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The Delphi–BCG Conceptual Framework for Strengthening Entrepreneurial Discovery Processes

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Abstract

This paper presents a conceptual Delphi–BCG framework to strengthen Entrepreneurial Discovery Processes (EDPs) within Smart Specialisation Strategies (S3) in small, open economies. It integrates expert-driven foresight with portfolio-level prioritisation to address fragmentation across industrial, innovation, and spatial policies. By combining Delphi and BCG approaches, the framework identifies emerging technological opportunities and uncertainties in regional energy ecosystems while generating actionable policy insights. Applied to the Finnish energy cluster, it highlights key domains including small modular reactors (SMRs), hydrogen, and advanced heat solutions towards 2045. “Star” areas include system-level energy optimisation, industrial waste heat recovery, high-temperature heat pumps, electricity storage, and direct current networks with smart microgrids. The framework supports targeted RDI investments, SME collaboration, and alignment between national and regional priorities, while helping policymakers manage uncertainty, prioritise investments, and advance industrial renewal and the green transition and profitable growth.

Key words:
Entrepreneurial Discovery Process; Smart Specialisation Strategy; Delphi method; BCG matrix; industrial policy; innovation policy; regional ecosystems; green energy transition; hybrid foresight; portfolio analysis

1. Problem and scope of the study

Small, open economies such as Finland operate in a turbulent environment shaped by geopolitical instability, supply chain disruptions, technological change, and the green transition. These pressures have renewed interest in active industrial policy and raised questions regarding how Entrepreneurial Discovery Processes (EDPs) within the EU's Smart Specialisation Strategies (S3) might be strengthened.

Industrial, innovation, and spatial policies remain fragmented: industrial policy is oriented towards national priorities, innovation policy emphasises research and development and innovation ecosystems, and spatial policy focuses on regional clusters. This lack of alignment is particularly problematic in energy clusters and innovation ecosystems, where technological change and regulation interact across national regimes and regional niches. Within the European Union, both excessive and insufficient regulation may generate inefficiencies and coordination failures.

Finland's strongest energy capabilities are concentrated within regional ecosystems, particularly in Western Finland, where firms, research organisations, and public actors co-evolve. These ecosystems are central to the green transition and industrial renewal; however, policymakers currently lack instruments that effectively integrate strategic **foresight, prioritisation**, and **structured analysis of regional strengths, weaknesses, opportunities**, and **threats.**

Traditional foresight methods provide long-term perspectives but often struggle to translate expert panel insights into concrete strategic choices. As is widely recognised, an effective foresight process integrates (i) the application of foresight methods, (ii) networking of key stakeholders, and (iii) a strategic decision-making model (Keenan et al., 2003). While such approaches support decision-making in innovation and investment processes, portfolio tools such as the BCG matrix provide a prioritisation logic but remain insufficient for addressing deep uncertainty in decision-making contexts.

This paper proposes a **Delphi–BCG** framework tailored to regional ecosystems, industrial policy, and strategic decision-making. Developed within the STRAIND project (funded by Business Finland), the framework identifies industrial policy instruments suited to small countries and clarifies the long-term strategic role of regions in national competitiveness.

2. Current understanding

Efforts have been undertaken to address the challenge of EU industrial competitiveness, taking into account contemporary drivers of structural change, as reflected in national, EU, and OECD strategies (e.g. Hämäläinen, 2013; EU, 2024; OECD, 2022; TEM, 2024). Recent research increasingly emphasises integrated, mission-oriented, and place-based approaches to industrial and innovation policy. Innovation policy has expanded beyond traditional research and development towards broader innovation ecosystems and systemic transformation, whilst spatial policy increasingly highlights regional capabilities and cluster-based development (see e.g. Kaivo-oja & Santonen, 2016, Sielker & Dannenberg, 2025; Okonkwo, Mäenpää, Kalliomäki & Tukiainen, 2024).

