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Innovation management in Europe's power grid

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# Abstract

In view of the changes in the energy sector associated with the energy transition, transmission system operators (TSOs) are in the midst of a fundamental transformation. The requirements for a secure, affordable and sustainable energy supply are growing and are placing increasing demands on TSOs to ensure greater flexibility in the grid and to make forecasts under high uncertainty. Robust technology and innovation management is needed to cope with these tasks.

In a benchmarking study by umlaut energy GmbH, the strategic orientation and organisational implementation of technology and innovation management at European TSOs was examined and evaluated. Historically grown structures of the TSOs and regulatory frameworks make innovation a major challenge – however, some are leading by example and best practices. The study shows that TSOs face three main challenges: great reluctance to prioritise innovation initiatives, intransparency of business objectives and immature governance structures. The best practices to overcome these challenges are predominantly based on the interplay between a synchronised innovation strategy across divisions, agile elements in research and development, and a coordination team.

# 1. Background and motivation

In a 2020 analysis by the European Network of Transmission System Operators (ENTSO-E), it was shown that the share of expenditure on research, development and innovation by TSOs is 0.5% of total turnover, far below the EU-wide industry average of around 3.4% [1;2]. However, considering the level of total turnover, this figure is still far from alarming. Still, in conjunction with an average human resource allocation to research, development and innovation of 0.36%, this suggests that innovation management has not yet become established in the TSO industry – despite the fact that the pressure to innovate is greater than ever.

With the European Green Deal, the EU member states set themselves the common goal of reducing net greenhouse gas emissions to zero by 2050. Among other things, the decarbonisation of the entire energy supply is a prerequisite for achieving this goal [3]. In the Ten-Year Network Development Plan (TYNDP) of 2018, various scenarios were created for 2040, which show the changes that would accompany a successful energy transition. All scenarios show an increase in renewable energy installations, particularly wind and solar. Between 65 and 81% of the energy demand in 2040 will be covered by renewable energy plants [4]. These plants will be largely connected to the distribution grid and thus the need for coordination between grid voltage levels will increase. With the decrease of fossil fuels, more and more applications (e.g. electric vehicles and heat pumps) will be electrified and grid loads will increase. In addition, power generation will be largely decentralised and consumers will be engaged more actively in the market. The coupling of the electricity, gas and heat sectors will also continue to take hold [5].

New technical and digital solutions are therefore becoming increasingly important in order to make the best possible use of the network's flexibility. Given these changes, an established innovation management is indispensable. In order to understand how TSOs are prepared for the future and what challenges they face, the organisations of 16 European TSOs were analysed and benchmarked.

# 2. Theoretical background

## The role of TSOs

Transmission system operators are responsible for the cross–regional transport of electrical energy in the high and extra–high voltage range. They are obliged to guarantee all market participants non–discriminatory access to the electricity grid and to ensure security of supply. Their tasks therefore include the secure operation and maintenance of the entire transmission system as well as the expansion and upgrading of the grid [6].

Since TSOs – with a few exceptions – own most of the national and, in some cases, international, infrastructural connection between electricity generation and consumption, they are natural monopolies and are therefore subject to state supervision. The respective national regulatory authorities are responsible for this supervision. The adoption of the European Union's Third Energy Package in 2009 led to the unbundling and liberalisation of the European energy market and the creation of a central regulatory authority. This created a Europe–wide regulatory framework within which member states operate [7]. This legal framework is a functioning instrument for preserving security of supply. Nevertheless, the European Commission sees a clear need to catch up in the incentivisation of innovations in the electricity grid [8].

## Innovation excellence

Irrespective of the external factors influencing the TSOs, the company's internal performance plays a decisive role in the success of innovation. This is generally referred to as innovation excellence and can be measured by various success factors depending on the respective model.

These factors reflect the different elements of the innovation ecosystem. Figure 1 shows a selection of different models and their factors.



