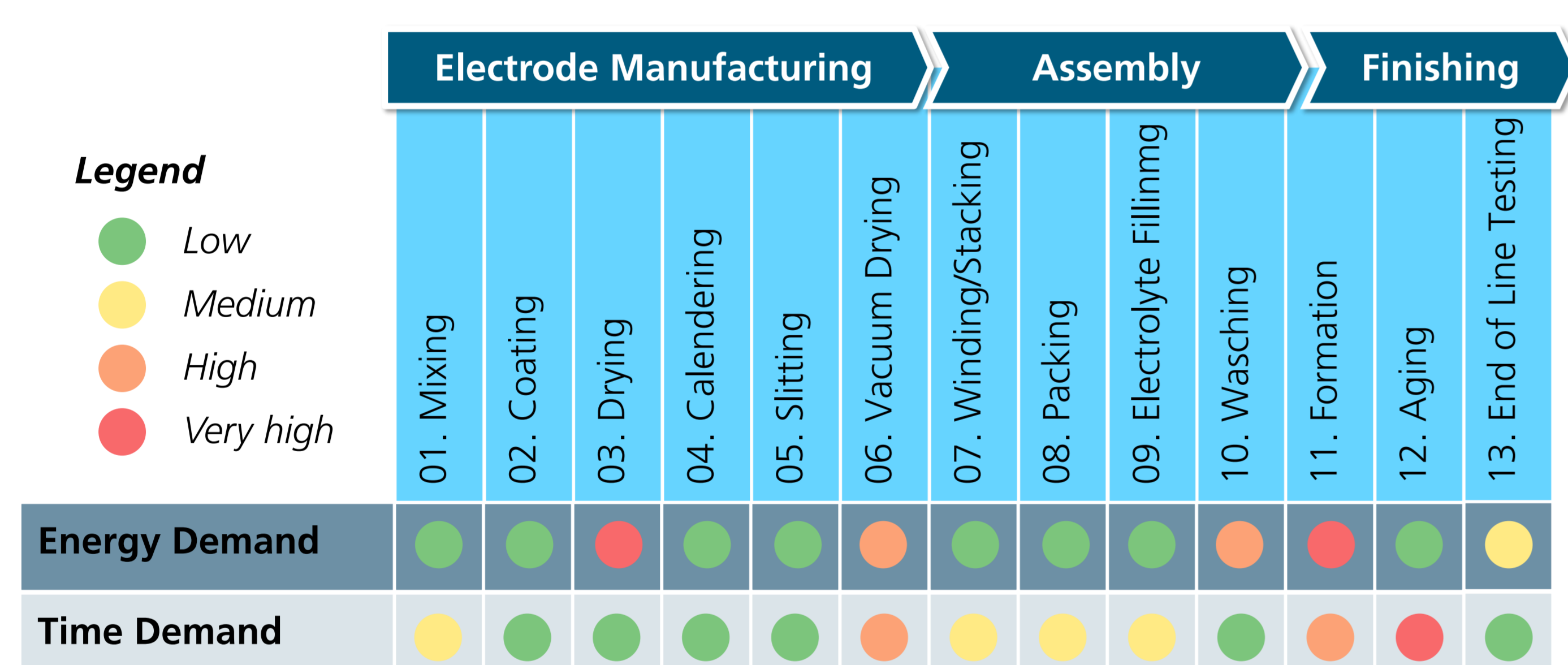


Optimizing Technology Decision Making in Battery Cell Manufacturing through Technology Studies: Establishing a Streamlined and Strategic Framework

