



Research and Innovation Priorities

A FRAMEWORK FOR RANKING DSO INNOVATION TOPICS

The R&I priorities in this document were identified and ranked by European DSOs through the E.DSO Innovation and Research Committee (IRCO), across five strategic domains.

The list and rankings reflect a 2026 snapshot and will be updated periodically.

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EXECUTIVE SUMMARY

The E.DSO Research and Innovation Priorities establishes a structured and transparent framework of the priorities of European Distribution System Operators in a rapidly evolving energy landscape. Faced with increasing electrification, decentralisation of energy resources, and growing system complexity, DSOs must balance immediate operational needs with long-term strategic transformation. The identified list of priority domains and subdomains is depicted in [Figure 1](#).

The results of this study clearly highlight that the **grid capacity, flexibility, and cybersecurity** subdomains are the most critical priorities for DSOs. The highest-ranked topic, “maximizing grid capacity through flexibility and enabling technologies,” reflects the urgent need to accommodate the fast growth of Electric Vehicles, Distributed Energy Resources, reflecting the increasing electrification of different sectors, and new types of demand without relying solely on traditional grid reinforcement. Closely following this, **cybersecurity and resilience** emerge as top concerns, underlining the increasing exposure of grid infrastructure to digital, climate and other risks.

A key finding of this analysis is that **topics with the highest operational impact and regulatory urgency consistently outperform those with higher technical feasibility or lower cost**. This indicates that DSOs are prioritising the implementation of innovative solutions that address **immediate system constraints and compliance requirements**, even when these solutions are complex or challenging to implement.

The study also reveals a strong focus on the transition toward **actively managed and digitised networks**. Subdomains related to **active network management, advanced planning tools, Artificial Intelligence, and data governance** rank highly, confirming that digitalisation is not only a supporting function but a **fundamental enabler for future grid operation**.

Domains such as **grid operations optimisation** and **organisational transformation** were perceived as **mature (in the case of operational tools)** or **indirect in their impact (in the case of people and organisational topics)**. This suggests a prioritisation bias toward technical and infrastructure-related challenges. However, cultural and organisational aspects are recognised as essential for long-term innovation success.

Across all domains, the results reflect a clear strategic shift: DSOs are moving from traditional, reactive infrastructure management toward a model based on **flexibility, digital intelligence, and system integration**. This transformation is mainly driven both by the **various operational constraints faced within the grid and the challenge of integrating new loads from an increasing number of electrified sectors**.

Finally, this prioritisation should be understood as a **time-dependent snapshot (2026 horizon)** of DSO needs. As technologies mature and regulatory frameworks evolve, these priorities will continue to shift. Therefore, this exercise will be periodically updated to maintain insight and ensure continued alignment between innovation efforts and the most pressing challenges faced by DSOs.

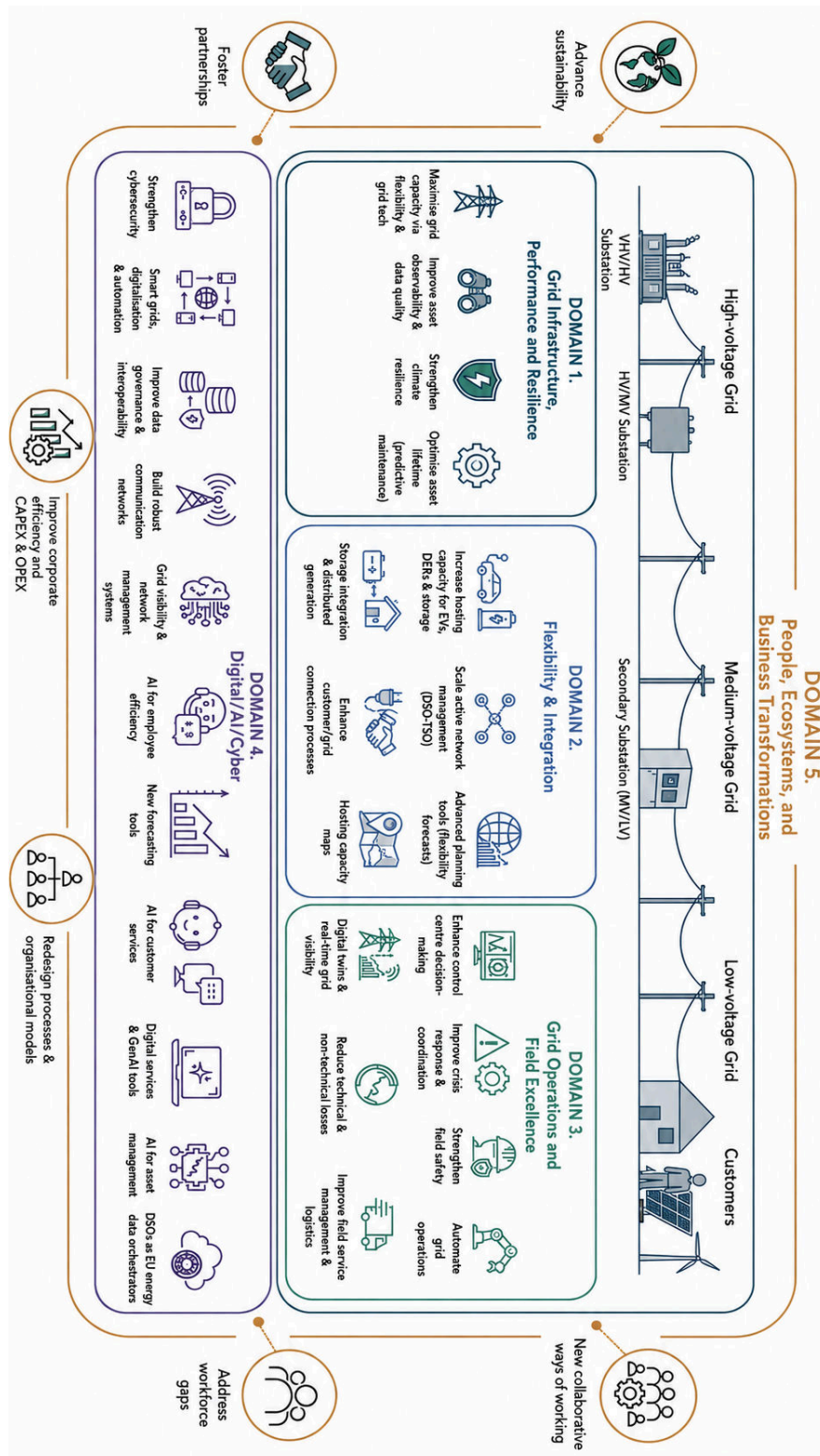


Figure 1: R&I Domains and Subdomains Infographic

1. INTRODUCTION

The E.DSO Research and Innovation Priorities intends to establish a structured and transparent framework for identifying and ranking innovation topics relevant to European electricity Distribution System Operators (DSOs). In an increasingly complex and rapidly evolving energy landscape, DSOs face the challenge of balancing operational efficiency, regulatory compliance, and long-term strategic transformation.

This document centres around real priorities identified and provided by DSOs. Despite the ranking established and the conclusions derived from the analysis, all defined domains and subdomains are relevant to DSOs and to the future of the energy transition. This list and rankings were obtained from a 2026 perspective. Therefore, this exercise will be updated periodically to assess priorities ensuring continued alignment between innovation efforts and the most pressing challenges faced by DSOs.

This document focuses on the needs and priorities of the distribution activity, identifying the needs of the DSOs on which innovation efforts can be focused. As such, the approaches of E.DSO members' and their general visions for such related needs was the starting point of this analysis. It also complements the E.DSO Technology Radar¹ as the technologies mentioned and described in the radar are enablers to the R&I priorities described in this document.

All the considerations stated in this document reflect on an extensive prioritisation exercise carried out amongst the E.DSO members, namely through the Innovation and Research Committee (IRCO). E.DSO encourages all relevant entities involved in the European and national innovation ecosystem to carefully consider the provisions. It is the association's firm view that taking them into account will be essential to ensuring that DSOs can deploy the necessary technologies and test relevant use cases amongst the grid value chain to respond to the challenges faced in the different domains, thereby guaranteeing a more sustainable, efficient and integrated energy system.

2. METHODOLOGY

Prior to initiating the work, a set of core methodological requirements were established to guide the prioritisation process. The methodology was designed to ensure consistency across organisations, minimise bias, provide robust justification for regulatory and budget planning, and maintain alignment with European Union (EU) strategic goals.

1. E.DSO, *Technology Radar*. <https://www.edsoforsmartgrids.eu/technology-radar/>

To support the development and implementation of this approach, a dedicated work group was formed. The group comprised representatives from multiple European DSOs, ensuring broad geographic and organisational diversity, including:

- F. David Martin Utrilla & Grace Moon (i-DE)
- Arnaud Tschirret (Enedis)
- Santiago Otero (Enel Grids)
- Luís Cunha (E-REDES)
- Carmen Calpe (E.ON)
- Nikolas Stefanakis (HEDNO)
- Ricardo Almeida Henriques (E.DSO Secretariat)

An initial list of innovation topics was developed, drawing on existing priority lists within respective DSOs. Given the diversity of DSOs and their operating environments, this initial compilation captured a wide range of perspectives and areas of interest that may not have emerged within a more homogeneous group. The list was subsequently reviewed, refined, and consolidated through iterative discussions to produce a comprehensive set of topics.

