sample therefore favours connected, surviving and relatively advanced firms. Only two cases were Scottish and both were tidal, so the study offers European insight rather than a direct account of UK wave-energy SMEs.

Dependability and confirmability

Dependability is supported by a codebook, two coding cycles, two researchers and cross-case matrices, but reporting is less clear on disagreements, codebook revision, negative cases and saturation. Eisenhardt's (1989) case range does not itself demonstrate theoretical saturation, and the prior framework may have directed attention towards its established categories.

Confirmability benefits from multiple sources and an explicit analytical sequence, but participant checking addressed factual gaps rather than interpretations and reflexive reporting is limited. The five-country sample was not designed for systematic cross-national comparison, so strong national-level conclusions are not supported.

4.6 Ethical Considerations

The use of case labels appears to protect firms, but anonymisation is not explained in detail. In a small specialist sector, country, technology, firm size, development stage and leadership history can still permit deductive disclosure (Kaiser, 2009), and contextual quotations may create similar identification risks.

Commercial confidentiality is also important because senior leaders may discuss intellectual property, consortium relationships, supplier weaknesses, failed funding attempts or strategy. Secure storage, controlled access, consent and careful quotation are relevant safeguards. Barrett and Crowley (2025) do not report ethics approval, consent, data management or conflicts in detail; this is a reporting limitation rather than evidence that safeguards were absent.

SELKIE recruitment may also create gatekeeper influence by shaping participation and willingness to criticise associated institutions. Government publications present a different risk because they may state policy intentions rather than implementation. Transparent document

selection and reflexive attention to access relationships are therefore important (Saunders, Lewis and Thornhill, 2023).

4.7 Critical Appraisal

Overall judgement

Overall, the study provides useful sector-specific evidence on leadership and inter-organisational interaction and shows why commercialisation cannot be understood through technology alone. Its principal limitations are one senior informant per firm, retrospective evidence, a relatively advanced supported sample, limited philosophical and ethical reporting, and no direct supply-chain, investment or performance measures.

Alternative design and implications for the proposed DBA

A stronger extension would be longitudinal and multi-actor within realistic DBA access limits. Four to six cases could combine SME leaders with selected suppliers, investors and public actors, supported by project documents, funding records and operational indicators. Observation in accessible cases and disconfirming cases, including failed partnerships, would strengthen rival explanations.

For the proposed DBA, the study offers relational propositions rather than a readiness model. Partner fit, trust, leadership, governance and institutional coordination may contribute to strategic supply-chain readiness but are not equivalent to investment readiness, bankability or actual flows. A pragmatic mixed-methods design could compare stakeholder perceptions with supplier, project, funding and commercial indicators at specific development and financing stages.

5. Discussion and Contribution

Although supply-chain readiness and investment readiness are usually discussed in separate parts of the literature, in practice they are difficult to separate. If an SME lacks sufficient supplier capacity or production capability, investors may see greater uncertainty around costs, delivery schedules and technical performance. Yet the relationship also works in the other direction. Without sufficient finance, firms may struggle to invest in testing, recruitment, supplier development and production preparation. Mason-Jones, Davies and Thomas (2022) show that firms may hesitate to invest when supply-chain readiness is weak. Owen (2023), on the other hand, highlights the role of finance in developing capability over time. In practice, one can therefore become difficult to improve without the other.

Bankability is better understood as something that develops with the firm and its surrounding network rather than as a fixed attribute. Technical progress on its own may not be enough. An SME can have a promising technology and still find it difficult to attract finance if investors are unsure about suppliers, maintenance arrangements, regulation or the route to market. A

smaller firm, however, may be viewed more positively when it can rely on experienced partners and specialist infrastructure. Barrett and Crowley (2025) help explain why. Their cases show that SME leaders had to choose suitable partners, build trust and manage relationships across industry, universities and government. The study does not test bankability directly, but it does show why commercial capability cannot be judged only by looking inside the firm.