<p><b>Arthur D. Little</b></p> <p>Innovation Strategy   Business Intelligence   Idea Management   Product/Service Portfolio Management   Technology Portfolio Management   Development &amp; Launch   Post-Launch   Resource &amp; Competence Management</p>
<p><b>PFI</b></p> <p>Kultur   Strategie   Organisation   Markteinführung   Entwicklung   Front End</p>
<p><b>RKW</b></p> <p>Innovationsstrategie   Innovationsprozess   Innovationscontrolling   Innovationskultur   Kundenorientierung</p>
<p><b>Hinterhuber</b></p> <p>Führung   Mitarbeiter   Strategie   Taktische   Maßnahmen   Glück</p>

Figure 1 – Innovation Excellence Models

# 3 Procedure

For the qualitative assessment of the TSOs' innovation capacity, a questionnaire was designed based on selected success factors. Following this guide, 16 companies were subjected to a one-hour interview. Based on these interviews, an assessed profile of innovation management was created for each interviewee and compared with the other profiles.

Those responsible for company-wide technology and innovation management were chosen as interviewees. Depending on the TSO, these are innovation, business development or asset managers.

In order to examine the challenges and best practices of the TSOs, they were first assessed in terms of their innovation excellence (see paragraph 2). In selecting the evaluation criteria, the success factors of the various models were used and adapted to the scope of the study.

Table 2 of the appendix lists the selected success factors and their exemplary characteristics. The criteria were weighted depending on their load-bearing capacity. For each characteristic, between zero and two points were assigned and multiplied by the respective weighting. With a total of 29 criteria, this resulted in a maximum achievable score of 58 points.

# 4. Results

The score for company-specific innovation excellence was calculated as a percentage of the maximum achievable score and plotted against the TSO headcount (see Figure 4). The scores ranged from 47.1% to 84.5% of the achievable score. The industry average was found to be 70.4% of the achievable score. The result implies that the staffing level of the companies has no clearly discernible relationship with innovation excellence. No significant correlations could be identified with regard to the type of regulation (cost-based vs. incentive-based) either.

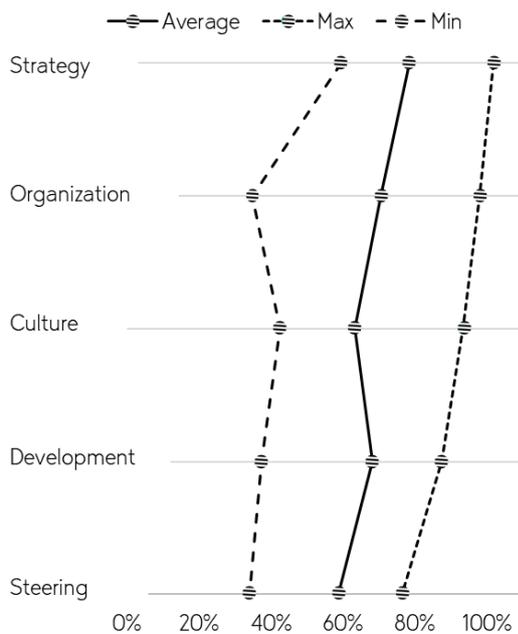


Figure 2 – Assessment profile of Innovation Excellence

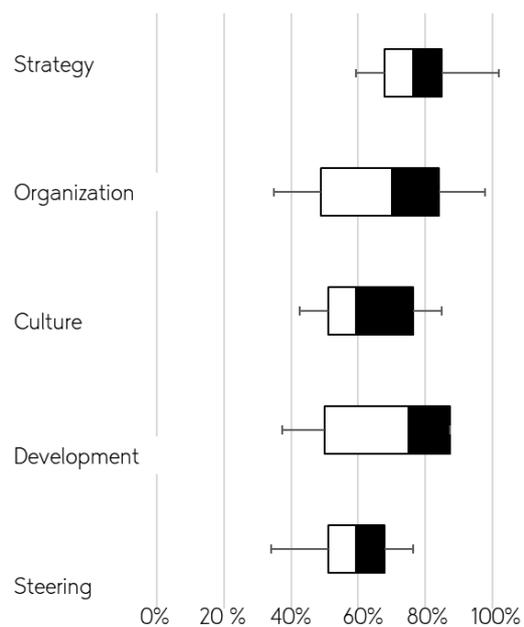


Figure 3 – Evaluation along the success factors

In Figure 2 and Figure 3, it can be seen that the dimensions of culture and steering receive the worst rating, both on average and in relation to the median.