This consolidated topic list formed the basis of the first questionnaire, which was distributed to the wider E.DSO membership. DSOs were asked to rank innovation topics relative to one another within defined categories, as well as to rank the categories themselves. In addition, respondents were invited to identify any relevant innovation topics not reflected in the initial list.

To further structure the evaluation, the work group defined five key assessment parameters against which each innovation topic could be measured:

- Impact on Grid Operations
- Regulatory or Market Urgency
- Technical Feasibility
- Cost/Complexity
- Business Strategy

It should be noted that not all of them have the same relevance. For this reason, DSOs were asked to assign relative weights to these parameters, reflecting their perceived importance in the prioritisation process. This weighting exercise enabled the methodology to capture stakeholder preferences while maintaining a structured and comparable evaluation framework.

The results of the first questionnaire were analysed by the work group, with particular attention given to both quantitative rankings and qualitative feedback. Based on these insights, the topic list was further refined, incorporating additional topics where necessary. The parameter weights provided by participants were reviewed and standardised, resulting in an averaged weighting scheme to be applied in subsequent analysis, shown in [Table 1](#).

Table 1. Evaluation Parameter Weights

	IMPACT ON GRID OPERATIONS	REGULATORY OR MARKET URGENCY	TECHNICAL FEASIBILITY	COST / COMPLEXITY	BUSINESS STRATEGY
AVERAGE WEIGHTS	32.38%	22.98%	16.29%	12.99%	15.36%

Building on this foundation, a second and final questionnaire was developed. This survey utilised the finalised list of innovation topics and asked participants to evaluate each topic against the five defined parameters using a standardised scoring scale from 1 (low) to 5 (high). This approach generated a consistent set of quantitative data, enabling objective comparison and the ranking of the innovation topics.

The final prioritisation results were derived through a combination of these quantitative scores and the relative rankings provided by participants. This integrated approach ensured that both structured evaluation criteria and stakeholder judgment were reflected in the outcome, resulting in a balanced, transparent, and evidence-based prioritisation of innovation topics.

3. E.DSO R&I DOMAINS AND SUBDOMAINS

The domains and subdomains list presented in this section serves as the reference framework against which all evaluations have been conducted and resulted from the 1st stage of the identification of the main R&I topics amongst DSOs.

3.1 Domains List Development and Considerations

This final list went through various revisions and was initially based on individual national innovation topic lists collected from different DSOs. These lists were compared and condensed to make a more universal group of initiatives (domains). The final topic list, shown below, includes 5 domains and 34 subdomains.

Each topic captures a **distinct area of relevance for DSO innovation**, expressed at a level that is sufficiently specific to allow assessment, while remaining broad enough to accommodate for different technological approaches and national contexts.

It is important to note that the topics should not be interpreted in isolation. In many cases, **interdependencies exist across domains**, particularly between digitalisation, grid infrastructure, and system operation. In addition, certain topics act as **enablers of others**, rather than standalone priorities. Lastly, there are differences in ranking may reflect **contextual factors** (e.g., regulatory environment, network maturity, or local system needs).

The list should be read as a **functional representation of priorities**, meaning that it reflects *what needs to be addressed*, rather than how it should be solved and allows for multiple implementation pathways depending on each DSO's strategy and capabilities.

3.2 E.DSO R&I Domains and Subdomains

The full list of domains and subdomains is presented below. Each of the five domains is listed together with its associated subdomains and a short description, so that the scope of every topic can be read directly against the framework introduced above.

R&I strategic domains



DOMAIN 1

Grid Infrastructure, Performance & Resilience

This domain covers the network's physical assets – expanding grid capacity; strengthening resilience against climate risks and operational disruptions; extending asset lifecycles through predictive maintenance; and improving observability through sensor data.

KEY SUBDOMAINS

- **Maximise the grid capacity through flexibility and grid technologies enhancing solutions**

This includes all solutions that allow stretching the capacity of the network to optimise its use – while this overlaps with other domains, the focus here is strictly on network capacity.

- **Strengthen resilience and robustness of the grid, namely against climate risks, including vegetation management**

The focus is on the network's response to occasional extreme events that challenge design and performance under non-normal operating conditions.

- **Optimise the asset lifecycle using monitoring, predictive maintenance and digital twins**

While this also pertains to resilience, the focus here is specifically on extending the asset's lifecycle.

- **Improve asset observability, controllability and technical quality data**

This requires sufficient sensors so that facilities are capable of generating the necessary data.



DOMAIN 2

Flexibility, Capacity & System Integration

This domain focuses on enabling electrification and integrating distributed and flexible resources – assets that sit outside the network itself. These investments help the network better understand its environment and help that environment in turn integrate with the network.

KEY SUBDOMAINS

- **Scale active network management (DSO and TSO coordination, flexibility procurement, activation, settlement, incentives, interoperable flexibility platforms and standard interfaces)**

This encompasses platforms and developments that let operators interact with their environment, whether that be other operators, controllable resources, or connected units.

- **Increasing hosting capacity for electric vehicles (EVs), distributed energy resources (DERs), storage, and new loads**

Focuses on the new types of demand that accompany the energy transition, or existing types experiencing a significant boom.

- **Develop solutions for storage integration, distributed generation**

This focuses on the new types of distributed generation that accompany the energy transition, or existing types experiencing a significant boom.

- **Increase transparency via hosting capacity maps and data sharing**

Here the focus is on increases of interaction with external agents around the capacity available on the network.

- **Enhance customer/grid interaction and connection processes**

Standardised data models and interoperability between control systems and field tools as well as increasing interaction with connected customers to improve the network's interoperability and controllability are encompassed by this subdomain.

- **Advanced planning tools linking network planning with operational flexibility forecasts and other probability management solutions**

Such tools and solutions enable network studies across multiple scenarios and base cases, evaluating flexibility solutions alongside traditional network investments, and incorporates probabilistic methods to assess scenarios against real-world uncertainty.



DOMAIN 3

Grid Operations & Field Excellence

This domain focuses on efficient, safe and intelligent day-to-day grid operations – field work, service quality, and the control of technical and non-technical losses. It covers the tools for day-to-day network operation, from control-room systems to tools used by field personnel.

KEY SUBDOMAINS

- **Enhance control centre decision making (ADMS, SCADA, digital twins, forecasting)**

That is, the control room's own systems.

- **Develop digital twins and real-time grid visibility solutions**

Distinct from control-room tools – this subdomain supports broader network management and decision-making, including real-time operational and strategic decisions. Examples include: substation monitoring and security systems, fire detection and management tools, and digital twins used for training and simulation purposes.

- **Automate grid operations (self-healing grids, network configurations)**

These are solutions that operate automatically, whether managed centrally from the control room or deployed locally via edge computing – these autonomous functions must be carefully coordinated with each other and with the network's protection systems.

- **Improve field service management platforms and logistics**

This refers to tools that coordinate, optimise, and support field team activities independent of the control room. Examples include route optimisation tools for fraud inspection crews as well as dispatch and routing solutions for maintenance and breakdown response teams.

- **Reduce technical and non-technical losses (including fraud detection)**

This subdomain covers the solutions, capabilities, and activities dedicated to identifying, preventing, managing, and reducing losses, regardless of which teams carry out the work.

- **Strengthen safety, quality, and supervision of field operations and contractors**

This subdomain includes digital tools for contractor qualification, real-time compliance and safety monitoring, data-driven service-quality analytics, and customer impact analytics – solutions that support, monitor, or verify the human activities performed in the field, from quality assurance to safety and operational/technical/regulatory compliance.

- **Improve crisis response and coordination with TSOs, municipalities, and other actors**

Crisis situations call for dedicated processes and solutions for rapid action – the focus here is on the specific information and processes generated during an emergency itself.



DOMAIN 4

Digitalisation, Data, AI & Cybersecurity

Here, the focus is on the digital transformation of the power system, end to end – data, AI, automation, forecasting, cybersecurity, and digital tools for both customers and employees.

KEY SUBDOMAINS

- **Position DSOs as data orchestrators within European energy data spaces**

This is focused on the role of DSOs at the European level.

- **Develop AI and advanced analytics**

This is subdivided into three areas of focus, spanning utility-specific AI and big data-based solutions to optimise asset management, forecasting and operations (including advanced situational awareness during extreme events and weather driven operational tools), customer services, and employee efficiency.

- **Smart grids, digitalisation, and automation (including smart substation solutions and Edge for Smart Secondary Substations)**

The cybersecurity and data-processing layer is the specific focus here. Asset-level technology sits in Domain 1 and operational tools in Domain 3, while standardised protocols and data exchange belong here.

- **Improve data governance, quality, interoperability and accessibility**

Here the emphasis is on data management according to its nature.

- **New tools and methods for forecasting consumption and production**

Load curves are a critical, sensitive element, so the tools and methods are approached from the perspective of the data itself.