There is a growing need to operationalise the European Smart Specialisation Strategy (S3) within the regional policy framework of the European Union (Foray, 2014, 2017, 2022; Foray et al., 2009, 2011, 2012; European Committee of the Regions: Commission for Social Policy, Education, Employment, Research and Culture, Fondazione FORMIT and Trilateral Research Limited, 2023). This study responds to the evolving requirements and challenges of European regional development policy, within which key elements include: (i) Entrepreneurial Discovery Processes (EDPs), (ii) the identification and exploitation of comparative advantages, (iii) the resilience of economic structures, and (iv) strategic innovation dynamics, including processes of creative destruction within European regions.

Foresight research has developed expert-based knowledge management approaches, most notably the Delphi method. Prior studies demonstrate that combining Delphi techniques with structured analytical tools facilitates the translation of expert judgements into strategic policy recommendations. In particular, Delphi-based expert assessments may be mapped into portfolio frameworks, including the BCG matrix, to support decision-making under conditions of uncertainty.

Within the European Union, a flagship initiative in Delphi-based foresight has been the BOHEMIA project ("Beyond the Horizon"), implemented by the European Commission. The report *New Horizons: Future Scenarios for Research and Innovation Policies in Europe* (2017), based on a large-scale Delphi survey, directly informed the post-2020 EU Research and Innovation Framework Programme (Horizon Europe) and identified key priorities in science, technology, and societal challenges. Other relevant Delphi-based strategic foresight studies include Hurmekoski et al. (2017), de Jesus et al. (2019), Tura et al. (2022), and Ojanen et al. (2025). Collectively, these international studies provide an important foundation for the present research, which focuses on future industrial policy in Finland. Within the STRAIND project, the specific objective has been to develop a novel strategic foresight approach tailored to the industrial policy planning and decision-making needs of Finland and its regions. These broader foresight studies thus also provide an important comparative background for national Finnish foresight work.

However, such hybrid methodologies remain underutilised in industrial and innovation policy, particularly within regional energy ecosystems. Existing analytical tools often fail to adequately capture the interaction between uncertainty, regional capabilities, and strategic prioritisation. Consequently, policymakers require frameworks that integrate expert-based foresight with actionable portfolio-level decision logic.

The STRAIND project builds upon this methodological foundation by developing a Delphi–BCG framework for regional energy ecosystems. The approach is further connected to growth path modelling through the Six Stage Model of Profitable Growth. While the present paper focuses primarily on the integration of Delphi and BCG methods, the broader conceptual framework links foresight, strategic prioritisation, and growth trajectory development.

3. Research questions and research gaps

This paper addresses three research questions:

1. How can expert-based foresight be systematically combined with portfolio-level analysis to support industrial and innovation policy in small, open economies?
2. What value does a Delphi–BCG framework provide in identifying and prioritising emerging technologies and capabilities within regional energy ecosystems?
3. How can such a framework improve alignment between national industrial policy and regional innovation strengths?

These questions guide the development and application of the conceptual framework to the Finnish energy cluster.

The research questions are directly linked to identified research gaps in strategic foresight within regional industrial policy and innovation ecosystem governance in the European Union. In particular, there remains limited understanding of how to integrate foresight methods with structured portfolio approaches in a manner that effectively supports policy coordination across governance levels.

4. Research design

The research design follows a conceptual and methodological logic, supported by empirical insights derived from pilot interviews conducted within the STRAIND project. The design comprises three main components: (1) Delphi method for expert foresight (2) BCG portfolio analysis for strategic prioritisation and decision-making, (3) Linking to growth path modelling. Application context is the Finnish energy cluster and innovation ecosystems.

Delphi method for expert foresight

The Delphi method is used to elicit expert judgements concerning future developments, uncertainties, and strategic priorities within the energy cluster. Experts assess technological trajectories, market developments, regulatory change, and ecosystem capabilities. The method is particularly suited to contexts characterised by uncertainty and rapid change, as it enables structured consensus-building and the identification of emerging opportunities.