When asked about the challenges for the technology and innovation management of the surveyed TSOs, the most frequently cited challenges were resource bottlenecks and regulatory risks (see Figure 5). The majority of respondents do not believe they are in a position to cope with the large number of new ideas and technologies with the available resources without neglecting day-to-day business. As a result, personnel is ineffectively distributed among the innovation projects.

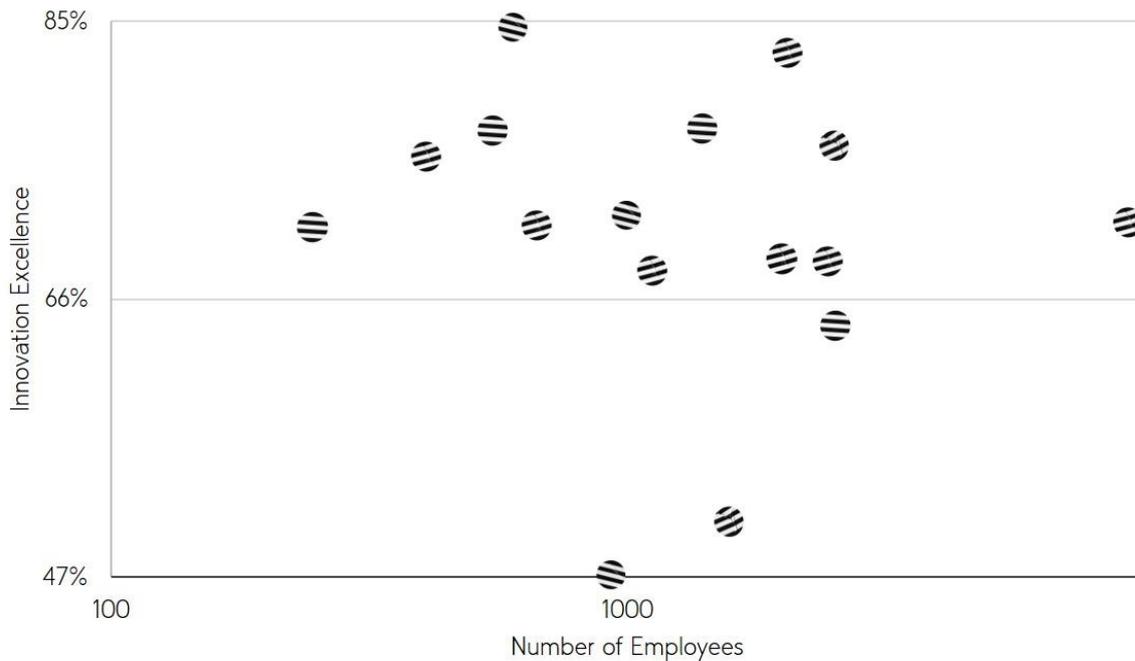


Figure 4 – Degree of innovation excellence compared to the number of employees

**“And we have a lot of people who have so many good ideas over the years and we just don't follow up on them because we don't have the time to do it.”  
(Interview 2)**

This can be attributed to the inadequate prioritisation of projects.

**“Sometimes, we may have started too many innovation projects. It would be better to prioritise.” (Interview 5)**

TSOs that do not see a problem in the appropriate allocation of their resources have several best practices, which are essentially based on a transparent innovation strategy. Clearly defined strategic search fields and selection criteria that are as precise as possible make it easier to make decisions and justify prioritisation.

Challenges in the regulation category can be viewed from different perspectives. One is inflexible support schemes, the other is unresolved legal issues regarding the integration of new technology into the grid. One frequently cited viewpoint relates to the regulated operating costs (OPEX) of the TSOs. Projects that do not directly serve the company's purpose – and thus also the testing of new technologies – must be justified in detail before the authorities. This involves a not inconsiderable amount of work. In some cases, moreover, project costs are only approved for regulatory purposes after successful implementation. If success is not guaranteed, this may entail considerable financial consequences.