- **Increasing grid observability and upgrading systems for network management (including end-to-end integration architectures for legacy and new digital systems)**

Distinct from sensors (Domain 1) and operational applications (Domain 3), this subdomain addresses the issue from the perspective of data and cybersecurity.

- **Strengthen cybersecurity, cyber-resilience, and secure-by-design systems**

Secure-by-design OT/IT convergence and lifecycle cybersecurity management are treated here as an independent subdomain covering cybersecurity as a whole.

- **Build robust communication networks and digital infrastructure**

Similar in spirit to subdomains in Domain 1, but specific to communications assets.

- **Enhance digital services for customers and internal efficiency (automation, GenAI tools)**

Data management in customer systems is always critical, and while AI development itself sits in an earlier subdomain, this one has a wider scope covering customer and internal-efficiency services.



DOMAIN 5

People, Ecosystem & Business Transformation

The domain reflects the corporate and transversal dimension of DSO transformation – partnerships, sustainability, environmental responsibility, skills development, and organisational readiness – addressing all topics related to people, organisations, and sustainability.

KEY SUBDOMAINS

- **Address workforce gaps through reskilling, upskilling, and a European Grid Academy**

Examples of this subdomain include digital skills, change management and human adoption of AI, automation, and human centric decision support

- **Foster partnerships with academia, startups, and industrial players**

- **Redesign processes and organisational models (automation, process mining, low-code tools)**

This focuses on organisations themselves.

- **Improve corporate efficiency and optimise CAPEX/OPEX**

The impact of people and organisations on CAPEX/OPEX and corporate efficiency is determinant here and the focus.

- **Advance sustainability**

Environmental footprint of assets and operations.

- **Enable new collaborative ways of working and innovation culture**

Examples include structured innovation governance and portfolio management and cross-DSO knowledge sharing.

4. PRIORITISATION AND MAIN OUTCOMES

[Figure 2](#) lists the overall and final ranking drawn from the results of the prioritisation efforts showing the ranking of topics based on calculated scores from DSOs input. Additionally, this figure serves as a reference key for [Table 2](#), with the topics listed in the same order.

4.1 Overall Ranking of Topics

The top-ranked topics are strongly concentrated around grid capacity expansion, also through flexibility, cybersecurity, system resilience, and integration of new loads and distributed resources. These topics are not isolated but form part of a coherent narrative: DSOs are prioritising their ability to accommodate rapid system growth while maintaining reliability and security. This reveals a strong prioritisation pattern driven by immediate operational constraints and system transformation needs, rather than incremental or long-term efficiency improvements.

A second cluster of topics (positions ~5 to ~15) reflects digital enablers such as data governance, smart grids, and AI, and also advanced operational tools, also control centre decision-making solutions, and planning tools. These topics support the top priorities and indicate that digitalisation is seen as a necessary condition to achieve core operational objectives.

Lower-ranked topics tend to fall into organisational and ecosystem-related areas, and also mature operational improvements (e.g. loss reduction, lifecycle optimisation).

E.DSO RESEARCH & INNOVATION PRIORITIES Subdomains - Ranked

Bar length scales with weighted score %

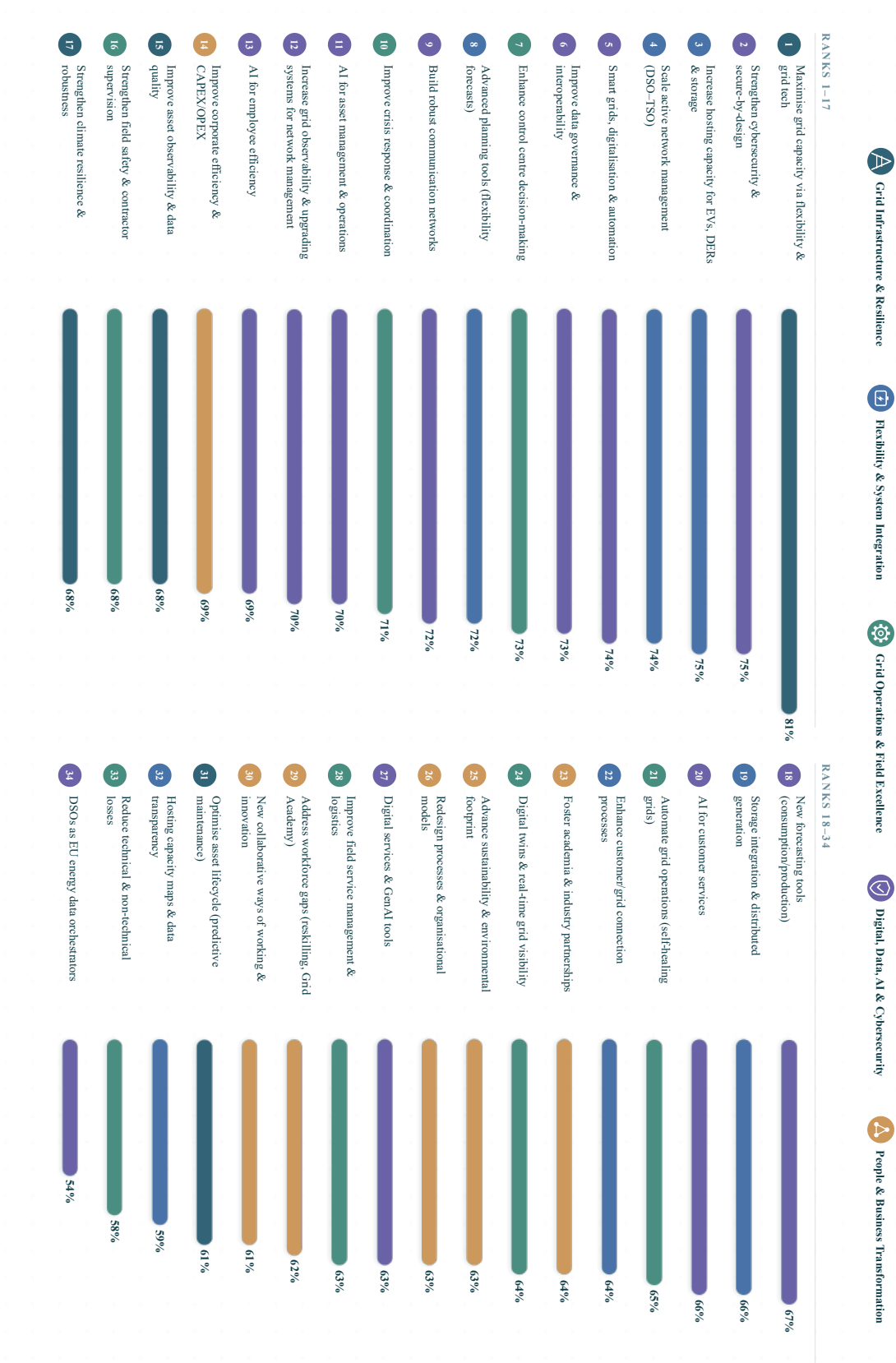


Figure 2: Weighted Ranks of Topics

In [Table 2](#) the individual parameter scores that drive the ultimate ranking can be observed. Each parameter additionally was multiple by its corresponding weight as determined in questionnaire 1 and listed in [Table 1](#). The ranking was generated from this weighted average.

Table 2. Averaged Rating of Final Prioritisation Topics

TOPIC	IMPACT ON GRID OPERATIONS	REGULATORY OR MARKET URGENCY	TECHNICAL FEASIBILITY	COST / COMPLEXITY	BUSINESS STRATEGY	WEIGHTED AVERAGE	WEIGHTED %	STANDARD DEVIATION
1	4.67	4.83	2.5	2.5	4.67	4.07	81%	0.17
2	4.33	4.17	2	2.17	5	3.74	75%	0.79
3	4.5	4	2.17	2.17	4.67	3.73	75%	0.37
4	4.5	4.17	2.17	2.5	4	3.71	74%	0.48
5	4.33	3.83	2.33	2.83	4.33	3.7	74%	0.51
6	3.83	3.67	3.17	3.17	4.17	3.65	73%	0.73
7	4.83	3	2.5	2.5	4.17	3.63	73%	0.44
8	4.33	3.83	2.17	2.67	4	3.6	72%	0.61
9	4.17	3.67	2.33	2.83	4.17	3.58	72%	0.88
10	3.83	3.67	2.67	3.33	4	3.57	71%	0.87
11	4.33	3.33	2.33	2.67	4	3.51	70%	0.46
12	3.67	3.83	2.83	2.67	4	3.49	70%	0.37
13	3.67	3.17	3.33	3	4	3.46	69%	0.50
14	3.5	3.67	3.17	3.17	3.5	3.44	69%	0.65
15	4.17	3.17	2.17	2.67	4	3.39	68%	0.60
16	3.67	3.5	2.67	2.67	4	3.39	68%	0.83
17	3.5	3.5	3.17	2.17	4.17	3.38	68%	0.72
18	3.83	3	2.67	3.17	3.67	3.34	67%	0.64
19	3.33	3.67	2.67	2.83	3.83	3.31	66%	0.37
20	3.33	3.17	3	2.83	4.17	3.3	66%	0.74
21	3.67	3.17	2.5	2.83	3.67	3.25	65%	0.61