Miha Podbreznik, Oliver Krätzig, Marcel Diehl

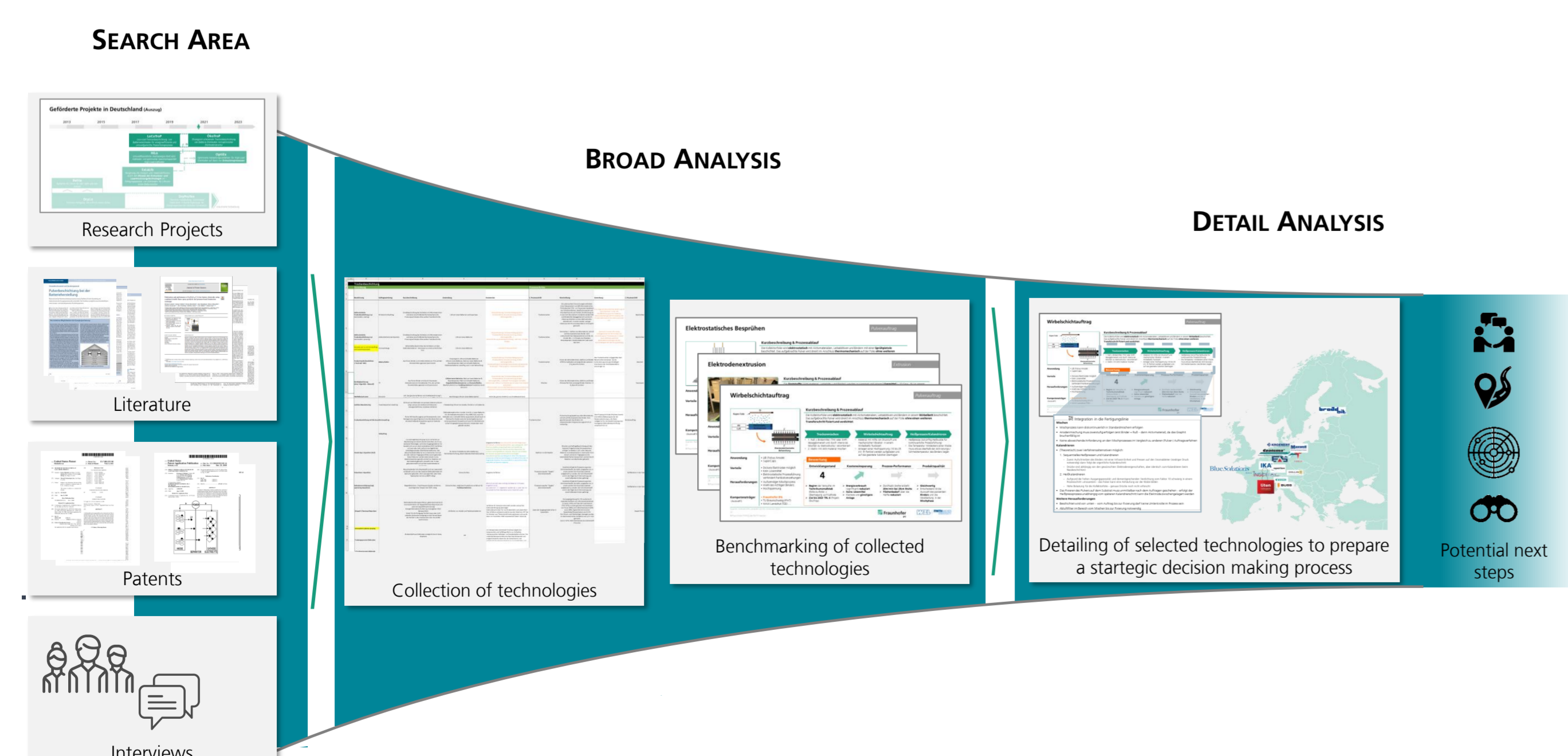
The desire to reduce costs is a major driving force behind process innovations in materials and process technologies, and this is evident in various areas of activity. A qualitative distribution energy and time demanding steps along the process chain is shown in the figure below¹. In the fast-paced environment of battery cell production, integrating key technologies early can be essential to achieving a competitive advantage. However, with a plethora of technological solutions available, identifying these key technologies is a challenge.

To optimize resource allocation in R&D, an objective and systematic decision-making framework is necessary. Thorough studies can provide a more secure basis for strategic decision-making and reduce the risk of allocating resources, ultimately impacting competitiveness. Technology studies that identify, benchmark, and analyze relevant battery production technologies can provide the necessary information for sound decision-making and enhance decision security.