**"[...] the challenge lies in integrating these new technologies and innovations into the overall process. And how successful you are in trying to explain, that you cannot do transmission and dispatching without the support of new technology and innovation." (Interview 4)**

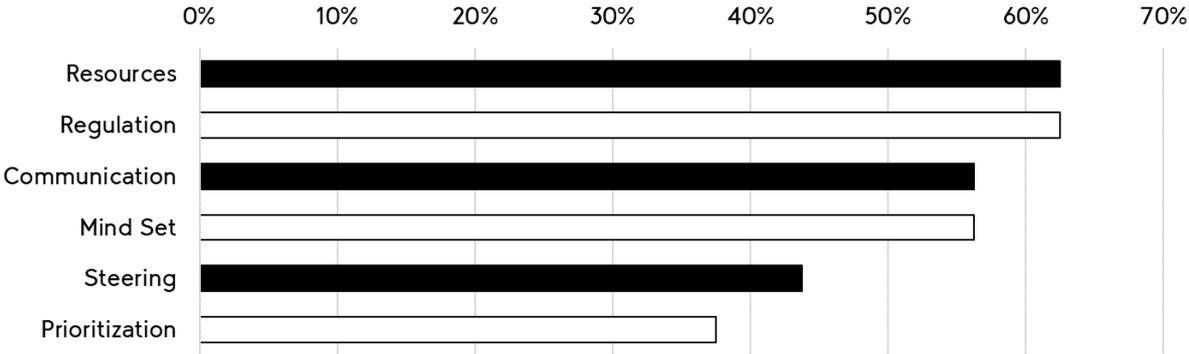


Figure 5 – Ranking of the six most frequently cited challenges

# 5. Conclusion

The challenges faced by TSOs are manifold and can only be attributed to individual causes to a limited extent. In summary, though, the core challenges can largely be attributed to a lack of commitment in senior management, an untargeted prioritisation of projects and incomplete governance structures.

## Management Commitment

Regulation is a key barrier to the development and deployment of new technologies. Regulators prefer to support capital-intensive rather than operationally-intensive projects; approval and funding procedures are time-consuming and regulatory approval uncertain. As a result, there is a general reluctance among the TSOs, although regulators are keen to give TSOs more freedom and incentives to innovate. What TSOs often lack in this situation is the necessary commitment or clear communication from senior management, which would give the implementing teams the freedom to present innovative project ideas to the regulator and find a common path.

- Continuous exchange with regulators is recommended to minimise legal risks and provide incentives for prioritised research & development.
- Structural incentives are recommended. These can be realised, for example, through an annually fixed portion of the profit that is reinvested in the highest-priority innovation initiatives.
- Agile development approaches are largely unheard of in the surveyed companies. Embracing these approaches may empower employees to develop ideas at low cost & risk.

## Prioritisation of projects

The interview series showed that the TSOs are working on many innovation projects. The extensive expert knowledge in the specialist departments regularly generates impulses and starting points for the use of new technologies. However, the increasing number of opportunities does not make it easy to select the right topics. Often, many projects are initiated at the same time – under the premise that the topics are well planned, and profitability calculations are available. What is usually missing is an evaluation and weighting of the projects against each other, which is why the allocation of resources is often unfocused.

- It is necessary to link the innovation goals more strongly to the corporate strategy and to transfer them transparently into the organisation in order to build up a strong basis for argumentation and prioritisation.
- It is not advisable to prioritise in the early phase on the basis of economic key figures. Soft factors, such as disruption potential, must be weighted more heavily.



- Consistent prioritisation of projects also clarifies the question of effective resource allocation.

## **Governance**

In recent years, the awareness of the need for new solutions has grown considerably, which can be seen, among other things, in the fact that the number of newly initiated units to coordinate innovation activities has increased significantly. However, these innovation units have often been set up without clear governance and transparency about responsibilities, i.e. the specialist departments often have no coordination – either with each other or with the strategy or innovation departments. As a result, ideas from the expert groups are not heard or innovation topics are delegated to the departments without organic exchange or a genuine innovation culture.

- Steering committees staffed with decision-makers from the specialist areas are recommended to ensure early involvement of the experts. For this purpose, a transparent RACI matrix along the process can provide information about the respective responsibilities.
- There is also a need for additional freedom that allows employees to participate in business development. One example of this could be internal accelerator programs.