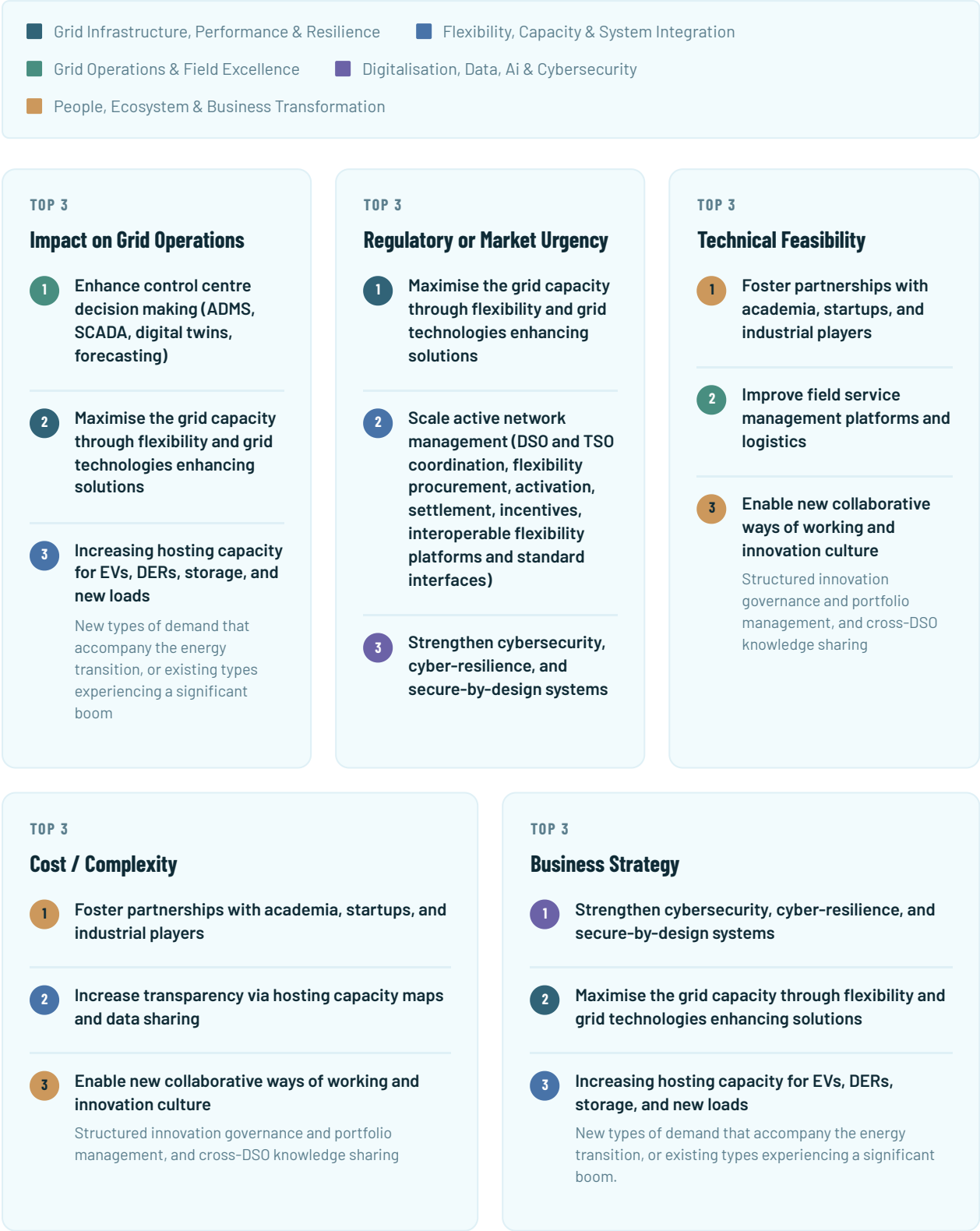
TOPIC	IMPACT ON GRID OPERATIONS	REGULATORY OR MARKET URGENCY	TECHNICAL FEASIBILITY	COST / COMPLEXITY	BUSINESS STRATEGY	WEIGHTED AVERAGE	WEIGHTED %	STANDARD DEVIATION
22	3.33	2.83	3.17	3.33	3.5	3.22	64%	0.69
23	3	2.83	3.5	3.83	3.33	3.2	64%	0.45
24	4	2.83	2.33	2.33	3.67	3.19	64%	0.52
25	3.33	3.33	3	2.67	3.17	3.17	63%	1.07
26	3.17	2.83	2.83	3.5	3.67	3.16	63%	0.62
27	3.17	3	2.83	3	3.83	3.15	63%	0.70
28	3	2.83	3.5	3.17	3.5	3.14	63%	0.77
29	3.5	2.67	2.5	2.5	4.17	3.12	62%	0.80
30	2.83	2.67	3.5	3.5	3.33	3.07	61%	0.76
31	3	2.83	3	3	3.67	3.06	61%	0.56
32	2.5	2.83	3	3.67	3.33	2.94	59%	0.61
33	2.83	2.83	3.17	2.5	3.17	2.9	58%	0.92
34	2.83	2.67	2.5	2.5	3	2.72	54%	0.94

*For Impact on Grid operations (1 – No Impact, 5 – Critical impact), Regulatory or Market Urgency (1 – No Urgency, 5 – Immediate Urgency), Technical Feasibility (1 – Very Difficult, 5 – Easily Feasible), Cost/Complexity (1 – Very high cost, 5 – No Cost), Business Strategy (1 – Low Priority to Achieving Company Results, 5 – High Priority to Achieving Company Results).

Topics ranked in the top positions consistently show very high scores in “Impact on Grid Operations” (typically >4.3) and high “Regulatory or Market Urgency” (often >4.0). At the same time, these topics tend to have low scores in Technical Feasibility and Cost/Complexity (~2.0–2.5). This confirms that **high-priority topics are not those easiest to implement**, but those **most critical to address**. DSOs are **willing to prioritise complexity** when **the operational or regulatory pressure is high**.

Several topics with high feasibility and low complexity (e.g., partnerships, organisational models) do not reach top positions in the overall ranking, even though their average scores are stable but not dominant. This puts feasibility and cost as secondary filters, not primary decision drivers – suggesting a need-driven prioritisation logic rather than an opportunity-driven one. This becomes clearer when viewing the top initiatives by parameter rather than by domain or overall ranking, as shown below.

4.2 Top Ranked Topics by Parameter



The company business strategy works as a reinforcing factor, ensuring that urgent operational needs are also consistent with long-term transformation goals.

Topics ranked lower tend to represent indirect contributors to system performance or long-term enablers with less immediate impact on operational priorities. Notably, items such as data ecosystem positioning, transparency tools or loss reduction are important but not perceived as urgent constraints in the current context.

Lastly, standard deviation results show divergence of opinions across DSOs in emerging topics but also differences in maturity, regulatory context, or network conditions. The lack of high significant standard deviation values shows a strong consensus across participants especially on critical system challenges.

Combining the insights from both tables, **several overarching conclusions can be made:**

- 1. Priority is driven by system constraints. Grid capacity, electrification, and resilience dominate the agenda.
- 2. Urgency outweighs implementation barriers. Complex and costly topics are prioritised when critical.
- 3. Digitalisation is an enabler, not an end goal. High-ranking digital topics support operational transformation.
- 4. Mature topics lose relative priority even if important; they are deprioritised in innovation focus.
- 5. Organisational/Ecosystem-related topics are not perceived as a priority in the short term despite their importance for long-term success.

4.3 Analysis by Domain

While the previous section solely analysed results from the final questionnaire, this section integrates insights from all questionnaires, enabling a more nuanced interpretation of the results. Additionally, by combining the quantitative context from the final questionnaire with the qualitative manual rankings which captured underlying perceptions, this allows for a more comprehensive understanding of priorities within each domain.

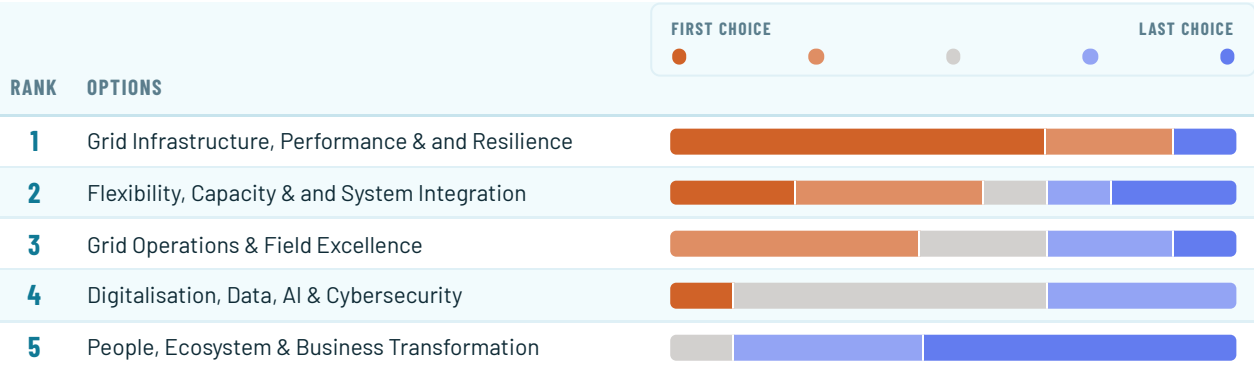


Figure 3: **Domain Prioritisation**

The results of this initial questionnaire ([Figure 3](#)) reveal that DSOs tend to prioritise system-critical and infrastructure-related domains over transversal or enabling areas. This reflects an early filtering effect, where DSOs rank higher those domains that represent core DSO responsibilities and that are directly linked to security of supply and system stability, or also topics that are under visible regulatory and societal pressure.