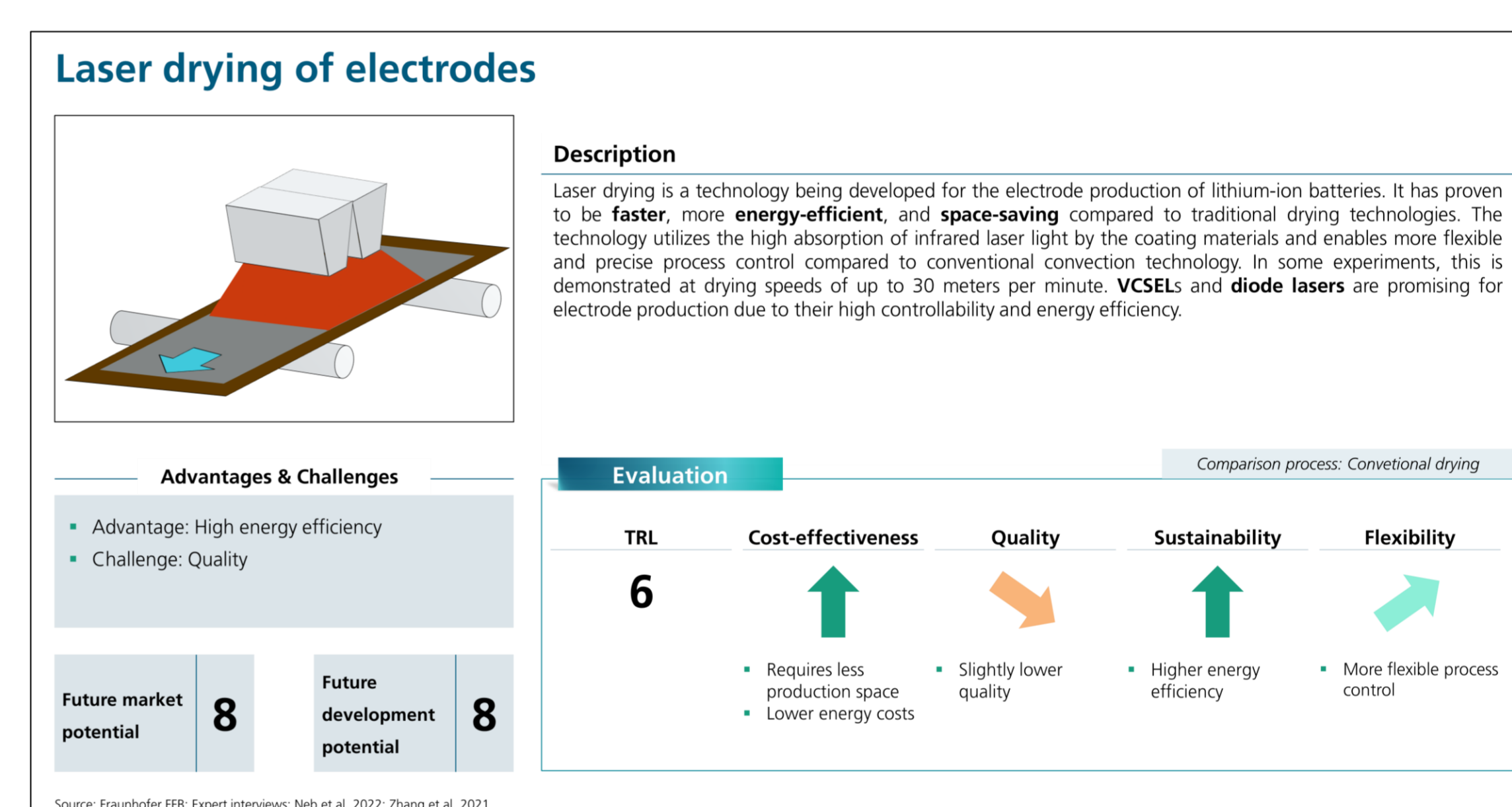
State-of-the-Art

Selecting and prioritizing new technologies can be difficult due to cognitive biases and subjective evaluations, leading to missed opportunities and increased risks. Decision-makers may prefer familiar ideas and dismiss valuable but unfamiliar technologies.² Maintaining objectivity and recognizing the potential of unfamiliar technologies is crucial. The Stage-Gate process, a stage-by-stage analysis and decision-making process, is a state-of-the-art approach. Managers evaluate projects based on predefined criteria before providing resources for the next stage.³

