TNO Nederlands Materialen Observatorium

Identifying and mitigating risks in the offshore windfarm value network

A summary of insights for the wind sector



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Summary

Realizing the Dutch ambition of 21 GW of offshore wind capacity by 2032 depends on value networks that can deal effectively with known risks and hard-to-quantify uncertainties. A value network is the wider group of actors and their interactions, including flows of goods, information, finance and trust. For offshore wind, it extends beyond the component supply chain to include offshore contractors, infrastructure operators, electricity offtakers, governments and many more actors. With negligible critical raw material mining, limited manufacturing capacity and a dominant position in offshore contracting, the Netherlands (and Europe) depends on a global market shaped by geopolitics. Around 4.7 GW is currently in operation, and 5.5 GW more is under construction, but the investment conditions needed to deliver the additional 11 GW are perceived risky.

This report summarizes the full TNO report (TNO-2026-17867) for professionals in the offshore wind sector and for Dutch policymakers. It sets out the risks that stakeholders perceive around offshore wind development and the actions that could mitigate them. **The central finding is that risk is concentrated with a few actors, while the strategies to mitigate it are spread across the entire network.** Offshore wind farm owners and component manufacturers (original equipment manufacturers, OEMs) carry the largest and most varied risk exposure. And many strategies that could reduce those risks need to be implemented by other stakeholders in the value network. This mismatch between risk owners and mitigation strategy owners is the central obstacle to realize 21 GW in 2032 that this assessment identifies.

The study applied a transparent and standardized five-step risk assessment approach: objectives, identification, analysis, evaluation and mitigation and sector stakeholder input and validation was included throughout. More than 100 risk events were identified, grouped into 30 risk clusters and 13 of these were prioritized for mitigation (see figure below).

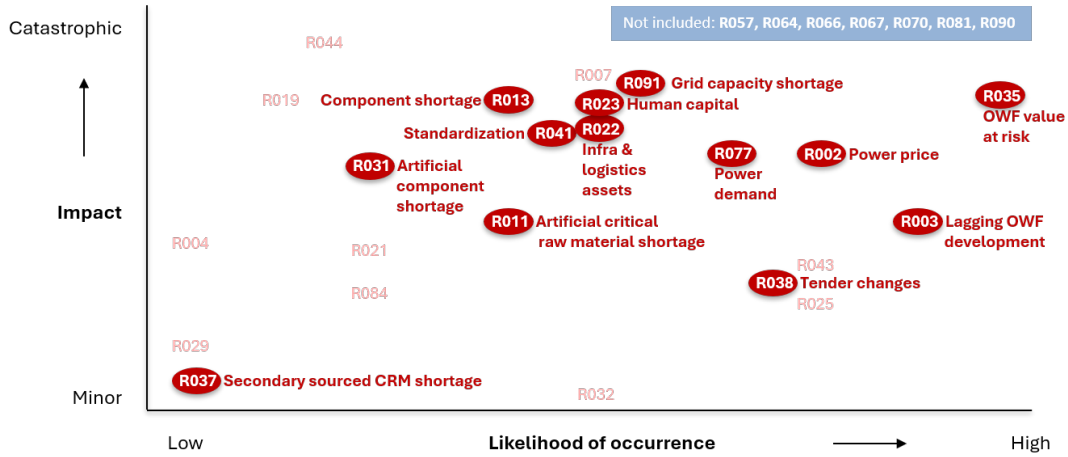


Figure 1.1 The 13 risk clusters prioritized for mitigation (highlighted), plotted by expert-estimated likelihood and impact.

Risks cascade downstream.
Risks that start upstream – with raw material suppliers, component manufacturers and logistics – are passed down through contracts and end up in the wind farm owner's business case. This upstream-to-downstream cascade lies behind almost every prioritized risk in this

study, and it can make the business case look like a single, unmanageable problem. It is not. By breaking that problem down into separate risk topics (such as grid capacity, the value of wind power, tender design and lack of standardization), each risk can be assigned to its owner and matched with suitable mitigation strategies. Untangling these interconnected risks, rather than treating the business case as one unsolvable knot, is what makes the situation possible to mitigate.

Risk tolerance levels differ per actor.
No single risk tolerance threshold can be set for the whole value network: what one stakeholder sees as an acceptable risk, another may not. Risk prioritization is therefore subjective by design. Of the 13 prioritized risk clusters, only one (R035, the value at risk of a wind farm after the final investment decision) was judged urgent by all experts involved; the other 12 were judged urgent by one or more stakeholders. To address the prioritized risks, the study defined 21 mitigation strategies, spread across the value network. There is no shortage of strategies, but implementation stalls when no clear strategy owner can be identified, or when that owner is a different actor than the one exposed to the risk.

Four priority strategies.
Sector experts point to three out of 21 strategies that deserve priority attention:

- **Transparent EU-level planning of offshore wind projects (M58)**, by EU and national governments. M58 stands out as the connecting strategy: a precondition for many of the other strategies to be effective.
- **Maintaining the pace of public infrastructure investment (M84)**, given the long lead times, by national governments, port authorities and transmission system operators.
- **Multi-actor coordination (M86)**, closely related to **changing business models (M104)**. Together they underline the importance of new risk-sharing collaborations and contracts, taken up collectively by value network stakeholders, from OEMs via contractors to electricity offtakers.

Act in parallel, despite imperfect information.
Nearly all value network actors have mitigation strategies available to them. They need to act in parallel, not in sequence. Imperfect information is the normal state of value network risk management and should not hold actors back from proactive collaboration to reduce the uncertainties that slow the further industrialization of the wind sector.

Expert judgement-based research and recommended iterations.
The findings rest largely on expert judgement and should be read as indicative. A different group of experts, or a re-assessment at a different moment in time, is likely to produce a different shortlist of risks. The five-step approach lends itself to repeated applications, combining lighter interim rounds with periodic full updates. And qualitative insights can be combined with quantitative information over time. Future assessments also need knowledgeable and authoritative participants who together represent the full range of stakeholder perspectives and thereby contribute to the quality of the risk assessment.

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1 Introduction and approach

Offshore wind energy is an important pillar of the energy transition in the Netherlands. The Dutch ambition is 21 GW of offshore wind capacity by 2032. Around 4.7 GW is currently in operation and 5.5 GW more is under construction, but the investment conditions needed to deliver the additional 11 GW are perceived risky. High ambitions and short timelines leave little room for unexpected setbacks.

Reaching this goal requires a broad set of connected activities: mining and processing of critical raw materials, manufacturing and supply of all components needed to build offshore wind farms, operation and maintenance, and end-of-life activities. The Netherlands has no mining activities related to wind energy and limited manufacturing of key offshore wind components, so companies active in the Dutch offshore wind sector operate in a global market influenced by geopolitics.

The offshore wind value network is inherently complex for four reasons:
1. The global value network has many stakeholders with diverging interests.
2. Information asymmetry and a lack of transparency is inevitable.
3. A large diversity of risks throughout the network and many risks are difficult to mitigate.
4. A well-functioning value network is preconditional for realizing the Dutch renewable energy transition goals. No alternatives are available.

Many risks in this value network are known and are already being addressed by individual stakeholders. But many risks are shared or have no clear owner which leads to decision impasses and unclarity regarding mitigation strategies required to overcome the hurdles in the current scale-up phase. This report takes a broad, overarching view of risks in the whole offshore wind value network and addresses two questions:

- **Question A:** What are the risks in the offshore wind value network, from critical raw material mining to offshore wind farm operation?
- **Question B:** How can these risks be mitigated so that the Dutch offshore wind targets can be secured?

The approach combines the ISO 31000 risk management standard with value network analysis and scenario planning into a five step approach:

- Step 1: Define the value network and its objectives (Chapter 2)
- Step 2: Identify risks and uncertainties (Chapter 3)
- Step 3: Analyse the likelihood and impact of risks (Chapter 4)
- Step 4: Evaluate which risks are acceptable and which need mitigation (Chapter 5)
- Step 5: Identify mitigation strategies and who should implement them (Chapter 6)

This study was carried out within the Netherlands Material Observatory (Nederlands Materialen Observatorium, NMO), which the Dutch government and TNO established in 2025 in the context of the EU Critical Raw Materials Act. The NMO supports government and companies with insights, data and methods on supply chain topics. This report summarizes the main findings of the full report (TNO-2026-17867 (Hajonides, 2026)).

2 Start by defining which objectives in the offshore wind network are at risk

2.1 Public and private objectives in the value network

The starting point of this risk assessment is the two value network objectives that are threatened. The explicit formulation of those objectives is essential to the success of this assessment as only risks that threaten one or both goals are considered in scope.

The collective societal objective is:

- Realize the **21 GW** offshore wind production capacity ambition in **2032** with acceptable societal **costs**, and within **ESG (environmental, social and governance)** and **quality** boundaries.

And the objective of each individual stakeholder is:

- Secure business continuity of **own firm** through **acceptable balance of perceived risks and revenues** in the portfolio of business activities.

And these objectives can cause conflicting stakeholder incentives that frustrate collaboration.

2.2 Scoping the offshore wind value network

The technical scope covers five components of the offshore wind farm: rotor, nacelle, tower, foundation and inter-array cables. The offshore high-voltage substation, export cable and scour protection are not included in the scope.