At the same time, the dispersion observed within some domains indicates that not all topics are perceived with the same urgency or maturity, even when grouped under the same category. The literal scores and rankings from Questionnaire 2 support this tendency as well. In this section, the different domains and subdomains are evaluated according to the survey results to extract specific conclusions about their priorities.

4.3.1 Grid Infrastructure, Performance, and Resilience

This domain ranked first overall, reflecting its central importance as the main body of the business. As electricity distribution companies, the performance, reliability, and longevity of grid assets are critical priorities. Particular emphasis is placed on physical robustness, asset lifecycle management, and climate adaptation. With the expected growth in electricity demand and the growing impact of climate change, ensuring the grid can withstand evolving stresses is essential. The questionnaire results are displayed in [Figure 4](#).

This priority is reflected in the rankings of the individual topics within the domain, which were placed 1st, 15th, 17th, and 31st ([Table 2](#) / [Figure 2](#)), resulting in a strong average position. Notably, the topic “*Maximise grid capacity through flexibility and grid-enhancing technologies*” ranked 1st overall, underscoring its strategic importance. Three out of the four topics fell within the top half of all priorities. Although “*Optimise the asset lifecycle using monitoring, predictive maintenance, and digital twins*” ranked lower at 31st, this result likely reflects varying levels of capability for said technology, leading to a more polarised evaluation rather than a lack of relevance.

These results reflect the growing pressure on existing infrastructure due to rapid electrification (EVs, heat pumps, industry electrification), increasing peak demand, grid congestion, and climate-related stress on assets. This trend is widely recognised in the literature, where electricity networks are increasingly identified as a critical bottleneck for the energy transition. According to the International Energy Agency (IEA), grids are “[...] not keeping pace with the rapid growth of key clean energy technologies such as electric cars and heat pumps”, with clear signs that they are becoming a limiting factor for electrification and decarbonisation efforts². In many regions, insufficient grid capacity and long connection queues are already delaying the integration of new demand and distributed resources, reinforcing congestion and slowing down system transformation³. Similarly, European analyses highlight that electricity networks face insufficient capacity to meet rapidly growing connection requests on both

2. International Energy Agency (IEA), *Electricity Grids and Secure Energy Transitions* (2023). www.iea.org/reports/electricity-grids-and-secure-energy-transitions

IEA, *Lack of ambition risks making grids the weak link in clean energy transitions* (2023). www.iea.org/news/lack-of-ambition-and-attention-risks-making-electricity-grids-the-weak-link-in-clean-energy-transitions

3. IEA, *Electricity 2026 – Grids Analysis* (2026). www.iea.org/reports/electricity-2026/grids

supply and demand sides, driven by electrification and new consumption patterns⁴. As a result, without accelerated grid reinforcement, digitalisation, and flexibility solutions, power networks risk becoming the binding constraint that limits the pace and scale of electrification across sectors.

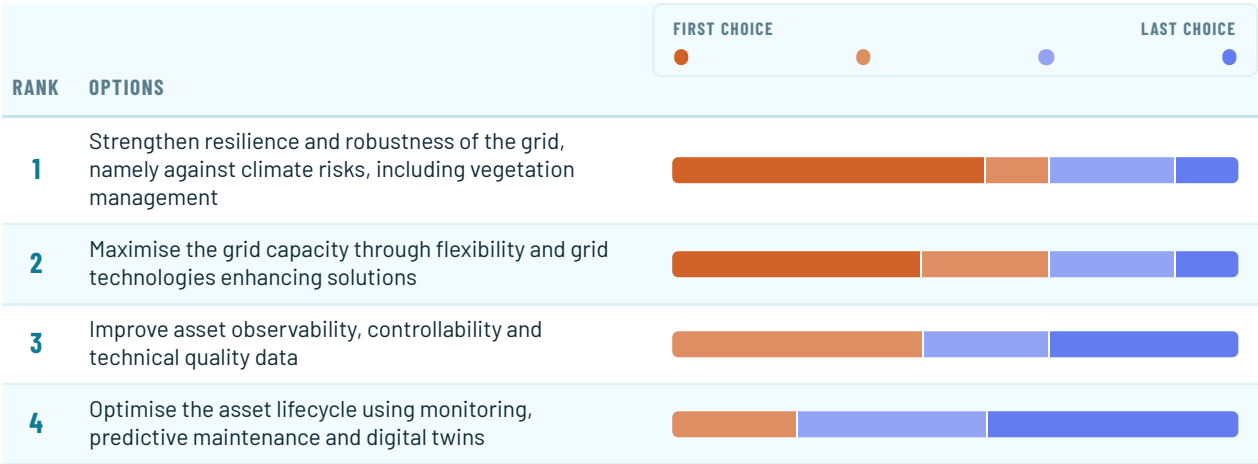


Figure 4: Questionnaire 1 Results – *Grid Infrastructure, Performance, and Resilience*

The reflection of these sentiments found in literature suggests that, even in a context of digital transformation, **physical grid constraints remain the dominant limiting factor**, reinforcing the need for both reinforcement and innovative alternatives such as flexibility (with these often going hand in hand).

4.3.2 Flexibility, Capacity, and System Integration

Ranked second among the domains, this group focuses on enabling electrification and integrating distributed, flexible energy resources. It is important as it prioritises initiatives that will allow for more future loads to be able to come onto the grid. It is an investment in the active growth of the electric grid. The previous domain mentioned flexibility; however, this section’s perspective is not about network capacity, but rather the capability of resources to integrate into a dynamic network with the possibility of active management considering congestion and other constraints. This section addresses dynamic network management. The questionnaire results are displayed in [Figure 5](#).

The subdomains achieved an average ranking of 14.6, which demonstrates strong overall performance. In particular, “Increasing hosting capacity for EVs, DERs, storage, and new loads” and “Scaling active network management” were among the highest-ranked topics. It should be noted that these two topics, compared to the others in this category, pertain more to the implementation of flexible solutions to the grid specifically.

These results reflect the increasing relevance of flexibility and system integration as key enablers to address the structural challenges posed by electrification and decentralisation. As highlighted by European regulators, the rapid uptake of distributed energy resources (DERs), electric vehicles and electrified heating is transforming consumption patterns and placing additional stress on network capacity and operation. In this context, flexibility is becoming essential to adapt consumption and

4. European Commission, *European Grids and Infrastructure Challenges* (2025). energy.ec.europa.eu/topics/infrastructure/european-grids_en

generation to grid constraints and avoid costly reinforcement, while enabling the efficient integration of renewable energy sources⁵. ACER and CEER emphasise that electricity systems must increasingly rely on demand response, storage and distributed resources to balance variability and maintain system efficiency, particularly as renewable penetration grows and demand patterns become more dynamic⁶. Moreover, regulatory analyses underline that the need for power system flexibility in Europe is expected to increase significantly in the coming years, driven by the growth of intermittent generation and electrified demand⁷. At the distribution level, flexibility mechanisms – such as market-based procurement, flexible connection agreements, or network tariffs – are already being deployed to alleviate congestion, optimise grid usage and accelerate the integration of new loads and generation⁸. Consequently, flexibility is not only a complementary solution but a central component of future system operation, enabling DSOs to manage increasing complexity and unlock additional hosting capacity without relying exclusively on traditional grid expansion.

Only five subdomains were analysed in this domain. A sixth subdomain was added only after feedback on the questionnaire had been collected, so it was not included in the ranking or in the average score of 14.6.