Readiness does not necessarily mean the same thing when it is examined from different research perspectives. From a post-positivist position, attention is likely to fall on measurable evidence, including funding, supplier capability, lead times and commercial progress. Such evidence is useful, but it cannot fully account for the judgement involved in investment decisions. Two investors may look at similar information and still reach different conclusions about the same firm. This is where an interpretive perspective adds something different, because credibility, risk and commercial potential are understood through the expectations of the actors involved. Harrer and Owen (2022) illustrate this in early-stage cleantech finance, where entrepreneurs and investors do not always interpret environmental and financial indicators in the same way. For this reason, readiness in this study is treated as more than a set of measurable indicators; it also depends on how those indicators are judged in context. Neither strand would answer the proposed DBA question on its own. Survey measures and secondary data could show whether firms with stronger supplier capability also report or record better access to finance, but they would say little about how readiness is judged by the people making those decisions. Interviews are useful for the opposite reason. They can explore why managers, investors and public funders place different weight on the same evidence, although interview accounts alone cannot establish whether those judgements are reflected in actual funding outcomes. The proposed DBA therefore takes a pragmatic position because the question requires both types of evidence. Morgan (2007) provides a basis for this problem-led view of pragmatism, while Creswell and Plano Clark (2018) show how quantitative and qualitative evidence can be brought together when neither strand provides a sufficient answer on its own.

The proposed DBA would draw on more than one source of evidence. A survey could first identify differences in supplier capability, financing experience and commercial progress across marine renewable-energy SMEs and related supply-chain firms. The survey findings could also help identify cases for the interview stage, especially where a firm's reported readiness does not seem to align with its financing outcome. Interviews with founders, managers, investors, public funders and policymakers could help explain why these differences occur. Innovate UK and UKRI funding records, Companies House filings and investment announcements would provide an additional check against firms' own accounts. This comparison could show whether firms' perceptions of their own readiness are reflected in their funding history and commercial progress.

Integration needs to be built into the design rather than added after the quantitative and qualitative stages have been completed. The literature review could provide the initial basis for the survey measures, and the survey findings could then be used to select cases that deserve closer examination. A useful contrast might be a firm with strong technical and supplier capability but limited access to private finance, compared with one that has fewer internal resources but benefits from stronger ecosystem relationships. Interviews would allow these differences to be examined in more depth. Funding records, partnership information and evidence of commercial progress could also be used to check whether reported readiness is reflected in what has happened in practice. Fetters, Curry and Creswell (2013) describe this type of connection between different stages of a study as an important part of mixed-methods integration.

On the basis of the literature reviewed, bankability can be understood as a stage-sensitive judgement influenced by six interconnected dimensions:

- technical and performance credibility;
- supply-chain capability and resilience;
- revenue and market credibility;
- policy and regulatory credibility;
- ecosystem coordination and network quality; and
- the fit between the development stage and available finance.

The practical value of this framework is that it identifies areas that different actors may be able to influence. SMEs can strengthen evidence, governance, supplier planning and investor communication. Public agencies can support stage-specific learning, shared infrastructure and supplier development. Investors can apply due-diligence criteria that recognise the long development horizons of hardware-intensive renewable technologies, while supply-chain firms can assess whether future demand is sufficiently credible to justify investment in skills and capacity.

Investment readiness in marine renewable energy cannot be judged from one signal alone. Guo and Ringwood (2021) show that a technology may progress through Technology Readiness Levels without resolving the cost, reliability and performance issues that matter commercially. Public funding creates a similar problem: receiving grants may support development, but it does not necessarily show that a firm is ready for the next type of finance. What counts as sufficient evidence also changes between prototype, demonstration and scale-up. This does not mean that early-stage firms should be given the benefit of the doubt indefinitely; some technologies and business models will remain unviable. The proposed DBA would examine where supply-chain capability begins to influence investment decisions and whether those judgements are reflected later in funding and commercial progress.

6. Conclusion

The review shows that commercialisation in UK marine renewable-energy SMEs cannot be explained by a single technological, financial or organisational barrier. Progress depends on interactions among technical, commercial, financial, institutional and regulatory conditions.

Supply-chain readiness extends beyond operational preparedness to supplier relationships, manufacturing knowledge, logistics, infrastructure, skills and adaptation. Investment readiness is similarly multidimensional, combining technical and financial evidence, governance, route to market, policy credibility, ecosystem relationships and fit between capital and development stage.

Five debates structure the literature: firm resources versus ecosystem capability; technology versus investment readiness; collaboration versus secrecy; resilience, efficiency and local content; and whether readiness is objective or socially constructed. The evidence supports a relational view in which observable capabilities interact with institutions and stakeholder interpretation.

Barrett and Crowley (2025) demonstrate the value of an interpretive, practice-based view of innovation relationships, but their single-informant, retrospective and purposive design limits causal and cross-country claims. Although they do not measure supply-chain or investment readiness directly, partner fit, trust and ecosystem coordination inform the proposed DBA framework.