Figure 1 illustrates the phases of the Delphi application, which is also employed in the STRAIND project, where the Delphi process is integrated into the analysis of the BCG matrix. In this application, the initial categories of the BCG framework are generated through a brainstorming process in the first round of the Delphi panel, and subsequently refined and evaluated during the second round.

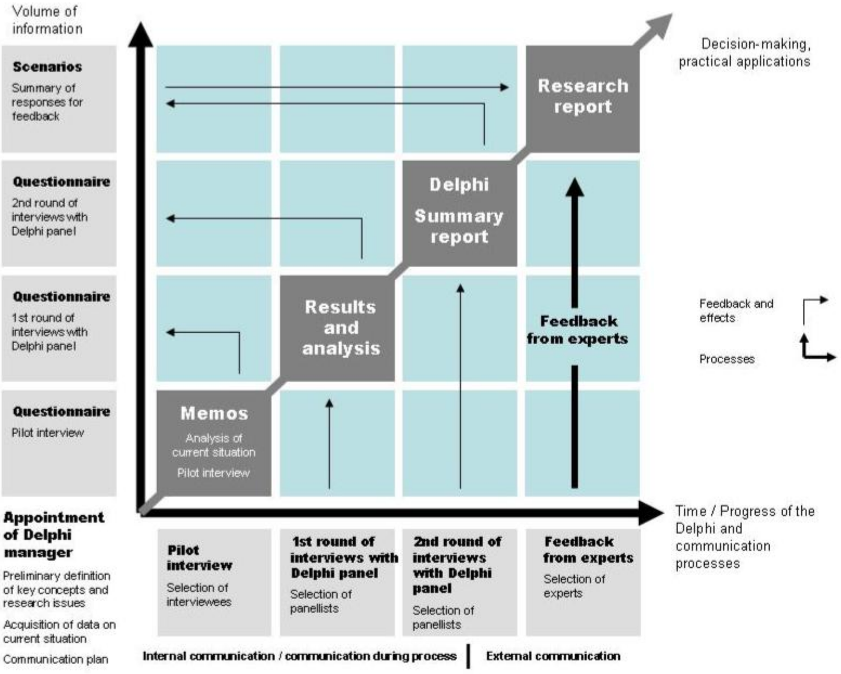


Figure 1 Delphi method according to Myllylä's dissertation and its application in the STRAIND project (Myllylä, 2008; Myllylä & Kaivo-oja, 2015), visualisation by Ossi Luoma (M&MC)

BCG portfolio analysis for strategic prioritisation and decision-making

Insights derived from the Delphi rounds are subsequently translated into a BCG matrix, which classifies technologies and capability areas into four categories (see Figure 2):

- **Question Marks** (high growth, low capability)
- **Stars** (high growth, high capability)
- **Cash Cows** (low growth, high capability)
- **Pets / Dogs**, Declining Areas (low growth, low capability)

This mapping provides policymakers with a structured overview of where to invest, experiment, and scale. These questions are central to the Smart Specialisation Strategy (S3) approach and Entrepreneurial Discovery Processes (EDPs).

"Question Mark" (or sunrise industry) refers to emerging areas with rapid growth but relatively low current market share or regional capability. At this stage, development is highly uncertain, and future trajectories may change significantly.

A "Star" product or domain is characterised by both high growth and a strong market position or capability base within the region. Although such areas are strategically important, they are not necessarily yet highly profitable and may require continued external investment and positive cash flow support.

"Cash Cow" products or domains represent established areas with a high market share or strong regional capability, but lower growth rates. While margins may be moderate, these areas generate stable cash flow, which can be reinvested to support the development of "Star" domains. Over time, "Stars" may mature into "Cash Cows".