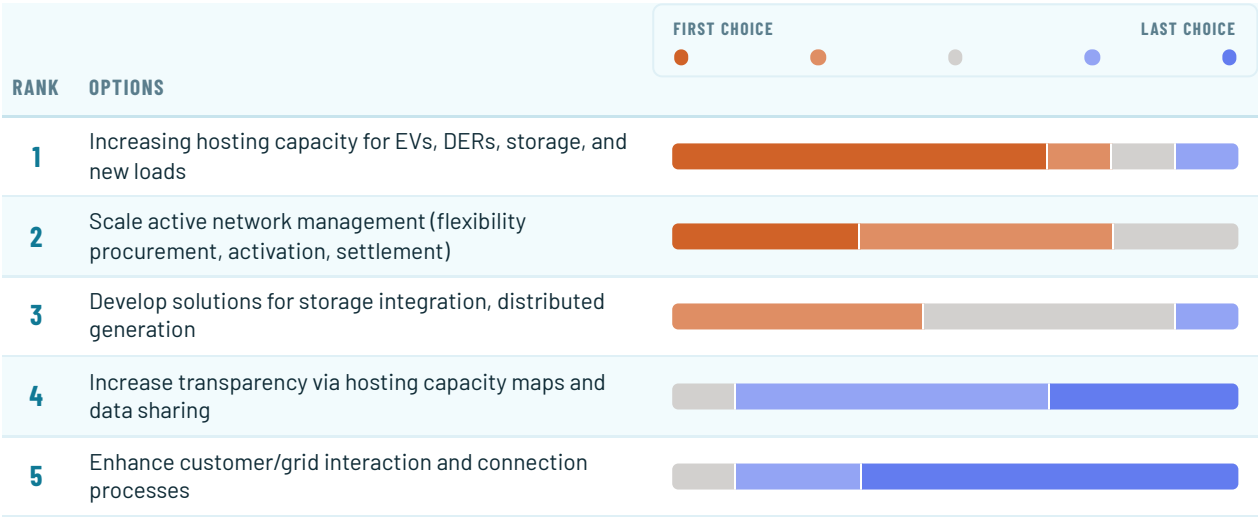


Figure 5: Questionnaire 1 Results – Flexibility, Capacity, and System Integration

4.3.3 Grid Operations and Field Excellence

This domain focuses on efficient, safe and intelligent day-to-day grid operations. It encompasses both field activities and the supporting technical systems, ranging from SCADA and automation tools to operational platforms and contractor management. It also addresses workforce safety, supervision, and

5. ACER, *Flexibility – What is power system flexibility and why it matters* (2026). <https://www.acer.europa.eu/flexibility>

6. ACER & CEER, *Guidance on Electricity Distribution Network Planning* (2025). <https://www.ceer.eu/wp-content/uploads/2025/07/ACER-CEER-Guidance-on-electricity-distribution-network-planning-final.pdf>

7. ACER / EEA, *Flexibility Solutions for a Decarbonised EU Energy System* (2023 overview). https://www.acer.europa.eu/sites/default/files/documents/Publications/EEA-ACER_Flexibility_solutions_support_decarbonised_secure_EU_electricity_system.pdf

8. CEER / Eurelectric, *Distributed Flexibility and DSO Practices* (2025). <https://www.eurelectric.org/publications/eurelectric-distributed-flexibility-report/>

crisis response coordination with external groups and stakeholders. The questionnaire results are displayed in [Figure 6](#).

The topics in this domain had an average ranking of 17.6, placing them consistently in the mid-range. This suggests that while these capabilities are essential for maintaining reliable operations, which are viewed as stable, ongoing priorities rather than areas requiring immediate transformation. Their positioning reflects their role as foundational functions that must be continuously maintained and improved, even if they are not seen as the most urgent, immediate strategic focus. The increasing importance of grid operations and field excellence are perceived as critical pillars for ensuring system reliability, resilience, and efficiency in an increasingly complex electricity system. As electrification accelerates and generation becomes more decentralised and variable, system operators must manage higher levels of operational complexity, requiring enhanced coordination, real-time monitoring and advanced operational practices. European regulators emphasise that DSOs are evolving into active system operators, responsible not only for maintaining infrastructure but also for optimizing power flows, integrating flexibility solutions, and ensuring high-quality service delivery to grid users⁹. At the same time, system operation at the transmission level remains essential for maintaining secure and coordinated pan-European electricity operation, with TSOs ensuring system stability across increasingly interconnected markets¹⁰.

Maintaining high levels of operational performance requires continuous improvement in quality of supply, reliability, and asset management practices. CEER benchmarking analyses underline that monitoring indicators such as continuity of supply, outage duration and voltage quality is a fundamental tool to ensure well-functioning electricity systems and improve operational performance¹¹. In parallel, regulators highlight the need for the deployment of performance indicators and smart-grid metrics to assess and enhance the efficiency of network operation and maintenance activities, ensuring that infrastructure delivers maximum value to users¹².

Moreover, recent operational incidents and system analyses have demonstrated the growing importance of robust operational practices, real-time visibility, and coordination across system operators. Lessons from system disturbances show that inadequate monitoring, delayed response times or insufficient reactive power management can significantly impact system stability, reinforcing the need for advanced operational capabilities and improved data availability across the system¹³. In this context, international analyses stress that the increasing complexity of modern grids – driven by electrification, renewables and new consumption patterns – requires not only infrastructure expansion but also enhanced

9. ACER, *Distribution System Operators and evolving roles in grid operation* (2026). <https://www.acer.europa.eu/news/visible-rise-electricity-distribution-grid-investment-acer-recommends-actions-optimize-ramp>

10. ENTSO-E, *Annual Report and System Operation Responsibilities*. <https://www.entsoe.eu/publications/general-publications/annual-report/>

11. CEER & ECRB, *Benchmarking Report on the Quality of Electricity Supply*. <https://www.ceer.eu/publication/7th-ceer-ecrb-benchmarking-report-on-the-quality-of-electricity-and-gas-supply/>

12. ACER & CEER, *Smart Grid Performance Indicators Guidance* (2024). https://www.acer.europa.eu/sites/default/files/documents/Position%20Papers/ACER-CEER-Network_Grids_Performance_Indicators.pdf

13. ENTSO-E, *System disturbance analysis and blackout reports* (2025-2026). <https://www.pv-magazine.com/2026/03/23/entso-e-report-finds-systemic-failures-behind-2025-iberian-blackout/>

operational frameworks, workforce capabilities, and field-level excellence to ensure safe and reliable operation¹⁴. Therefore, strengthening grid operations and field execution capabilities is essential to maintain system resilience, optimise asset utilisation, and support the energy transition.

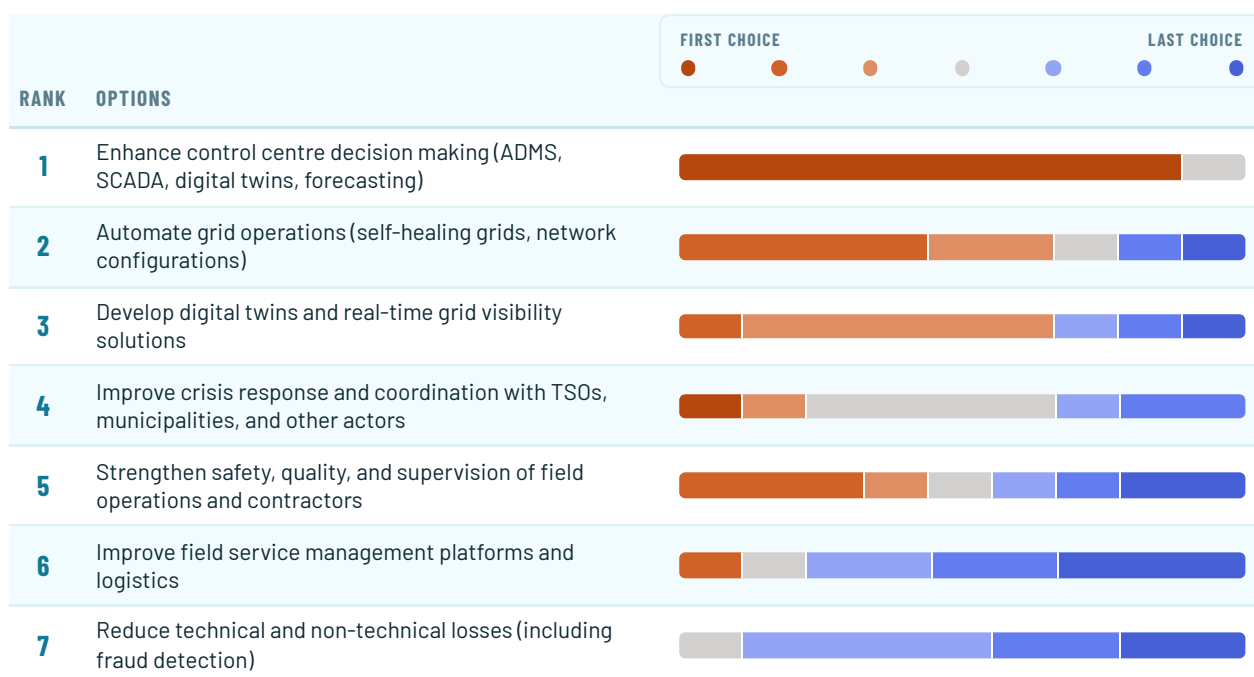


Figure 6: Questionnaire 1 Results – **Grid Operation and Field Activities**

This domain showed a more balanced distribution of rankings, without extreme positions. From questionnaire 2, it can be seen that a multitude of topics were considered as first or second choice by multiple users, demonstrating different priorities across the different organisations. Operational tools such as SCADA, automation, and field management were generally ranked in the middle, and safety and supervision also showed moderate prioritisation. This pattern suggests that respondents view these areas as essential but perhaps as already-established capabilities, where improvements are expected to be incremental rather than transformative. Differences in ranking may also reflect varying levels of digital maturity across organisations.

4.3.4 Digitalisation, Data, AI, and Cybersecurity

As computing power increases and data-driven technologies continue to evolve, this domain has gained significant importance. It focuses on the end-to-end digital transformation of the power system, including data management, artificial intelligence, automation, forecasting, cybersecurity, and digital tools for both employees and customers. The questionnaire results are displayed in [Figure 7](#).