A pragmatic mixed-methods approach is therefore appropriate because it can combine observable indicators such as funding, supplier capability, lead times and project performance with qualitative evidence on confidence, collaboration and credibility. This avoids reducing bankability to a single indicator.

Practically, marine SMEs should develop finance and supply-chain strategy together using stage-appropriate evidence. Public support should be sequenced around learning, infrastructure, patient capital and credible market formation, while investors may need stage-sensitive due diligence rather than comparison with mature renewable technologies.

Finally, the review identifies several priorities for future research. Longitudinal studies are needed to follow ventures across different stages of development and financing. Research should also include failed ventures, rejected financing applications and unsuccessful commercialisation pathways, which remain underrepresented in the current literature. Further research is required to examine how firm-level capabilities interact with wider ecosystem conditions and, importantly, whether improvements in supply-chain and investment readiness are associated with observable changes in investment flows.

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Appendix A. Literature review matrix

Study	Theory or lens	Methodology and philosophy	Main finding	Relevance and gap
Mason-Jones, Davies and Thomas (2022)	Theory of Constraints	Three-phase study using surveys, focus groups and current-reality-tree analysis; applied systems orientation	UK renewable supply chains are constrained by weak readiness, limited knowledge, uncertain policy and poor investment visibility	Direct supply-chain relevance; does not focus specifically on marine SMEs or actual investment flows
Mason-Jones et al. (2025)	Theory of Constraints and Future Reality Tree	Design-oriented systems research; systematic review plus ToC CRT-FRT analysis	Marine renewable supply-chain entry requires a roadmap linking constraints and desired future states	Direct marine-sector relevance; needs empirical testing of proposed pathways
Harrer and Owen (2022)	Institutional logics	Interpretive mixed methods: documents, interviews, CEO-investor pairings and workshops	Environmental indicators and hybrid logics shape information asymmetry in early-stage cleantech finance	Strong investment-readiness evidence; not marine-specific and not longitudinal
Barrett and Crowley (2025)	Triple Helix and management-as-practice	Qualitative multiple-case study of eight European ORE SMEs; management-as-practice lens	Leadership practice, partner fit, trust and coordination influence innovation and commercialisation interactions	Direct marine/offshore renewable SME relevance; does not measure investment flows or supply-chain readiness; one SME leader interviewed per case
Cowling and Liu (2023)	SME finance and capital-market analysis	Large UK dataset and quantitative analysis	Cleantech firms demand more external capital and traditional providers do not fully meet demand	Strong UK SME relevance; limited marine-sector and supply-chain detail

Study	Theory or lens	Methodology and philosophy	Main finding	Relevance and gap
Owen et al. (2020)	Resource complementarity and transaction-cost logic	Longitudinal UK case studies	Public-private co-financing can support early-stage green SMEs	Relevant to blended finance; limited direct marine evidence
Owen (2023)	Systems framework and absorptive-capacity learning	Qualitative study of government venture-capital funds and more than 100 interviews	Public venture capital develops learning and market capability over time	Strong policy and finance relevance; not supply-chain specific
O'Reilly, Mac an Bhaird and Greene (2025)	Entrepreneurial finance and valley of death	Empirical study of equity capital and cleantech scaling	Equity-backed cleantech firms reach key financial milestones more slowly than non-equity-backed firms	UK cleantech equity-finance evidence; limited marine-specific application
van der Schans, Owen and Hussain (2026)	Patient-capital perspective	Longitudinal quantitative analysis using Beauhurst and PitchBook data	Hardware-based UK Greentech firms face scale-up funding gaps linked to investor risk aversion	Important for proposed DBA; marine supply-chain mechanisms remain underdeveloped
Jin and Greaves (2021)	Sector review	Critical review of UK wave energy	Wave energy remains strategically important but commercially immature	Strong UK context; mainly sector-level evidence
Guo and Ringwood (2021)	Technology and commercialisation review	Technical, research and commercial synthesis	TRL is insufficient; performance, niche markets and IAG collaboration matter	Links technology, supply chain and bankability; review rather than primary empirical study