"Pets / Dogs" (or declining areas) refer to domains with both low market share and low growth potential. In many cases, these may represent the end stage of a lifecycle, and strategic withdrawal or de-prioritisation may be justified.

According to the model, "Question Mark" areas in particular require substantial research and development efforts to evolve into more mature categories. These areas also signal opportunities for innovative small and medium-sized enterprises (SMEs) and so-called innovation clusters or start-up ecosystems.

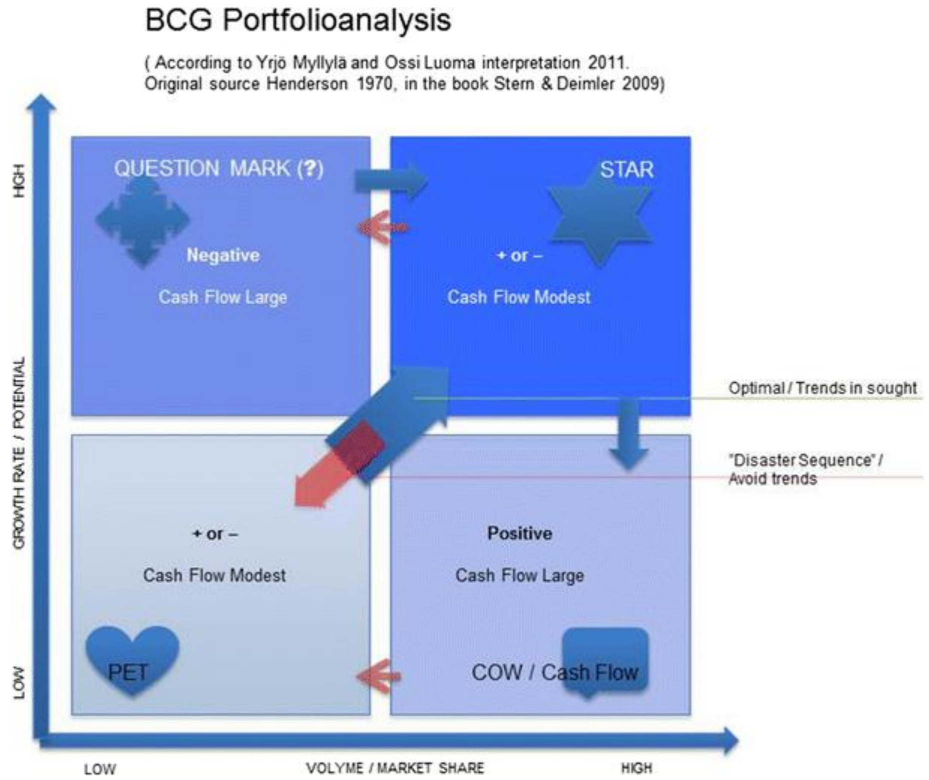


Figure 2 Boston Consulting Group (BCG) matrix framework (Myllylä & Kaivo-oja, 2015, 2024a; Henderson, 1970)

Linking to growth path modelling

Although not the primary focus of this paper, the framework outlines how the Six Stage Model for Driving Profitable Growth (SSMPG) may be applied once portfolio analysis results have been established. This firm-level management model provides structured pathways for the development of selected technologies and capabilities, thereby linking foresight and strategic prioritisation to actionable growth strategies within European regions.

An entrepreneurial culture that emphasises start-up formation and the navigation of so-called “valleys of death” is often constrained by access to finance, which constitutes a major bottleneck for growth-oriented entrepreneurship. Conventional models of growth entrepreneurship are frequently debt-driven. This logic is also embedded in the BCG matrix, which assumes that in the “Question Mark” (or sunrise) phase, cash flows are typically negative due to substantial product development and scaling investments. In the “Star” phase, cash flows may already be positive, but can remain negative depending on continued growth-related investment requirements. Only in the “Cash Cow” phase are cash flows consistently positive and stable.