This domain contains the largest number of topics, with an average ranking of 14.3. Overall, it performed strongly, with many topics placed near the top of the rankings. Given the sensitivity and scale of operational and customer data pertaining to electricity distribution, cybersecurity emerges as a critical priority. Additionally, leveraging large volumes of data through advanced analytics and AI offers

14. IEA, *Electricity Grids and Secure Energy Transitions* (2023). www.iea.org/reports/electricity-grids-and-secure-energy-transitions

significant opportunities to improve efficiency, decision-making, and service quality. The consistent high rankings across this domain highlight the multiple organisations' recognition of digitalisation as a key enabler of future grid performance. In this regard, results show the central role of digitalisation, data management, artificial intelligence, and cybersecurity as foundational enablers of the future electricity system. As the European Commission stresses, digitalisation is now a system-wide requirement to support decarbonisation, electrification and system integration, enabling smarter operation, improved efficiency, and better coordination across the energy value chain¹⁵. The increasing deployment of AI and advanced data analytics is transforming grid operation by enhancing forecasting, predictive maintenance, and real-time system optimisation, allowing DSOs to manage growing complexity, integrate renewable energy sources, and improve reliability¹⁶. In parallel, the emergence of large-scale data infrastructures – such as smart meters, IoT devices and data centres – is creating both opportunities and challenges, requiring robust frameworks for data governance, interoperability and secure cross-border data exchange¹⁷.

At the operational level, European system operators highlight that digital solutions such as digital twins, advanced monitoring systems and automation tools are becoming critical to support planning, asset management, and decision-making in increasingly dynamic networks¹⁸. However, these developments also introduce new vulnerabilities. As energy systems become more interconnected and reliant on digital processes, cybersecurity has emerged as a core component of system resilience, with EU regulation (e.g., NIS2 Directive and the Cybersecurity Network Code) establishing stricter requirements for risk management, incident reporting, and protection of critical infrastructure¹⁹. In this context, the transition towards a digital and data-driven power system requires not only technological deployment but also robust regulatory frameworks, coordinated standards, and strong cybersecurity governance, ensuring that digitalisation enhances system efficiency and flexibility without compromising security and reliability.

15. European Commission, *Digitalisation of the Energy System*. https://energy.ec.europa.eu/topics/eus-energy-system/digitalisation-energy-system_en

16. European Commission, *Digitalising the Energy System* (2022). <https://www.europeansources.info/record/digitalising-the-energy-system-eu-action-plan/>

Joint Research Centre (JRC), *AI and the Energy Sector*. <https://ses.jrc.ec.europa.eu/ai-and-energy-sector>

17. European Commission, *Strategic Roadmap for Digitalisation and AI in Energy* (2026). https://energy.ec.europa.eu/news/commission-presents-measures-digitalise-europes-energy-system-while-ensuring-sustainable-2026-06-03_en

18. ENTSO-E & EU DSO Entity, *TSO-DSO Challenges & Opportunities for the Digital EU Electricity System* (2025). <https://www.entsoe.eu/news/2025/03/06/report-tso-dso-challenges-opportunities-for-digital-electricity-system/>

19. European Commission, *Critical Infrastructure and Cybersecurity in Energy*. https://energy.ec.europa.eu/topics/energy-security/critical-infrastructure-and-cybersecurity_en

ENTSO-E / EU DSO Entity, *Network Code on Cybersecurity for the Electricity Sector* (2024). <https://www.entsoe.eu/news/2024/05/24/first-network-code-on-cybersecurity-for-the-electricity-sector-published-today/>

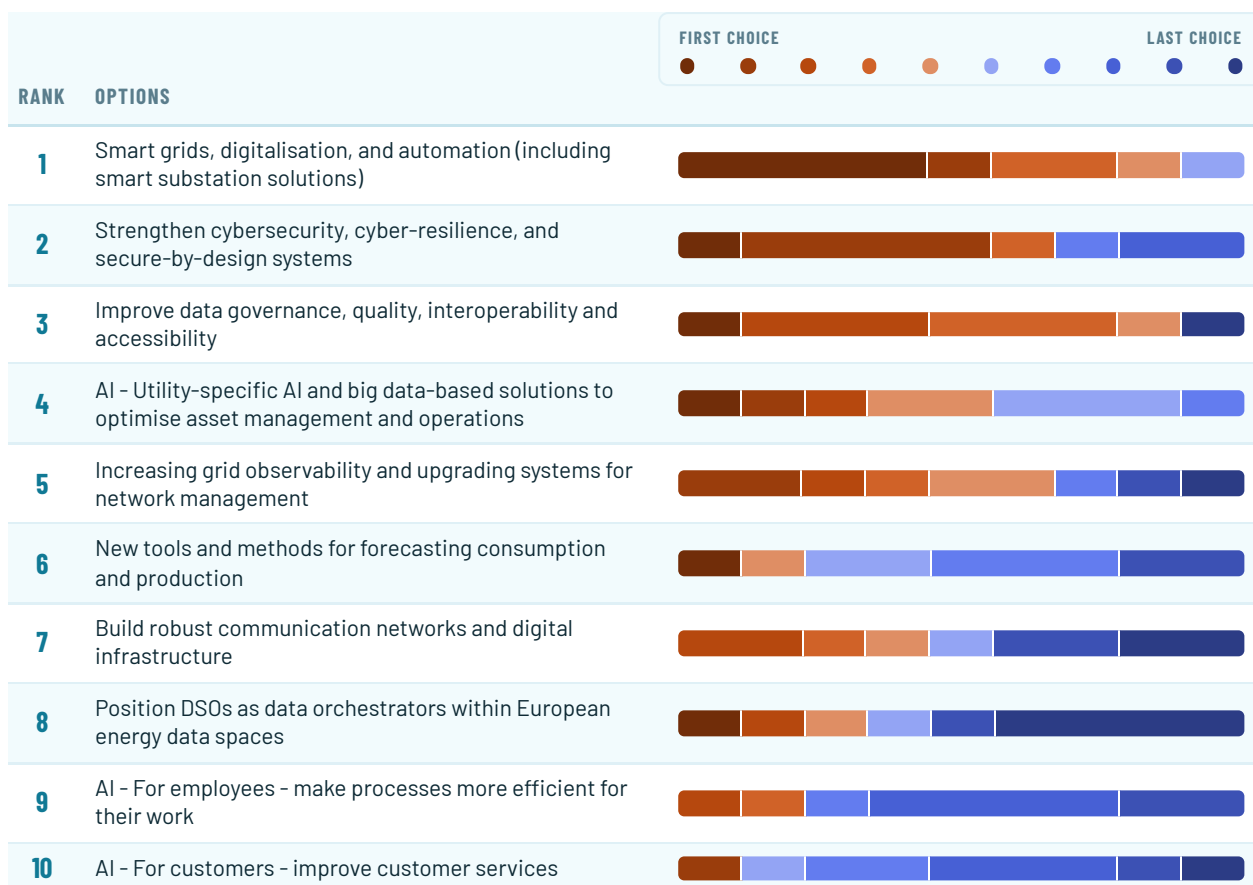


Figure 7: Questionnaire 1 Results – *Digitalisation, AI and System Automation*

Results in this domain show that cybersecurity and core digital enablers tend to receive strong prioritisation and more conceptual or emerging topics (e.g., broader data ecosystem roles) show less consensus. This variability reflects the dual nature of digitalisation. On one hand, it is recognised as critical for future operations. On the other, its implementation is still evolving and uneven across all European DSOs, leading to different perceptions of urgency and applicability.

4.3.5 People, Ecosystem, and Business Transformation

This domain reflects corporate and people-centred initiatives, including workforce development, partnerships with academia, and broader sustainability and societal responsibilities. It ensures that the organisation remains competitive, innovative, and aligned with external expectations. The questionnaire results are displayed in [Figure 8](#).

The topics within this group had an average ranking of 24.5, making it the lowest-ranked domain overall. However, this does not diminish its importance. Many of these initiatives are inherently embedded within other strategic priorities. For example, technological innovation is often driven through collaboration with universities and external partners and their research. The deployment of new systems

requires significant workforce upskilling and cultural adaptation as well. These elements play a critical enabling role, supporting the successful execution of higher-ranked technical and operational initiatives, even if they are not viewed as standalone priorities.

These results underline that the energy transition is not only a technological and infrastructure challenge, but also a deep organisational, workforce and ecosystem transformation. European institutions emphasise that the transition towards a decarbonised and digitalised energy system requires a significant evolution of skills, capabilities and organisational models, as well as a coordinated effort across the entire energy value chain. In particular, the European Commission highlights that the lack of a sufficiently skilled workforce is already emerging as a critical bottleneck, potentially slowing down the deployment of clean energy technologies and grid infrastructure²⁰. This challenge is further reinforced by evidence from industry and system operators, who identify workforce shortages as a major constraint for electrification and grid expansion, requiring urgent action on education, re-skilling and talent attraction across Europe²¹.