The value network scope covers three supply chains: (1) mining and refining of (critical) raw materials; (2) manufacturing of components, integration of components into operating wind farms, the end-of-life stage of these components; and (3) the production, transport and consumption of electricity. Together with eight generic stakeholders, these stakeholders together form the value network of offshore windfarms as defined for this risk assessment.

The Dutch government, specifically the Ministry of Economic Affairs and Climate, is responsible for meeting the offshore wind targets (objective 1) and therefore shares responsibility for the future performance of the value network. The value network is mapped in Figure 2.1.

The full report also contains a quantitative mass flow analysis of the components and raw materials needed for the planned growth in offshore wind capacity, and a more detailed description of the method.

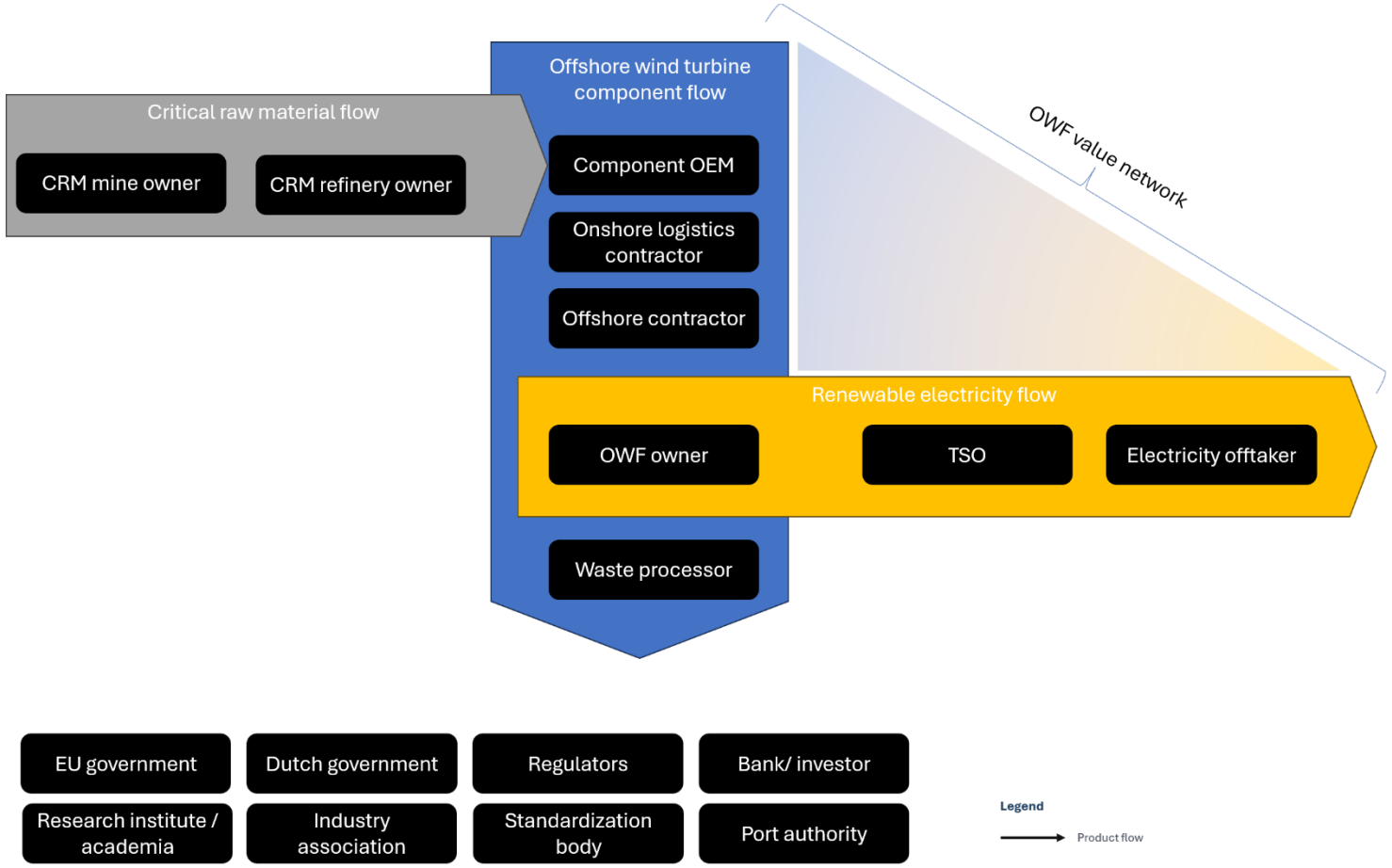


Figure 2.1 Offshore wind supply value network: Stakeholders and product flows.

3 Which risks are identified, and who owns them?

The offshore wind value network involves a wide range of stakeholders, each with their own objectives, interests and views on risk. The risk identification step must acknowledge this. The assessment approach transparently shows how the risk register came to be.

Risks were identified and structured in four steps:

1) Identify risk events through stakeholder consultations and literature reviews.
2) Assign each risk to a dominant risk owner.
3) Group risk events into overarching risk clusters and relate clusters to objectives.
4) Structure the risks per value network stakeholder.

This summary report shares the 30 risk clusters as the outcome of step 3 in **Table 3.1** Three actors own most of the risk clusters: OWF owners (8 clusters), component OEMs (7) and the Dutch government (6). The number of clusters an actor owns says nothing about the potential impact of those risks.

The clusters owned by OWF owners and component OEMs contain multiple, interlinked risks, such as shortages of components or raw materials, competitive pressure and policy uncertainty. Many risks in the OWF owner's clusters originate upstream: downstream actors accumulate risks passed on from earlier supply chain stages and must manage them.

Thematic patterns also emerge. Risks owned by component OEMs and CRM mine owners are largely commercial and market-driven, centred on cost structures, supply availability and competitiveness. Risks owned by the Dutch government concern policy design, regulatory clarity and infrastructure capacity – all critical for stable investment conditions. Risks owned by the value chain as a whole cut across stakeholders and concern systemic enablers such as trust, standardization and collaboration.

Clusters that involve many stakeholders beyond the dominant owner typically represent multi-faceted, systemic issues in the offshore wind ecosystem. These risks are not only more complex but also more likely require multi-actor mitigation (see Chapter 6). They also received the most input during the consultations, reflecting both the urgency stakeholders perceive and the interdependence of risk ownership. Note that smaller clusters may point to more targeted risks, which can still have a significant impact if left unaddressed.

The risk identification step results in an overview of risk events and uncertain trends without value judgements to what extend a risk is problematic. Evaluating which risks are prioritized for mitigation is discussed in Chapter 5.

Table 3.1 Aggregated risk clusters with the (dominant) risk owner and related objectives under threat.

Risk	Risk cluster name	Threatens objective	Dominant owner (A-Z)
R019	Serial defects beyond acceptable margins in OWF components	Business continuity	Component OEM
R066	EU manufacturing industries outperformed on global markets		
R067	CRM independent OWF component designs unable to compete with CRM based components		
R081	Other sector(s) outcompete OWF sector in global market for multi-purpose components		
R004	Global shortage of mined critical raw materials	Renewable electricity generation 2032	
R011	Artificially created shortage of traded critical raw materials		
R070	Unclear implementation of EU policies (CRMA, NZIA, CID) at member state levels		
R021	CRM demand volume and/or volatility beyond anticipated boundaries	Business continuity	CRM mine owner
R032	ESG non-compliance in supply chain		
R084	CRM price level and/or volatility beyond anticipated boundaries		
R043	Unfair competition in public tenders	Business continuity	Dutch government
R003	Lagging offshore wind farm capacity deployment in the Netherlands	2032 RE generation	
R031	Insufficient spatial reservations onshore (logistics) and/or offshore (wind farm plots)		
R077	Lagging renewable electricity demand NL and EU		
R090	Unclear effectiveness of Dutch policy support to OWF upscaling		
R091	Insufficient electricity grid capacity		
R002	Low and/or volatile power price in NL and EU	Business continuity	OWF owner
R025	Unfavourable financing conditions (e.g. cost of capital, interest and exchange rates, inflation)		
R035	Predicted value at risk of wind farm develops negatively beyond accepted bandwidth after final investment decision		
R038	Tender procedure and/or underlying agreements change before final investment decision		
R007	Global shortage of manufactured offshore windfarm components	2032 RE generation	
R013	Artificially created shortage of traded offshore windfarm components		
R022	Unavailability of adequately sized infrastructure and logistics assets		
R057	Global shortage of low emission raw materials (e.g. green steel)		
R041	Insufficient consensus in OEM sector on standardization aspects to industrialize manufacturing processes	Business continuity	Value chain
R044	Climate-related and environmental harmful events		
R064	Breaking of trust amongst supply chain partners		
R023	Human capital shortage	2032 RE generation	
R029	Social resistance to new asset development	Business continuity	Waste processor
R037	Global shortage of secondary sourced (critical) raw materials	2032 RE generation	

4 What are the likelihood and impact of the risks?

The risk analysis estimates the likelihood (L) and potential impact (I) of each risk cluster to determine its relative risk score (R=L*I). TNO experts made initial estimates based on offshore wind sector stakeholder interviews and recent literature. Participants in a stakeholder workshop (19 experts, July 2025) then confirmed or corrected these estimates.

The risk matrix in Figure 4.2 below positions the risk clusters along impact and likelihood axes to support prioritization and discussion. The positions are indicative rather than exact: they are not scores on a fixed scale and combine various expert judgements that may differ considerably. See the full report for a detailed documentation of this step.