Applying the Six Stage Model of Profitable Growth to technologies already in the sunrise and star phases may reduce the duration of the debt-financed growth period and, in some cases, may prevent it altogether. Our peer-reviewed study in the *Journal of Business Economics and Management* on the Six Stage Model of Profitable Growth proposes an alternative perspective. The model may also be conceptualised as a sales- and management-driven decision-making framework (see Myllylä & Kaivo-oja, 2025).

Six Stage Model of Profitable Growth

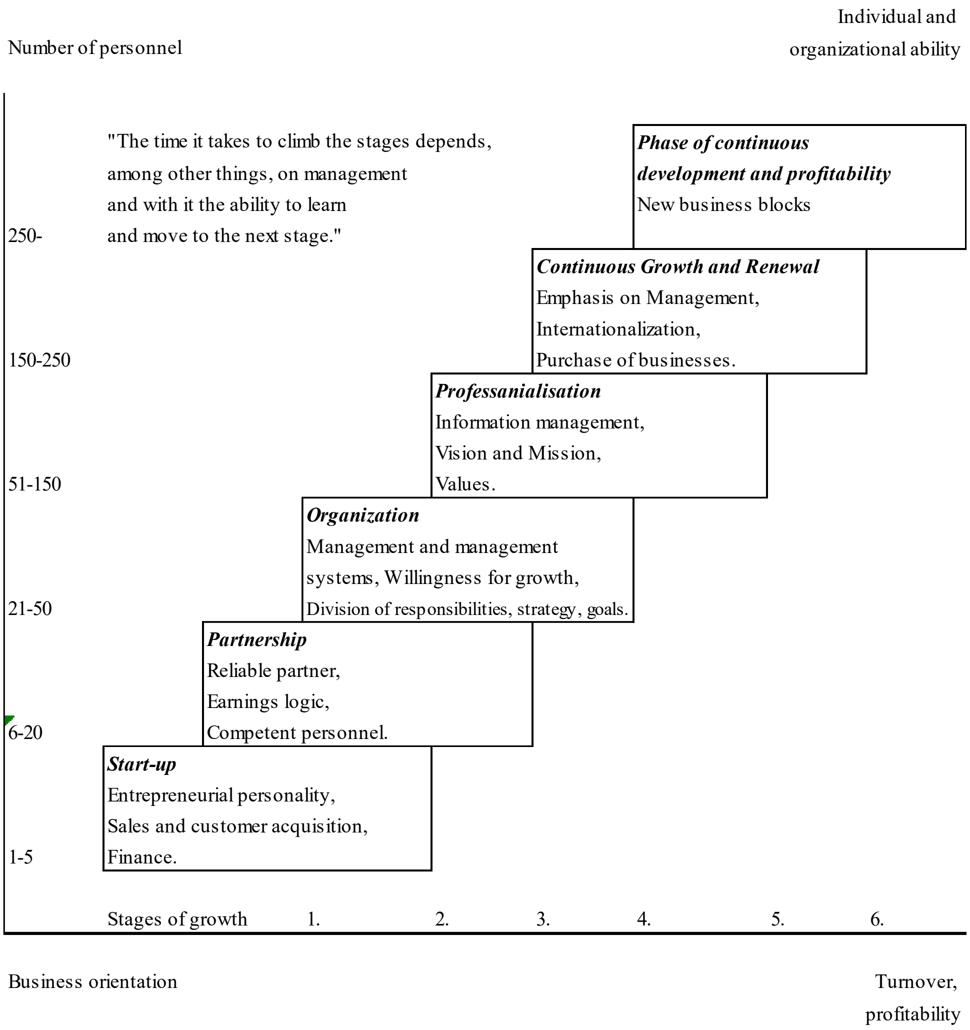


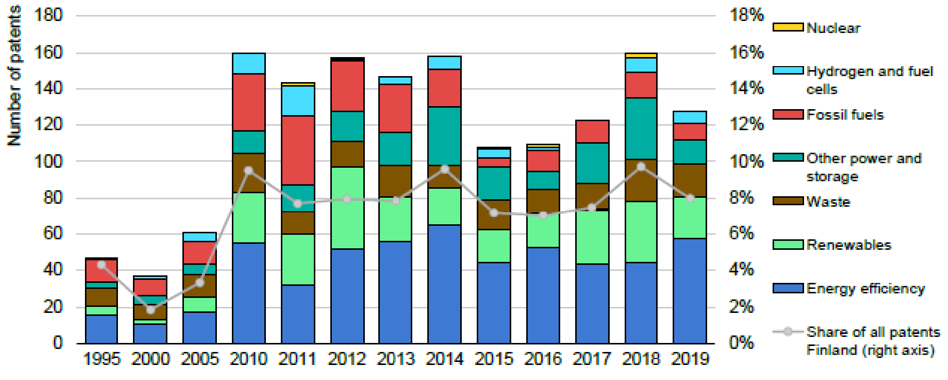
Figure 3 The Six Stage Model of Profitable Growth and critical growth factors (Myllylä & Kaivo-oja, 2024b, 2025)

Application context: the Finnish energy cluster and innovation ecosystems

In this case study, the framework is applied to the Finnish energy cluster, a strong regional ecosystem with both national and international relevance. The cluster serves as an appropriate testbed for examining how foresight-driven portfolio tools may support industrial renewal and the green transition.

A key component of the Finnish energy cluster is its energy technology competence clusters, which export specialised products and solutions globally within their respective areas of expertise. The Vaasa region in Ostrobothnia, in particular, represents one such cluster, where major energy companies such as Wärtsilä Corporation, ABB, Hitachi Energy, and Danfoss Drives have concentrated