# 6 Bibliography

- [1] ENTSO-E. (2020). Research, Development & Innovation Roadmap 2020–2030. Von [https://eepublicdownloads.entsoe.eu/clean-documents/Publications/RDC%20publications/entso-e-rdi\\_roadmap-2020-2030.pdf](https://eepublicdownloads.entsoe.eu/clean-documents/Publications/RDC%20publications/entso-e-rdi_roadmap-2020-2030.pdf) abgerufen
  
- [2] Hernandez Guevara, H., Grassano, N., Tuebke, A., Amoroso, S., Csefalvay, Z., & Gkotsis, P. (2019). The 2019 EU Industrial R&D Investment Scoreboard. Luxembourg: Publications Office of the European Union. doi:10.2760/59430
  
- [3] European Commission. (12. Mai 2021). A European Green Deal. Von European Commission: [https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal\\_en](https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en) abgerufen
  
- [4] ENTSO-E. (2018). TYNDP 2018. Von [https://eepublicdownloads.blob.core.windows.net/public-cdn-container/clean-documents/tyndp-documents/TYNDP2018/consultation/Main%20Report/TYNDP2018\\_Executive%20Report.pdf](https://eepublicdownloads.blob.core.windows.net/public-cdn-container/clean-documents/tyndp-documents/TYNDP2018/consultation/Main%20Report/TYNDP2018_Executive%20Report.pdf) abgerufen
  
- [5] ENTSO-E. (2019). Vision on Market Design and System Operation towards 2030. Von [https://vision2030.entsoe.eu/wp-content/uploads/2019/11/entsoe\\_fp\\_vision\\_2030\\_web.pdf](https://vision2030.entsoe.eu/wp-content/uploads/2019/11/entsoe_fp_vision_2030_web.pdf) abgerufen
  
- [6] ENTSO-E. (12. Mai 2021). ENTSO-E Member Companies. Von ENTSO-E: <https://www.entsoe.eu/about/inside-entsoe/members/> abgerufen
  
- [7] Third energy package adopted. (12. Mai 2021). Von Linklaters: <https://web.archive.org/web/20130112052907/http://www.linklaters.com/Publications/Thirdenergypackage/Pages/Index.aspx> abgerufen
  
- [8] McRobb, L., Downie, G., Haffner, R., Roose Øvlisen, F., Ladermann, A., Hancher, L., Harry, V. (2019). Do current regulatory frameworks in the EU support innovation and security of supply in electricity and gas infrastructure? Luxembourg: Publications Office of the European Union.

# 7. Appendix

Table 1 – Overview of the interview partners

#	Role of the interview partner	TSO employees	Regulation
1	Innovation Manager	2000–3000	Cost-based
2	Business Development Manager (Digitalisation)	<500	Cost-based
3	Business Development Manager (R&D)	>3000	Incentive-based
4	New Technologies Manager	2000–3000	Cost-based
5	System Operation Manager / Associated Activities	1000–2000	Hybrid
6	Business Development Manager (Technology Management)	500–1000	Incentive-based
7	Corporate Development Manager (R&D)	500–1000	Cost-based
8	Technology Management Lead	1000–2000	Incentive-based
9	Head of Asset Management	1000–2000	Incentive-based
10	Asset Manager (Digitalisation)	500–1000	Hybrid
11	Balancing Specialist	1000–2000	Incentive-based
12	Innovation Manager	1000–2000	Hybrid
13	Strategy Manager	1000–2000	Incentive-based
14	Asset Manager	500–1000	Incentive-based
15	F&E-Manager	2000–3000	Cost-based
16	Innovation Manager	<500	Incentive-based

Table 2 – Overview of evaluation criteria and selected characteristics

		<b>Weight</b>
<b>Innovation strategy</b>	Innovation goals have been set as part of the strategy	30%
	The innovation strategy is cascaded and communicated across all parts of the company	
<b>Organisation</b>	There is a cross-functional innovation steering group at the corporate level	20%
	There is a regular exchange between those responsible for innovation and the Strategy Committee.	
<b>Culture</b>	The innovation goals are known and accepted by the entire staff	10%
	Employees have the opportunity to actively submit their ideas and also	
<b>Development</b>	Development projects are initiated from the beginning with the experts of the respective department	10%
	Agile methods and a fail-fast approach are used in early development	
<b>Management &amp; Controlling</b>	There is an effective, systematic approach to resource allocation	30%
	There are clearly defined termination criteria for projects at certain milestones	



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