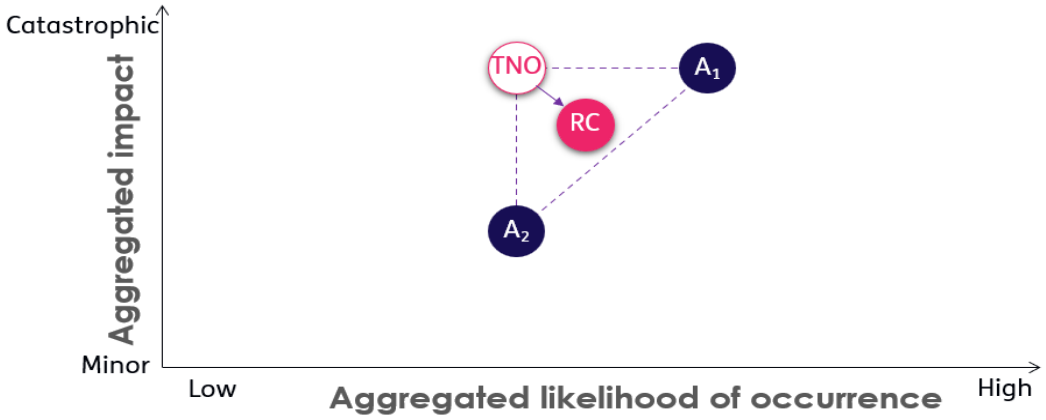


Figure 4.1 Visualisation of the assessment process for risk R035, showing the initial estimate by TNO (TNO), expert inputs from two workshop sessions (Actor A1 and Actor A2), and the resulting aggregated estimate for the risk cluster (RC) used in the subsequent steps of this assessment.

Read together with
The Risk identification step results in an overview of risk events and uncertain trends without value judgements to what extend a risk is problematic. Evaluating which risks are prioritized for mitigation is discussed in Chapter 5.

Table 3.1, the risk matrix shows which actors own the risks with the highest risk scores. For example, risk cluster R035 *the predicted value of a wind farm developing negatively beyond the accepted bandwidth after the final investment decision* was assessed as the most likely of all risks, with a major impact on the business continuity objective of the OWF owner.

Seven clusters could not be placed in the matrix as these risks were identified during the final workshop. Including these risks would have required an additional iteration of the research. The risks excluded from the matrix are: R057, R064, R066, R070, R081 and R090. See Table 3.1 for more details.

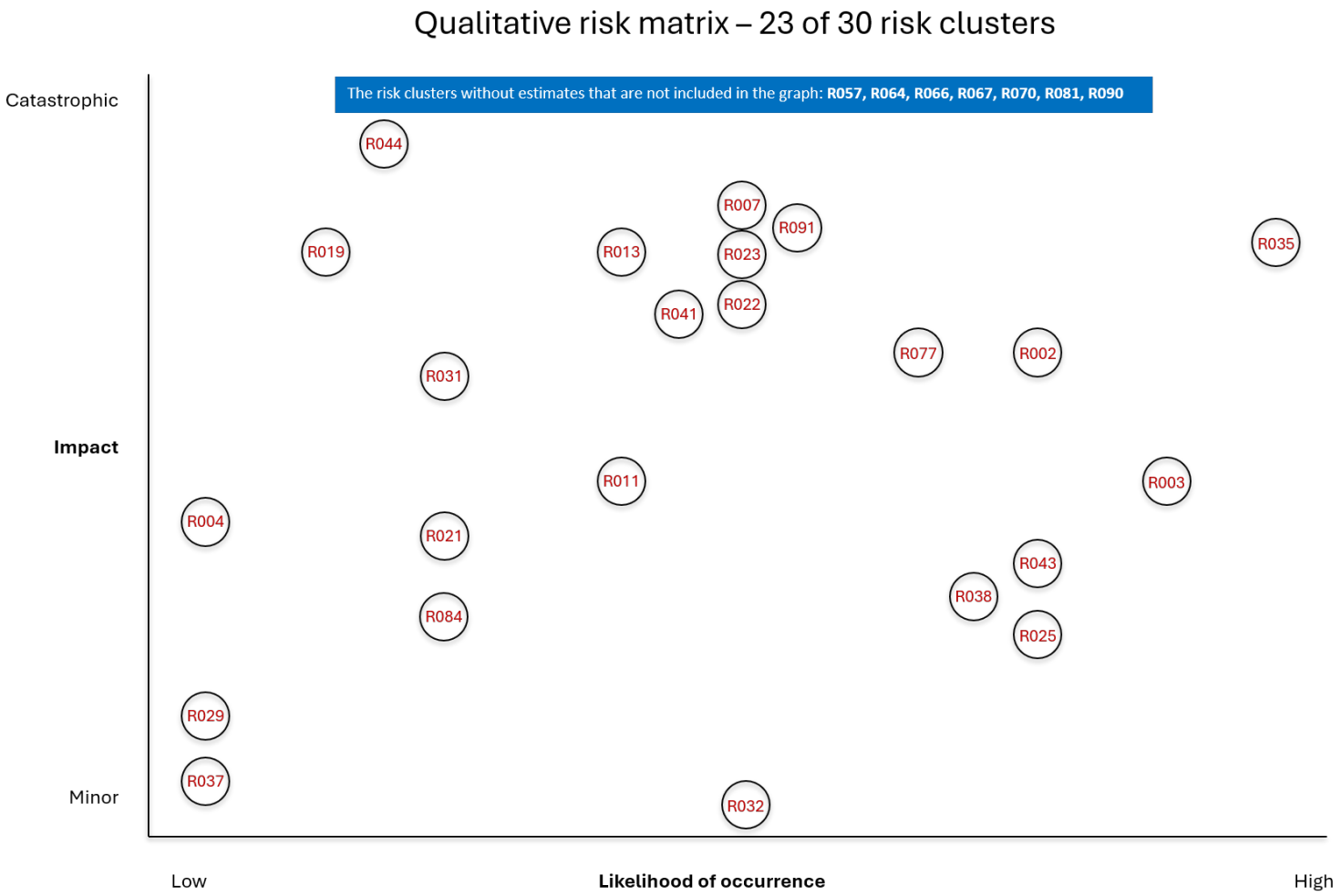


Figure 4.2 Qualitative risk matrix with aggregated risk clusters.

Five insights were drawn from this qualitative risk analysis

1. **Project developers rely on sufficiently high and stable electricity prices** to secure financing and an acceptable return on investment. Paradoxically, the more offshore wind is added to the electricity system, the less attractive further investment becomes, as markets saturate and electricity prices fall. This cannibalisation effect is widely known as an upscaling obstacle for renewable electricity supply.

2. **All actors perceive the uncertainty about the multi-year pipeline of wind farm projects, in the Netherlands and across the North Sea as a problem.** A predictable pipeline is a precondition for project development and for further industrialization and standardization of component supply chains. As demand for renewable electricity is driven mainly by the electrification of energy demand in the Netherlands and Europe, demand for wind farms is directly linked to how fast that electricity demand grows.

3. OEMs and their component suppliers, as well as offshore installation contractors are **hesitant to invest in new production facilities or ships without firm volume commitments or long-term product or service offtake agreements that make those investments bankable**. The limited and steadily declining share of European offshore wind manufacturing capacity (OEMs and suppliers), and the international CRM supply chains this industry relies on, is undesirable for maintaining a European manufacturing base and calls for convincing and coordinated industrial policy at Dutch and EU level. Without industrial policies, the global level playing field is perceived unfavourable for Dutch and EU manufacturing industries.

4. Because of their dependence on upstream supply chain performance, **risks accumulate at the downstream actors in the offshore wind supply chain**. Wind farm owners therefore perceive the largest number of risks, as upstream risks such as raw material price volatility and component supply delays are passed on to them.

5. The further downstream in the supply chain, **the more actors are involved, which makes managing risks exponentially more complex** and accurate performance data expensive and difficult to obtain. Industrial supply chains are also in continuous flux (e.g. mergers and acquisitions, relocations, expansions and bankruptcies), so it is impossible to generalize or assume that they stay the same over time.

Based on these insights it can be concluded that risk mitigation is urgently needed in nearly all supply chain stages to realize the planned 21 GW of Dutch offshore wind capacity, and a lower risk profile is a precondition for wind farm developers and OEMs to scale up and further industrialize the supply chains.

5 Which risks do ‘we’ tolerate?

Deciding which risks are acceptable, and which are not, is a crucial step in risk management. And this step is arguably the most difficult because it is subjective. But because mitigation efforts require scarce resources (time, money and effort), these efforts should focus on risks whose potential consequences are perceived the most unacceptable. And therefore, this risk evaluation step is crucial before continuing with risk mitigation strategies.

The likelihood and impact of risks (Chapter 4) do not tell the whole story: stakeholders can judge the urgency of mitigating a risk cluster differently based on their own perception, interest and various cognitive biases. Evaluating risks with the intention to separate tolerable versus not tolerable risks introduces stakeholder-dependent risk tolerance (risk appetite) characteristics. No single threshold line (dotted line in Figure 5.1) can be drawn to represent the perspectives of all stakeholders involved.