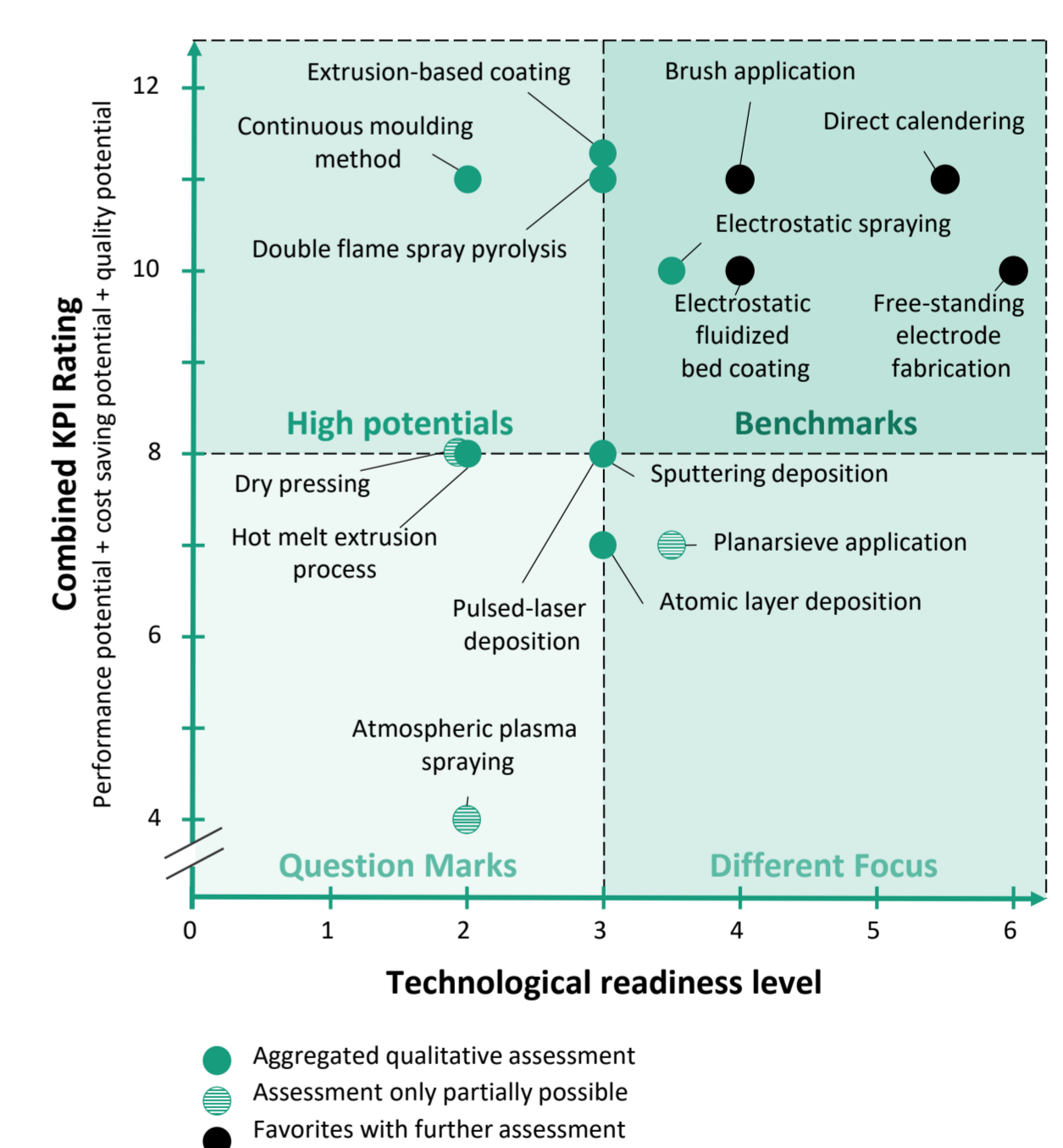


Framework approach

The procedure within a technology study usually consists of three parts in the form of a defining the search area, a broad analysis, and a detailed analysis that results in the derivation of recommendations for action for the customer. Focus and level of detail increase in a funnel shape (see diagram on the bottom left). Two results of completed studies are exemplified for the different stages of the funnel (broad analysis: technological profile of a laser drying process, detailed analysis: portfolio analysis for dry coating technologies).



The individual technology analyses at fact sheet level are plotted by making use of a portfolio-format referring to important KPIs (quality, costs, sustainability and flexibility) of individual technologies bundled as a point score over technology maturity (here as TRL). This enables a quick overview of the analyzed results and leads to simplified decision-making.



Conclusion and Outlook

The format of the technology studies has already proven itself for the structured collection of information and as a basis for comparison for the objective of strategic decision-making for a number of use cases. There is scope for extending the range of applications, which has so far focused primarily on manufacturing technologies, in the direction of a material or cell design focus, as well as in the direction of modification with regard to methodological usability as technology transferability studies in cross-industry applications. In terms of a more comprehensive and broader analysis focus, the integration of further data sources and mixed-methods approaches such as AI-based patent analytics or news crawling offers further optimization potential. To conclude, the methodological approach to technology assessment is also likely to gain further added value by being designed in the context of quantitative evaluation procedures.

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¹ F. Degen and O. Krätzig, "Modeling Large-Scale Manufacturing of Lithium-Ion Battery Cells: Impact of New Technologies on Production Economics," in IEEE Transactions on Engineering Management, doi: 10.1109/TEM.2023.3264294.
² Sukhov a., 2018: The role of perceived comprehension in idea evaluation; Creativity and Innovation Management, Volume 27, Issue 2 p. 183-195
³ Cooper, R.G.; Edgett, S.J.; Kleinschmidt, E. J. 2002: Optimizing the Stage-Gate Process: What Best-practice Companies do – I., in: Research Technology Management, Jg. 45, Band 2, S. 21-27.