Study	Theory or lens	Methodology and philosophy	Main finding	Relevance and gap
Hannon, van Diemen and Skea (2017)	Technology Innovation Systems	Mixed methods using interviews, grants, bibliometrics, patents, projects and indicators	UK wave support was weakened by premature scale-up, poor learning and weak market formation	Strong direct UK evidence; limited explicit philosophy and ethics reporting
Proimakis, Hooper and Østergaard (2021)	Community-energy and ecosystem perspective	Semi-structured interviews with marine-energy stakeholders in the UK, Canada and Denmark, plus public interviews in England	Small-scale projects can support local learning and supply chains but face finance and regulatory barriers	Relevant to alternative commercial pathways; not focused on firm-level investor decisions
Leete, Xu and Wheeler (2013)	Investor preference analysis	Investor-focused empirical study	Technology risk, policy credibility and revenue certainty shape marine investment	Foundational investor evidence; predates the main five-year review window
Bucher et al. (2016)	Investor-confidence framework	System-dynamics modelling of multi-level expert interviews	Funding and device-performance risks are interdependent; array-scale success builds investor confidence	Useful for bankability dimensions; limited observed financing data
Wilson, Rowley and Watson (2011)	Risk-based systems engineering	Bayesian and systems due-diligence model	Device evidence must be connected to system-level costs and risks	Strong methodological basis for supply-chain due diligence; needs real-world validation
Hutcheson, De Andrés and Jeffrey (2016)	Risk-versus-reward methodology	Case-based modelling and engineering judgement	Lower cost can require higher development risk; collaboration may be needed to share risk	Useful for investment appraisal; subjectivity and data sensitivity limit validity

Study	Theory or lens	Methodology and philosophy	Main finding	Relevance and gap
Polzin et al. (2019)	Investor perspective on policy	Systematic review	Policy mobilises private finance by improving risk-return conditions	Strong synthesis; broad renewable scope rather than marine SMEs
van der Loos et al. (2022)	Global value-chain governance	Quantitative analysis of supplier contracts	Local-content effects depend on governance and lead-firm capability	Useful industrial-policy comparison; offshore wind is more mature than wave
Noble, Grattan and Jeffrey (2024)	Learning curves and deployment economics	Quantitative scenario modelling	Support requirements are highly sensitive to learning rates and starting costs	Shows value and limits of modelling; tidal rather than wave and not SME-focused

Appendix B. PRISMA-informed review audit trail

Stage	Review activity	Reporting decision
Identification	Documented report searches, targeted academic searches, backward and forward citation chaining, and targeted metadata verification	Search blocks covered sector, supply chain, finance, ecosystem and research-method terms; database-specific counts were not reconstructed
Screening	Removal of duplicate or overlapping records where identifiable, promotional material, purely technical papers and studies without management relevance	Titles and abstracts were assessed against the stated inclusion and exclusion criteria; screening was conducted by the coursework reviewer
Eligibility	Full-text reading of the most relevant available studies, including Harrer and Owen (2022), Barrett and Crowley (2025), Hannon, van Diemen and Skea (2017), Guo and Ringwood (2021), Wilson, Rowley and Watson (2011), Hutcheson, De Andrés and Jeffrey (2016), van den Burg et al. (2017), Proimakis, Hooper and Østergaard (2021), and Noble, Grattan and Jeffrey (2024)	Method, evidence, philosophy, ethics, validity, bias and limitations were extracted and critically appraised
Inclusion	Studies were retained when they materially informed supply-chain readiness, investment readiness, commercialisation, ecosystem capability or philosophical analysis	Recent studies were prioritised; foundational studies were retained where required to establish or critique theory

A numerical PRISMA flow diagram is not included because complete search, de-duplication and screening records were not retained throughout the review, and the figures were not reconstructed afterwards. Appendix B provides a PRISMA-informed audit trail of the review process.

Appendix C. Coding framework

Theme	Example codes
Supply-chain readiness	supplier capability; manufacturing; procurement; logistics; ports; vessels; maintenance; quality; skills; local content
Investment readiness	investor confidence; governance; financial records; pitch quality; evidence; due diligence; information asymmetry; patient capital
Commercialisation	prototype; demonstration; array scale; niche market; revenue pathway; customer; offtake; scale-up
Innovation ecosystem	university-industry-government; intermediaries; test centres; networks; knowledge exchange; regional clusters
Sustainability and ethics	net zero; environmental performance; community legitimacy; responsible procurement; lifecycle; decommissioning
Policy and finance	grants; CfD; guarantees; blended finance; state investment banks; policy credibility; public-private collaboration
Philosophy and method	positivism; interpretivism; critical realism; pragmatism; ontology; epistemology; axiology; reflexivity