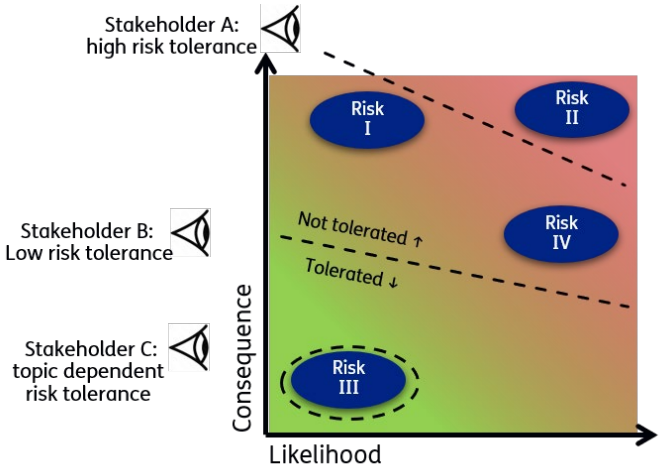


Figure 5.1 Risk evaluation introduces stakeholder-dependent risk tolerance levels instead of a single risk threshold level.

Based on expert interviews and workshop discussions, the urgency to mitigate a risk cluster was rated low, medium or high by each expert involved (Table 5.1). A cluster can have more than one rating, reflecting differing views. Higher urgency generally aligns with a higher position in the risk matrix, though there are exceptions.

Many clusters did not reach consensus, which is to be expected. Even so, the ratings provide a practical basis for focusing mitigation on the risks considered most urgent within this assessment. The 13 clusters rated high by at least one participant were selected to proceed to the mitigation step. Only one risk, R035 *value at risk of the wind farm after the final investment decision*, was rated highly urgent by all experts involved. Ten clusters were rated low to medium, and seven were not assessed.

Note: a different group of experts, or a different moment, would likely produce a different shortlist, and stakeholders not consulted here may consider other risks urgent.

Table 5.1 Estimated urgency to mitigate, by risk cluster.

Risk ID	Risk cluster name	Risk owner	Urgency to mitigate? L	M	H	Proceed to mitigation?
R002	Low and/or volatile power price in NL and EU	OWF owner				Yes
R003	Lagging offshore wind farm capacity deployment in the Netherlands	Dutch government				Yes
R004	Global shortage of mined critical raw materials	Component OEM				
R007	Global shortage of manufactured offshore windfarm components	OWF owner				
R011	Artificially created shortage of traded critical raw materials	Component OEM				Yes
R013	Artificially created shortage of traded offshore windfarm components	OWF owner				Yes
R019	Serial defects beyond acceptable margins in OWF components	Component OEM				
R021	CRM demand volume and/or volatility beyond anticipated boundaries	CRM mine owner				
R022	Unavailability of adequately sized infrastructure and logistics assets	OWF owner				Yes
R023	Human capital shortage	Value chain				Yes
R025	Unfavourable financing conditions (e.g. cost of capital, interest and exchange rates, inflation)	OWF owner				
R029	Social resistance to new asset development	Waste processor				
R031	Insufficient spatial reservations onshore (logistics) and/or offshore (wind farm plots)	Dutch government				Yes
R032	ESG non-compliance in supply chain	CRM mine owner				
R035	Predicted value at risk of wind farm develops negatively beyond accepted bandwidth after final investment decision	OWF owner				Yes
R037	Global shortage of secondary sourced (critical) raw materials	Waste processor				Yes
R038	Tender procedure and/or underlying agreements change before final investment decision	OWF owner				Yes
R041	Insufficient consensus in OEM sector on standardization aspects to industrialize manufacturing processes	Value chain				Yes
R043	Unfair competition in public tenders	Dutch government				
R044	Climate-related and environmental harmful events	Value chain				
R057	Global shortage of low emission raw materials (e.g. green steel)	OWF owner	Not assessed			
R064	Breaking of trust amongst supply chain partners	Value chain	Not assessed			
R066	EU manufacturing industries outperformed on global markets	Component OEM	Not assessed			
R067	CRM independent OWF component designs unable to compete with CRM based components	Component OEM	Not assessed			
R070	Unclear implementation of EU policies (CRMA, NZIA, CID) at member state levels	Component OEM	Not assessed			
R077	Lagging renewable electricity demand NL and EU	Dutch government				Yes
R081	Other sector(s) outcompete OWF sector in global market for components with various purposes	Component OEM	Not assessed			
R084	CRM price level and/or volatility beyond anticipated boundaries	CRM mine owner				
R090	Unclear effectiveness of Dutch policy support to OWF upscaling	Dutch government	Not assessed			
R091	Insufficient electricity grid capacity	Dutch government				Yes

Figure 5.2 places the 13 prioritized risk clusters on the value network map which illustrates clearly that two stakeholders in the value network own the most risks that were judged urgent to mitigate: the OWF owner and the Dutch government.

And Figure 5.3 highlights the 13 prioritized risk clusters in the risk matrix from Chapter 4. As the value network includes so many types of stakeholders, no single risk tolerance line can be drawn: whether a position is acceptable depends on who is asked. The matrix therefore shows the spread of expert estimates rather than a shared verdict on which risk clusters must be mitigated first.

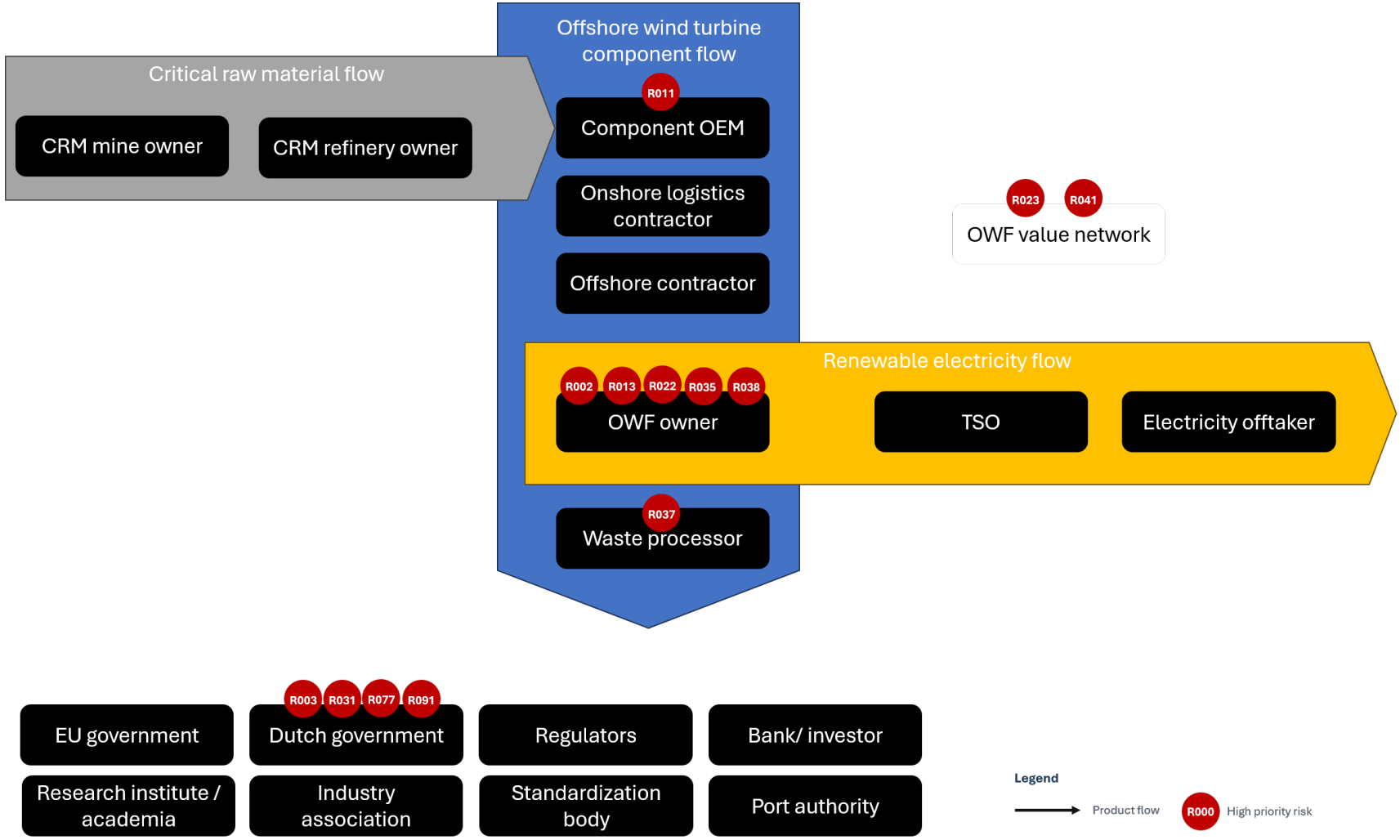


Figure 5.2 Offshore wind supply value network: Owners of prioritized risks.