At the same time, the transformation of the energy system is reshaping the broader energy ecosystem, requiring stronger collaboration between regulators, system operators, technology providers, consumers and new market participants. ACER and CEER underline the importance of well-functioning, integrated and consumer-centric energy markets, where multiple stakeholders interact to deliver flexibility, innovation and efficient system operation²². Similarly, European energy policy increasingly promotes cross-sector integration and coordinated planning, recognizing that achieving climate neutrality depends on aligned actions across electricity, transport, industry and digital sectors²³. This shift requires organisations to move beyond traditional siloed approaches towards more collaborative, platform-based ecosystems.

From a business perspective, the transition is driving profound changes in operating models, value chains and market structures. The rapid expansion of clean energy technologies and electrification is generating significant job growth and transforming professional profiles, with the electricity sector becoming a major source of employment and demand for new skills globally²⁴. However, this growth is accompanied by structural challenges, including skill mismatches, ageing workforce in critical roles, and increasing competition for talent. In this context, organisations must adapt through continuous upskilling, cultural transformation, and the adoption of agile and innovation-driven business models, ensuring they can effectively respond to the evolving demands of the energy transition.

20. European Commission, *Skills for the Clean Energy Transition*. https://pact-for-skills.ec.europa.eu/community-resources/publications-and-documents/skills-clean-energy-transition_en

21. ENTSO-E et al., *Skilled Workforce Gap in the Energy Transition* (2025). <https://www.entsoe.eu/news/2025/05/16/electrifying-europe-industry-and-grid-operators-discuss-the-skilled-workforce-gap/>

22. ACER & CEER, *Market Monitoring and Consumer-Centric Energy Systems*. <https://acer.europa.eu/node/134>

23. European Commission, *State of the Energy Union Report* (2025). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52025DC0667>

24. IEA, *World Energy Employment 2025*. <https://www.iea.org/reports/world-energy-employment-2025>

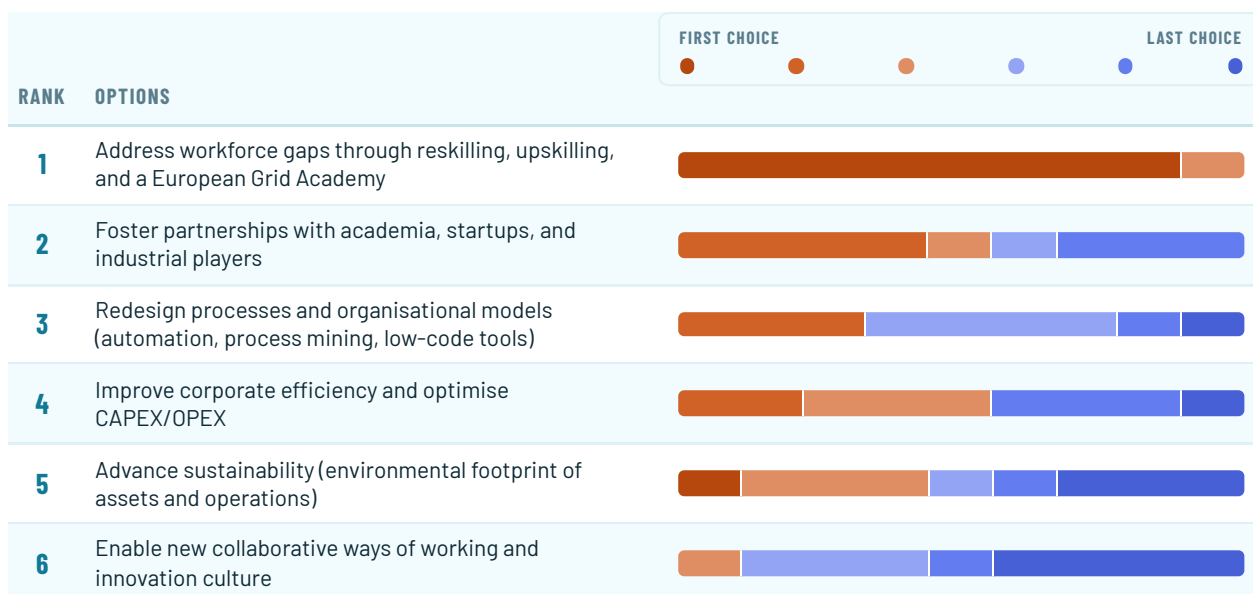


Figure 8: Questionnaire 1 Results – *People, Ecosystem, and Business Transformation*

Topics related to skills, partnerships, and organisational change were generally perceived as lower priority. Even though these topics scored well in feasibility and being a key enabler of long-term success, they were not ranked highly. However, as mentioned above, in an indirect sense they are still a priority.

5. MAIN OUTCOMES

The prioritisation results clearly show a strong alignment across DSOs toward immediate operational challenges driven by electrification, grid congestion, and system complexity. Topics that directly impact grid capacity, flexibility, and cybersecurity dominate the ranking, indicating that organisations are primarily focused on ensuring system reliability under rapidly evolving demand conditions.

A key observation is that topics with high “Impact on Grid Operations” and “Regulatory Urgency” consistently rank higher, even when their technical feasibility or cost/complexity scores are relatively low. This suggests that DSOs are willing to prioritise strategically critical and urgent challenges over easily implementable solutions.

Conversely, topics with high feasibility and low cost tend to rank lower if they do not directly address immediate system constraints or regulatory pressures.

5.1 Conclusions Synthesis: DSOs Leading the System Transformation

The electricity sector is entering a phase of system-level transformation, where infrastructure, flexibility, digitalisation, operations and organisational capabilities must evolve in a coordinated and integrated manner. Electrification and decentralisation are fundamentally reshaping the system, moving from predictable, centralised models to complex, dynamic and bidirectional networks.

Grid development alone is no longer sufficient. European regulators and institutions emphasise that flexibility, digital tools and active system management are essential to optimise existing capacity and integrate renewables efficiently²⁵. In parallel, digitalisation – supported by data and AI – is becoming the core enabler of real-time system optimisation, improving visibility, forecasting and operational decision-making²⁶. However, this increased digital dependency also elevates cybersecurity as a critical condition for system resilience²⁷.

Operational excellence remains a key pillar. As system complexity rises, ensuring reliability increasingly depends on advanced operational practices, coordination and performance monitoring, rather than infrastructure alone²⁸. At the same time, DSOs are evolving into active system orchestrators, expanding

25. ACER, *Flexibility in the electricity system*. <https://www.acer.europa.eu/flexibility>

European Commission, *Digitalisation of the Energy System*. https://energy.ec.europa.eu/topics/eus-energy-system/digitalisation-energy-system_en

26. JRC, *AI and the Energy Sector*. <https://ses.jrc.ec.europa.eu/ai-and-energy-sector>

European Commission, *Strategic Roadmap for Digitalisation and AI in Energy* (2026). https://energy.ec.europa.eu/news/commission-presents-measures-digitalise-europes-energy-system-while-ensuring-sustainable-2026-06-03_en

27. European Commission, *Critical Infrastructure and Cybersecurity in Energy*. https://energy.ec.europa.eu/topics/energy-security/critical-infrastructure-and-cybersecurity_en

28. CEER & ECRB, *Benchmarking Report on Quality of Supply*. <https://www.ceer.eu/publication/7th-ceer-ecrb-benchmarking-report-on-the-quality-of-electricity-and-gas-supply/>

their role beyond asset management towards optimisation of flows, flexibility and data-driven services²⁹.

Critically, this transition is also organisational. The energy transition is driving profound changes in skills, workforce³⁰ and ecosystem collaboration, with talent shortages already identified as a major bottleneck for deployment³¹. At the ecosystem level, increasing system complexity requires stronger coordination between regulators, operators, technology providers and consumers, supported by integrated market frameworks³².

In this context, the key strategic implication is clear: success will not depend on isolated initiatives, but on the ability to execute a holistic transformation, aligning infrastructure investment, flexibility deployment, digital capabilities, operational excellence and organisational change.

Ultimately, the challenge is to build a resilient, adaptive and secure electricity system, capable of supporting large-scale electrification while maintaining reliability, affordability and efficiency.

29. ACER, *DSO evolving roles and grid operation*. <https://www.acer.europa.eu/news/visible-rise-electricity-distribution-grid-investment-acer-recommends-actions-optimize-ramp>

30. ENTSO-E et al., *Skilled Workforce Gap in the Energy Transition* (2025). <https://www.entsoe.eu/news/2025/05/16/electrifying-europe-industry-and-grid-operators-discuss-the-skilled-workforce-gap/>

31. European Commission, *Skills for the Clean Energy Transition*. https://pact-for-skills.ec.europa.eu/community-resources/publications-and-documents/skills-clean-energy-transition_en

32. ENTSO-E, *Annual Report and System Operation Responsibilities*. <https://www.entsoe.eu/publications/general-publications/annual-report/>



Thank You

TO OUR PARTNERS IN RESEARCH & INNOVATION

The priorities in this document were identified and ranked by European DSOs through the E.DSO Innovation and Research Committee (IRCO), across five strategic domains. Together they give E.DSO and its members a shared, DSO-grounded view of where Research and Innovation effort should go.

This list is, and will remain, a **living reference**: it reflects a 2026 snapshot, and future editions will update the topics and their rankings. Thank you to the Secretariat, the IRCO members and every DSO that took part in the ranking.

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