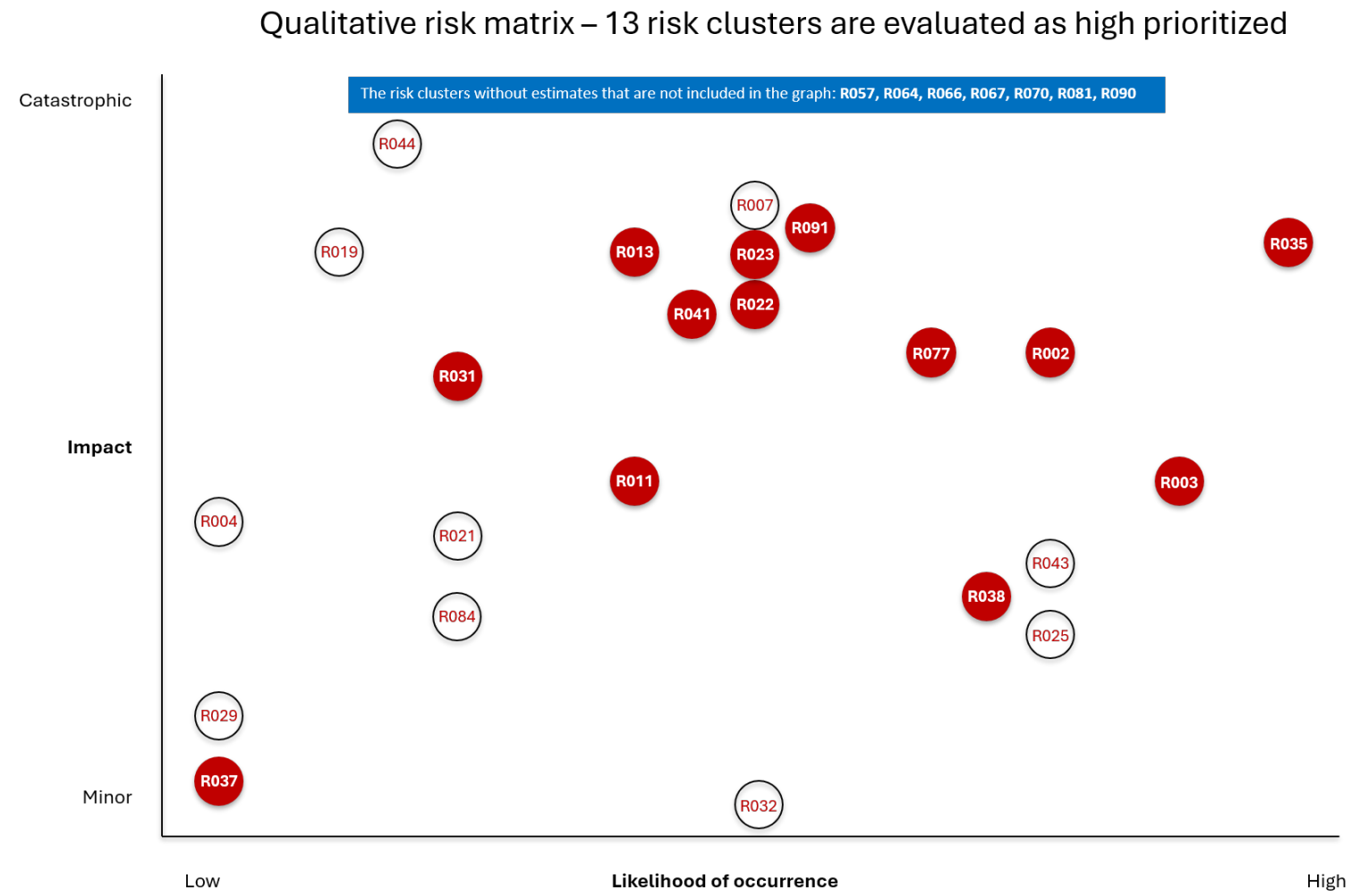


Figure 5.3 Qualitative risk matrix of the 13 risk clusters evaluated as high priority to mitigate.

6 Which actions can mitigate risks, and by whom?

6.1 A longlist of risk mitigation strategies

Once the risks requiring mitigation efforts has been selected, the next step was to identify mitigation strategies. Those strategies were collected from the literature and from experts through interviews and workshops, and then synthesized into 21 strategy clusters. The list is not exhaustive, and many strategies are normal business practice.

For each strategy, Table 6.1 gives: a summary of example actions, the actor expected to implement the strategy (the dominant strategy owner) and an indication of its expected effectiveness. This effectiveness is assessed through three categories:

- **quick wins** deliver benefits soon after implementation;
- **strategic bets** may or may not prove highly effective, depending on future events;
- **foundational strategies** provide long-term benefits and/or enables other mitigation strategies, without clear and measurable short-term effects.

/

Figure 6.1 brings the 21 mitigation strategy clusters and 13 prioritized risk clusters together on the value network map, showing for each stakeholder both the risks they own and the mitigation strategies they own.

Mitigation number	Mitigation strategy cluster	Summary of mitigation strategy (incl. non-exhaustive examples)	Most dominant strategy owner	Estimated effectiveness
m002	Financial aid	Deploy targeted grants, soft loans, guarantees and export credit for strategic component manufacturers, port infrastructure and first-of-a-kind non-virgin material processing and usage (recycling, magnet production). Implement partial derisking mechanisms for wind farm owner revenue such as two-sided contract-for-difference, long term loan agreements.	National governments/ EU public banks	Quick win
m008	ESG values	Increase ESG performance objectives and decommissioning requirements. Embed ESG due diligence into windfarm tendering and procurement/sourcing criteria (e.g. supplier codes of conduct, grievance and traceability for critical minerals, modern slavery checks, carbon reporting, biodiversity protection and enhancement, and product end-of-life responsibilities related to foundation removal).	Wind farm owner	Foundation
m009	Fiscal aid, tariffs and permitting process	Import tariff relief on critical raw materials and components where appropriate; and predictable, streamlined (wind farm, manufacturing facility) permitting processes; Align customs and local content rules at EU level to avoid delays or unanticipated added costs.	(inter)national governments; regulators	Strategic bet
m017	Vertical integration	Secure critical capacity by acquiring or partnering with (tier 1-2-3+) supply chain actors considered critical; See Risk reward sharing (M29) and Multi-actor coordination (M86)	Supply chain	Strategic bet
m024	Audits and protocols	Institute rigorous supplier, quality and cybersecurity assurance across supply chain tiers. ISO/IEC based frameworks serial production and cyber security standards for SCADA. Conduct red team drills and incident response exercises. Onsite and remote audits to verify ESG, origin and sanctions compliance.	OEMs	Quick win
m029	Risk and reward sharing	Use alliance contracts with pain/gain sharing, transparent cost indices and shared change/force majeure clauses. Align incentives for schedule, HSE and quality, and share commodity/inflation risks via indexation.	Supply chain	Strategic bet
m032	Optionality	Design and contract for flexibility. Incorporate contractual options to shift volume or timing.	Wind farm owners; OEMs; offshore contractors	Quick win
m039	Made in EU	Develop EU-located and owned manufacturing facilities of strategic components; coordinate diversification of OEMs throughout the EU member states and avoid market fragmentation.; Supply state aid, IPCEIs and demand guarantees.	EU and national governments	Strategic bet
m043	Resilient procurement strategies	Diversify procurement strategies: Shift from one-off, lowest price tenders to multi-project framework agreements, prepayments for reserved slots, supplier development and geographic diversification. Implement performance bonds and step in rights.	Wind farm owners; OEMs	Quick win
m045	Stockpiling	Hold strategic inventory of long lead or sanction sensitive components, intermediates, refined material and/or critical raw materials; Rotate stock to manage obsolescence; pool at fleet or EU level; Set clear allocation rules and distribution methods for periods of shortages.	EU and national governments; OEMs	Strategic bet

Mitigation number	Mitigation strategy cluster	Summary of mitigation strategy (incl. non-exhaustive examples)	Most dominant strategy owner	Estimated effectiveness
m046	Education and knowledge sharing	Expand and maintain workforce within the sector, spread operational knowhow amongst actors when collaborating to enhance knowledge sharing. Fasttrack training (e.g. HSE/permitting). Attract workforce from other sectors. Joint industry projects and openly share lessons learned. Increase mutual understanding of organisational challenges through secondments between wind farm owners, OEMs, TSOs, ports and governments. A predictable offshore wind project development pipeline is desirable for training uptake and retention.	Industry associations	Foundation
m049	R&D	Fund and execute R&D focused on long term technology needs (recyclability by design, non-rare earth magnet and generator design, recycling process technology).	OEMs & research institutes (co funded publicly)	Strategic bet
m058	EU transparent transition planning	Provide long-term visibility of auctions, grid connections, port upgrades and industrial decarbonization and climate policy across, and in coherence amongst, EU member states. Develop coherent North-West EU policy that stimulates renewable power demand and supply, to capitalize on cross-border electricity trade. Increase transparency on multi-country planning of wind farm development timelines to align scarce vessel and environment-based offshore operation windows.	EU and national governments	Foundation
m063	Industrialisation and standardization	Scale serial production using standardized designs and industry-wide interface specifications; modularisation; prioritize mass-manufacturing (cost-reduction through scaling) over novel design decisions (cost reduction through R&D); set industry-wide material and product passport standards.	OEMs & standards bodies	Strategic bet
m071	Renewable power offtake contracts	Establish bankable offtake contracts. Support (two-sided) CfDs with inflation/commodity indexation, long term PPAs from creditworthy buyers and curtailment compensation. Predictable revenue lets developers place earlier orders and enables OEMs to finance capacity expansion.	Wind farm owners; electricity offtakers; Dutch government	Quick win
m072	Asset life cycle optimization	Use reliability centred design, prioritize maintainability and optimize operational lifetime of assets and components to reduce demand and increase predictability of condition-based maintenance demand and timing; actively implement lifetime extension and/or repowering strategies. Standardize spares and interchangeable components to improve availability and reduce OEM dependency.	Wind farm owner	Quick win
m076	Material substitution	Develop component designs that reduce dependence on scarce or price-volatile materials.	OEMs	Strategic bet
m084	Public infrastructure investment	Invest in infrastructure assets with public ownership and long lead times (port quays, cranes, high voltage grid reinforcements, cable corridors); reduce lead times by optimized planning and prediction of in and outflow of infrastructure using assets.	National governments/port authorities/TSOs	Strategic bet
m086	Multi-actor coordination	Create programme level governance aligning wind farm developers, OEMs, TSOs, ports, offshore contractors and regulators; shared schedules, market assumptions, operational constraints and jointly discuss risk registers.	Supply chain	Quick win

Mitigation number	Mitigation strategy cluster	Summary of mitigation strategy (incl. non-exhaustive examples)	Most dominant strategy owner	Estimated effectiveness
m104	Change business model	Develop and adopt business models that incorporate risk management more efficiently (e.g. pay for availability for specialty vessels, capacity reservation or take or pay for key component production capacity reservation by project developer at OEM); Adopt outcome based service agreements with shared KPIs (see risk and reward sharing strategy M29); Focus on business models and collaborations that yield smooth cashflows for all actors involved and incentivize reliability of performance rather than minimal (initial) cost; introduce end-of-life asset value into LCoE.	Wind farm developers (with OEMs/contractors)	Strategic bet
m44	Virgin material avoidance	Reduce dependence on virgin critical raw materials and/or secondary sourced material inputs via (closed-loop) recycling and return schemes, including digital product passports including operational data improve traceability, design for disassembly principles and high-value asset re-use options; establish long-term offtake contracts with secondary source raw material suppliers/recyclers.	OEMs; Wind farm owners	Foundation

Table 6.1 The 21 mitigation strategy clusters, with dominant owner and estimated effectiveness.

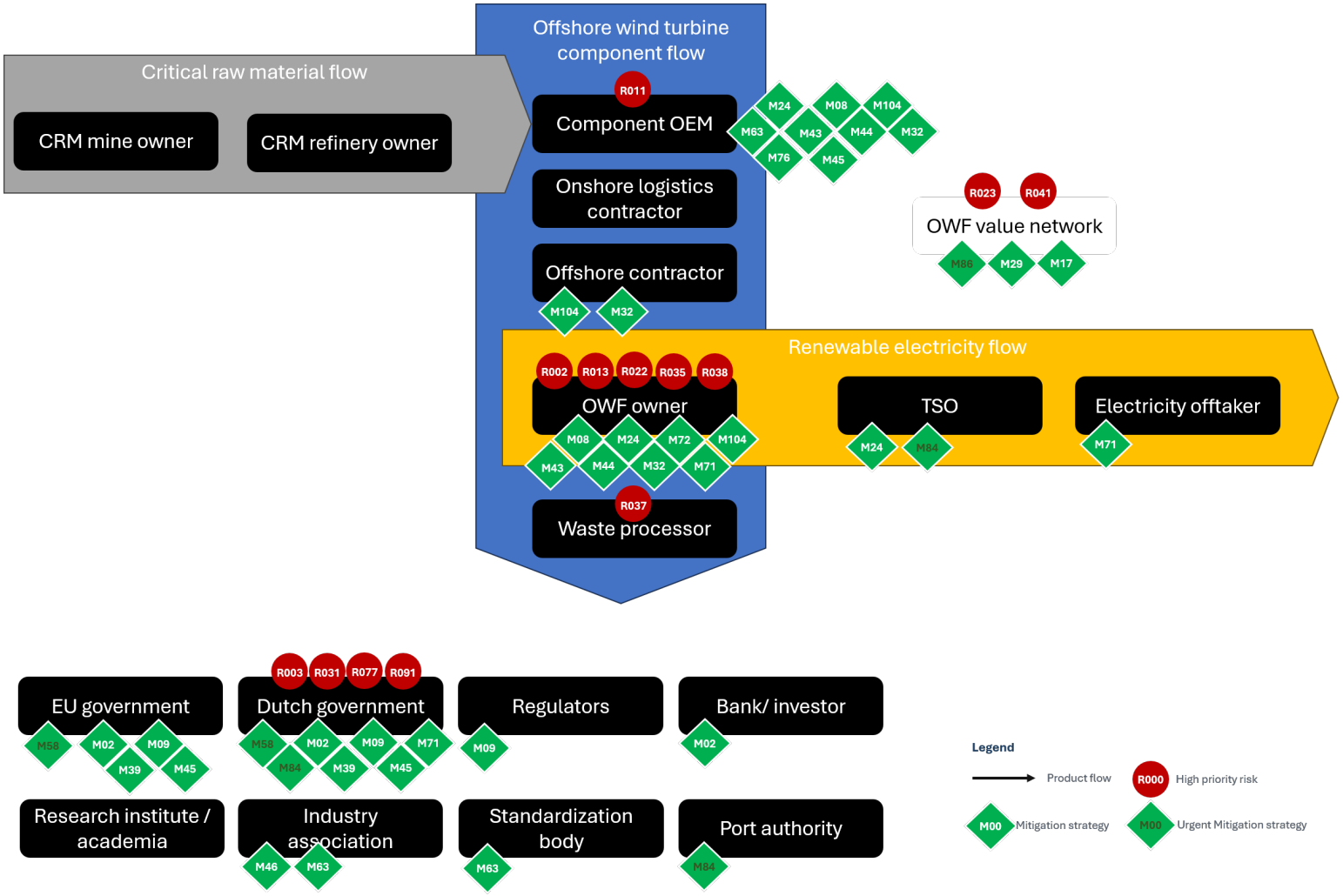
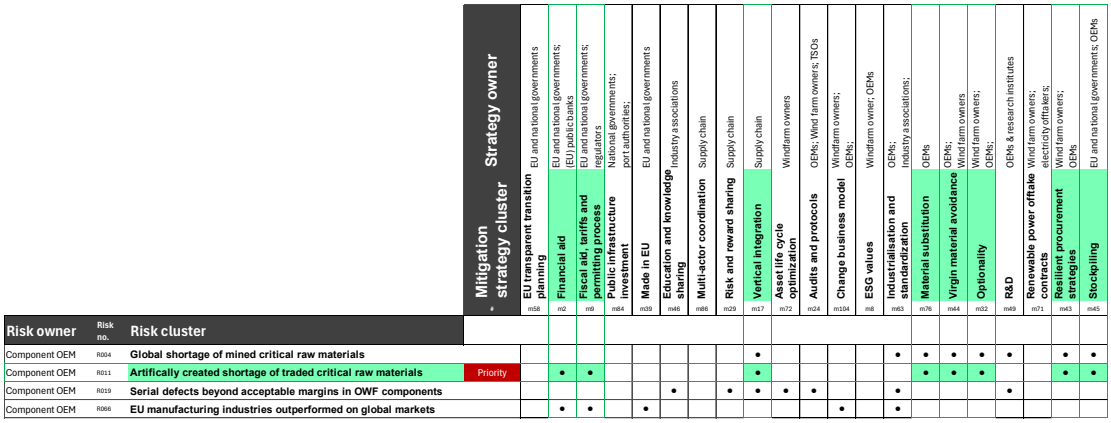


Figure 6.1 Offshore wind supply value network: Owners of prioritized risks and owners of mitigation strategies.

Matching 21 mitigation strategies with 13 (30) risks

The 13 prioritized risk clusters were matched with the 21 mitigation strategies. The result links each risk cluster and risk owner to the strategies that may mitigate it, and to the owners of those strategies. The resulting matrix (Figure 6.3) shows all estimated relations. The read-me example below shows how to read the full risk-mitigation match matrix.



Risk owner	Risk no.	Risk cluster		Mitigation strategy cluster *	Strategy owner	EU transparent transition planning	Financial aid	Fiscal aid, tariffs and permitting process	Public infrastructure investment	Made in EU	Education and knowledge sharing	Multi-actor coordination	Risk and reward sharing	Vertical integration	Asset life cycle optimization	Audits and protocols	Change business model	ESG values	Industrialisation and standardization	Material substitution	Virgin material avoidance	Optionality	R&D	Renewable power offtake contracts	Resilient procurement strategies	Stockpiling
						m58	m2	m9	m84	m39	m46	m86	m29	m17	m72	m24	m104	m8	m63	m76	m44	m32	m49	m71	m43	m45
						EU and national governments	EU and national governments; (EU) public banks	EU and national governments; regulators	National governments; port authorities;	EU and national governments	Industry associations	Supply chain	Supply chain	Supply chain	Windfarm owners	OEMs; Wind farm owners; TSOs	Windfarm owners; OEMs;	Windfarm owner; OEMs	OEMs; Industry associations;	OEMs	OEMs; Wind farm owners	Wind farm owners; OEMs;	OEMs & research institutes	Wind farm owners; electricity offtakers;	Wind farm owners; OEMs	EU and national governments; OEMs
Component OEM	R004	Global shortage of mined critical raw materials												•					•	•	•	•	•		•	•
Component OEM	R011	Artifically created shortage of traded critical raw materials	Priority			•	•							•						•	•	•			•	•
Component OEM	R019	Serial defects beyond acceptable margins in OWF components									•		•	•	•	•			•				•			
Component OEM	R066	EU manufacturing industries outperformed on global markets					•	•		•							•		•							

Figure 6.2 Read-me instructions of risk-strategy match matrix: A match between a risk cluster and corresponding mitigation strategy cluster is indicated with a black dot (example highlighted in green).

Reading along the row of risk cluster R011, for example, shows eight mitigation strategies that may mitigate that risk:

Risk #	Risk cluster	Dominant risk owner
R011	Artificially created shortage of traded critical raw materials	OEM
Miti #	**Mitigation strategy cluster**	**Dominant mitigation strategy owner(s)**
m2	Financial aid	National governments; (EU) public banks
m9	Fiscal aid, tariffs and permitting process	(inter)national governments; regulators
m17	Vertical integration	Supply chain
m76	Material substitution	OEMs
	et cetera	

The match matrix is a starting point for discussing who owns a risk and who owns a mitigation strategy. Additional observations are highlighted with colours:

- **Black dots**: a match between a risk and a strategy. The risk owner can, at least partly, implement the strategy on its own.
- **Purple backgrounds**: a mismatch between risk owner and strategy owner. A different value network actor is needed to mitigate the risk.
- **Orange backgrounds**: risks and mitigation strategies collectively owned by the value network. No clear point of contact and/or ownership.
- **Red labels**: risks evaluated high priority for mitigation.

Risk owner	Risk no.	Risk cluster	Interview mentions:	EU transparent transition planning (m58)	Financial aid (m2)	Fiscal aid, tariffs and permitting process (m9)	Public infrastructure investment (m84)	Made in EU (m39)	Education and knowledge sharing (m46)	Multi-actor coordination (m86)	Risk and reward sharing (m29)	Vertical integration (m17)	Asset life cycle optimization (m72)	Audits and protocols (m24)	Change business model (m104)	ESG values (m8)	Industrialisation and standardization (m63)	Material substitution (m76)	Virgin material avoidance (m44)	Optionality (m32)	R&D (m49)	Renewable power offtake contracts (m71)	Resilient procurement strategies (m43)	Stockpiling (m45)
		Mitigation strategy cluster ▸ Strategy owner		EU and national governments	EU and national governments; (EU) public banks	EU and national governments; regulators	National governments; port authorities;	EU and national governments	Industry associations	Supply chain	Supply chain	Supply chain	Windfarm owners	OEMs; Windfarm owners; TSOs	Windfarm owners; OEMs;	Windfarm owner; OEMs	OEMs; Industry associations;	OEMs	OEMs; Windfarm owners	Windfarm owners; OEMs;	OEMs & research institutes	Windfarm owners; electricity offtakers;	Windfarm owners; OEMs	EU and national governments; OEMs
			11	3	6	7	1	0	7	3	1	1	0	5	1	4	1	2	3	0	5	3	1
Dutch government	R.003	Lagging offshore wind farm capacity deployment in the Netherlands	Priority	•	•	•				•	•	•					•					•		
Dutch government	R.031	Insufficient spatial reservations onshore (logistics) and/or offshore (wind farm plots)	Priority	•			•									•				•				
Dutch government	R.077	Lagging renewable electricity demand NL and EU	Priority	•	•	•	•			•	•	•										•		
Dutch government	R.091	Insufficient electricity grid capacity	Priority				•			•												•		
Supply chain	R.023	Human capital shortage	Priority						•	•							•							
Supply chain	R.041	Insufficient consensus in OEM sector on standardization aspects to industrialize manufacturing processes	Priority	•	•			•	•	•	•	•	•	•	•		•							
OWF owner	R.022	Inavailability of adequately sized infrastructure and logistics assets	Priority				•					•					•						•	
OWF owner	R.035	Predicted value at risk of wind farm develops negatively beyond accepted bandwidth after FID	Priority	•	•					•	•				•					•		•	•	
OWF owner	R.038	Tender procedure and/or underlying agreements change before final investment decision	Priority	•		•				•				•	•									
OWF owner	R.002	Low and/or volatile power price in NL and EU	Priority	•	•	•					•	•			•					•		•	•	
OWF owner	R.013	Artifically created shortage of traded offshore windfarm components	Priority		•	•		•			•	•								•			•	
Component OEM	R.011	Artifically created shortage of traded critical raw materials	Priority		•	•						•						•	•	•			•	•
Waste processor	R.027	Global shortage of secondary sourced (critical) raw materials	Priority		•		•					•					•	•		•	•		•	

The full matching matrix of 30 risk clusters and 21 mitigation strategies is included in the full report.

Figure 6.3 Overview of 13 prioritized risk clusters matched with 21 potentially effective mitigation strategies.

When reviewing the matching matrix from the value network angle instead of the individual stakeholder, three risk clusters are value network owned and (also) three mitigation strategies are value network owned:

Risk owner	Risk cluster	Mitigation strategy cluster	Strategy owner: Multi-actor coordination (Supply chain)	Strategy owner: Risk and reward sharing (Supply chain)	Strategy owner: Vertical integration (Supply chain)
Supply chain	Human capital shortage	Priority	•		
Supply chain	Insufficient consensus in OEM sector on standardization aspects to industrialize manufacturing processes	Priority	•	•	•
Supply chain	Breaking of trust amongst supply chain partners		•	•	•

Figure 6.4 Value network risk and mitigation strategy illustration.

Two of those risks, *insufficient consensus on standardization (R041)* and *breaking of trust amongst supply chain partners (R064)*, align most closely with the network owned strategies *multi actor coordination (M86), risk and reward sharing (M29)* and *vertical integration (M17)*.

The question then arises: How to initiate, organize and implement those strategies in a value network with many stakeholders in a globalized level playing field? This challenging situation lies at the core of what can be called a value network risk, a risk that falls between actors and that no single owner is positioned to resolve.

6.2 Which strategies are most likely to reduce risk?

Section 6.1 matched the 21 mitigation strategies (Table 6.1) to the 30 risk clusters and identified owners for both risks and strategies. To evaluate which strategies are most likely to reduce the prioritized risks, nine experts who had taken part in the risk evaluation workshop were interviewed individually. Each spoke from the same stakeholder perspective as in the workshop.

Exploring mitigation strategy priorities through expert interviews

The nine experts spoke from four stakeholder perspectives: offshore installation contractor (five experts), component OEM (two), CRM mine owner (one) and Dutch government (one). No follow-up interviews were held with participants from offshore wind farm owner, CRM mining and refining, or TSO organizations, even though these organization types took part in the workshop. The findings below are therefore informative for the four perspectives interviewed, not representative of the full value network.

Table 6.2 lists the risk clusters prioritized at least twice in the interviews. Seven of these eight clusters were among the 13 prioritized in Chapter 5. R070 *unclear implementation of EU policies at member state level*, was not assessed in the workshop.

Table 6.2 Prioritized risk clusters by interviewees.

Risk cluster	Times prioritized	Prioritized by
R091 Insufficient electricity grid capacity	3	Offshore Installation Contractor; Dutch government
R035 Predicted value at risk of wind farm develops negatively	3	Offshore Installation Contractor
R038 Tender procedure and/or underlying agreements change	3	Offshore Installation Contractor
R070 Unclear implementation of EU policies at member state level	2	Component OEM
R031 Insufficient spatial reservations onshore and/or offshore	2	Offshore Installation Contractor; Dutch government
R041 Insufficient consensus in OEM sector on standardization	2	Offshore Installation Contractor
R022 Unavailability of adequately sized infrastructure and logistics	2	Offshore Installation Contractor
R023 Human capital shortage	2	Offshore Installation Contractor

The three most frequently prioritized risks (R091, R035 and R038) all relate to concerns about the business case: grid capacity acts as a hard physical brake, the predicted value of the wind farm is under pressure, and tender design influences that value. Several experts, from both the government and the installation contractor perspectives, argued for changing tender and auction award criteria from lowest price towards qualitative and risk-sharing criteria. This is recorded as a refinement of how strategies M9 and M104 are applied through auction design, rather than as a new strategy. Table 6.3 lists the mitigation strategies mentioned at least twice in the interviews.

Table 6.3 Most frequently named mitigation strategies.

Mitigation strategy	Frequency named
M58 EU transparent transition planning	11
M86 Multi actor coordination	7
M84 Public infrastructure investment	7
M9 Fiscal aid, tariffs and permitting process	6
M104 Change business model	5
M71 Renewable power offtake contracts	5
M63 Industrialisation and standardization	4
M29 Risk and reward sharing	3
M43 Resilient procurement strategies	3
M32 Optionality	3
M2 Financial aid	3
M44 Virgin material avoidance	2

These frequencies are indicative. They partly reflect the composition of the interview sample and where interviewees' attention lies rather than only the underlying merit of a strategy. Interviewees often focused on risks they own or can attribute to another actor. Strategies that received little or no attention are not necessarily less urgent or effective. Those strategies need further assessments by different stakeholders. With these points of attention in mind, the interviews point to three directions that require prioritized attention.

First, **EU transparent transition planning (M58)** stands out as the central enabling strategy. This includes, but is not limited to, long-term visibility of auctions, international grid connections, port quay upgrades and coherent climate and industrial policy across EU member states. More than any other intervention, it was viewed as the foundation for confident investment, market growth and the effectiveness of other mitigation measures. Without greater long-term certainty about auctions, grid expansion and future demand, many stakeholders questioned whether other interventions could achieve their intended impact.

Second, **public infrastructure investment (M84)** emerged as the preferred response to the grid bottleneck. Stakeholders broadly agreed that the most pressing physical constraints are largely outside the direct control of individual market participants and require public sector leadership, primarily from governments, TSOs (high-voltage grid reinforcements and cable corridors) and port authorities (port facilities). Measures such as renewable power offtake contracts (M71) can support investment decisions in the near term, but were generally seen as complementary rather than substitutive solutions.

Third, the combination of **multi actor coordination (M86)** and **business model change (M104)** appears to offer the most comprehensive response to the business case, tendering and value at risk challenges that dominate stakeholder concerns. However, the interviews highlight a structural tension: coordination is widely recognized as necessary, yet no actor is clearly accountable for delivering it. This reinforces a broader finding throughout the study that the absence of an effective cross sector coordination mechanism remains a significant obstacle to risk reduction.

The strongest area of alignment among interviewees was the importance of the business case. Stakeholders differed in their individual priorities, but there was broad agreement that many of the highest priority risks ultimately converge on investment attractiveness, revenue certainty and the ability to secure long term returns. Similarly, there was substantial agreement that the most important physical bottlenecks cannot be resolved by the value network acting alone.

The clearest divergence concerned the role of **fiscal and financial support**. Some OEMs and offshore installation contractors were skeptical, arguing that subsidies do little to address structural issues and may weaken market incentives. Other participants, including government representatives, considered public financial support a legitimate and sometimes necessary policy instrument. Views also differed on the urgency of grid, spatial and raw material constraints: some stakeholders saw them as critical barriers, others as manageable under current market conditions.

Taken together, the interviews suggest that the most effective risk reduction efforts are likely to focus **on increasing long term planning certainty, improving coordination across the value network and strengthening the underlying business case.** While views differ on the role of financial support and on the urgency of specific constraints, there was broad agreement that many of the highest priority risks ultimately converge on investment attractiveness, revenue certainty and the ability to secure long term returns. The majority of identified risks can be viewed as underlying risks, implying that many mitigation strategies to those risks are also indirectly beneficial to that business case.

From the analysis we conclude that comparatively few instruments exist to address misaligned incentives and structural uncertainties across the broader value network. Critical suppliers remain exposed to demand uncertainty and uneven risk allocation, which can slow investment decisions and constrain value network expansion.

Risks at value network level – those without a clear individual owner – received little attention from individual interviewees, which is itself informative. Interviewees readily raised the risks that burden them most, particularly where ownership could plausibly be attributed to another actor, most often government. Risks and strategies without such a party to point to received less attention. This is what makes those risks structurally difficult to mitigate, and it reinforces the conclusion that mitigation of these risks requires coordinated action that no individual actor is positioned to mitigate. Governmental bodies currently focus on risk reduction for wind farm developers, but there is limited focus or initiative to align incentives across the full value network.

Reducing risk and uncertainty at value network level is therefore fundamentally more complex than at the level of individual actors. Because the interviews covered only part of the value network, additional perspectives are needed before final conclusions can be drawn.

7 Conclusions and recommendations

Realizing the Dutch offshore wind ambitions depends on value networks that can address risks and uncertainties effectively through collaboration. This assessment shows that risk in the Dutch offshore wind value network is concentrated with a few stakeholders, while the strategies available to mitigate these risks are distributed across many more. Offshore wind farm owners, the Dutch government and OEMs carry the largest and most varied risk exposure in the network.

Three mitigation strategies are brought forward that may be most effective in mitigating unacceptable risks:

(1) Transparent EU level offshore wind project planning; by EU and national governments
(2) maintaining the pace of public infrastructure investments; by national governments, port authorities and TSOs;
(3) multi-actor coordination and changes in business models to address various topics of concern; by value network stakeholders collectively.

There is no shortage of mitigation strategies. Mitigation stalls when no clear strategy owner can be identified, or when that owner is not the actor exposed to the risk. This mismatch between risk owners and mitigation strategy owners is the central obstacle this report identifies.

Who carries which risk?

The study defined 10 key actors in the offshore wind value network: critical raw material (CRM) mine owners and refinery owners, component OEMs, onshore logistics contractors, offshore installation contractors, offshore wind farm owners, waste processors handling components at end of life, TSOs, electricity offtakers and the Dutch government.

More than **100 specific risk events** were identified and grouped into **30 risk clusters**, each with a dominant owner. And **13 of these risks were prioritized** as most urgent to mitigate. Offshore wind farm owners, component OEMs and the Dutch government own the most risk clusters (8, 7 and 6 respectively). This concentration reflects the structure of the network itself: risks that originate upstream – in raw material availability, component manufacturing capacity and logistics – accumulate downstream at the actor who ultimately makes the investment decision, the offshore wind farm owner.

The business case: One topic, many underlying causes.

Upstream risks repeatedly converge on one downstream constraint: the offshore wind farm owner's business case. Grid capacity, wind farm value and tender design each surfaced as prioritized risks that connect to this same underlying pressure. Treating the business case as one large, unmanageable problem obscures this pattern. Untangling it makes each underlying risk possible to mitigate, with its own risk owner and its own mitigation strategy and owner.

Risk tolerance depends on who is asked.

No single risk tolerance threshold applies across the network. A risk judged acceptable by one stakeholder, may not be tolerated by another. Whether a risk is acceptable thus depends on which actor is answering the risk evaluation question. And given the network structure and associated dependencies between stakeholders, unacceptable risks for stakeholder A may therefore be problematic for stakeholder B.

Who can take mitigation actions?

The 21 mitigation strategies are spread across many stakeholders the value network. However, **the actor who owns a risk is often not the actor best placed to mitigate it**. Collaboration between the two (or more) is therefore a precondition rather than a preference. Where no actor owns the risk or the strategy at all, the risk becomes a structural issue in the value network. The majority of risks may be mitigated, but only if **ownership of each strategy is made explicit** and the actors exposed to a risk collaborate with the actors best placed to act on it.

Because responsibilities are distributed across so many actors, a single 'control tower' approach to coordinate all risk management activities across the whole value network is unlikely to succeed at this scale. Effective mitigation instead depends on many initiatives and collaborations happening in parallel.

These directions converge with the Routekaart Circulaire Wind op Zee (circular offshore wind roadmap; RVO, 2026). Although the roadmap starts from a circularity perspective, it reaches similar conclusions on moving beyond project-level price competition, on standardization at European or North Sea scale, and on reforming tender award criteria towards qualitative, non-price criteria. That two independent analyses from different angles point in the same direction strengthens the case for them.

Three overall conclusions follow from this assessment

1. A lower risk profile is a precondition for both offshore wind farm developers and original equipment manufacturers to scale up and further industrialize the offshore value network.
2. Urgent mitigation is needed to realize the planned 21 GW of Dutch offshore wind capacity in 2032, but action is hampered because ownership of the mitigation strategies is unclear or unsupported.
3. Risks throughout the value network cascade down to the wind farm owner and the business case behind its investment decision. The business case is therefore not a single issue but an accumulation of separate, traceable upstream risks. Mitigation is needed throughout the value network – not only around the business case of the wind farm owner – so that each risk is addressed where it originally emerged.

7.1 Why a well-performing value network matters

Critical materials and components are needed for the energy transition and the Netherlands thus depends on value networks that involve foreign actors and countries. High ambitions and short timelines, such as the 21 GW goal in 2032, leave little room for unexpected setbacks.

Value networks behave as complex systems with many (inter)dependencies. Actors make decisions with cascading and reinforcing effects on the network as a whole. Beyond the classic desire for high-performing, low-cost value networks, two developments are changing value networks: EU directives and related frameworks that stress non-financial values in value network performance (such as the CSRD and CSDDD[1] and the TNFD[2]), and the trend towards a more autonomous position for EU industry in its globalized economic and geopolitical context.

These developments make it harder for individual organizations to maintain a healthy business model with long-term prospects, and for government to provide clear guidance. This assessment therefore looks both at risks that threaten the goals of individual actors and at risks that actors collectively perceive as threatening societal goals (value network risks). This risk assessment demonstrated the importance of having explicitly formulated value network objectives as the starting point for subsequent risk identification, analysis, evaluation and mitigation. Only by acknowledging both the individual stakeholder objectives and the collective societal objective(s), one may find effective opportunities to improve the value network performance on the short and the long term.

7.2 From facilitated exercise to action ownership and follow-up

Identifying risks, analysing them and matching mitigation strategies to their owners can easily remain a theoretical exercise. This risk assessment approach has helped to structure that process, but structure alone does not lead to the adoption and implementation of actions.

For each prioritized risk, the study names the stakeholder best placed to act and makes the required collaboration visible when an acting stakeholder differs from the one exposed to the risk. Agreement on, and commitment to, this division of responsibilities for individual and collective mitigation is a precondition for progress.

Timing determines what can be acted on first. Some strategies are business as usual for procurement managers of wind farm components and can be (or are already) put into practice with little delays; others, such as public infrastructure investment, have long lead times and thus take time before they convincingly reduce perceived risks.

A value network changes faster than a single assessment can capture. The full report therefore recommends treating this assessment as the first in a recurring cycle:

- Short cycled and lighter interim updates can capture new input as it emerges;
- Full iteration rounds to update and expand the assessment. Future rounds should broaden the group of participants, select them for their role in the value network and their ownership of high-priority risks and mitigation strategies.

This study did not explore this time dimension. Including timing, delays and cost-benefit trade-offs when deciding on mitigation strategy implementation is essential, and it is a major omission that the next iteration should address.

[1] Corporate Sustainability Reporting Directive (CSRD), Corporate Sustainability Due Diligence Directive (CSDDD).
[2] Taskforce on Nature-related Financial Disclosures (TNFD)

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