their operations over time. Key product areas in this ecosystem include electric motors, which are required in electricity generation in data centres; frequency converters, which are essential in wind power generation and widely used in electrical equipment; as well as electric motors, switches, and transformers.

In addition, several other regions in Finland host local ecosystems that support the development of the energy sector. Figure 4 presents the thematic areas to which energy-related patents in Finland were assigned during the period 1995–2019. In the field of strategic and technology foresight, patent analysis constitutes a valuable knowledge base for innovation policy and management. For this reason, patent activity in Finland between 1995 and 2019 is included in the analysis. In Finland, large and novel innovations are more likely to be patented, and patent propensity varies significantly according to firm size and technological domain. However, caution is required in interpretation, as patent data is a partially biased indicator of innovation, given that not all innovations are patented. Recent empirical studies also indicate a strong lagged relationship between patenting activity and industrial growth (Heinonen, 2023). Within the European Union, there is also an observable transition from patent-based activity towards trademark-based activity (Kaivo-oja, 2016).



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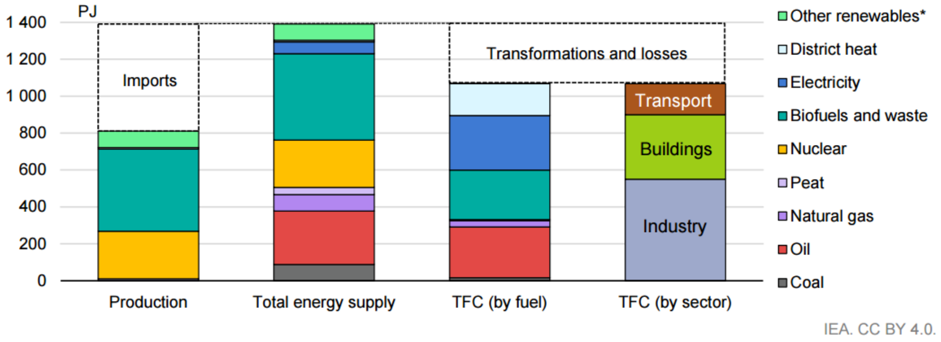
Source: IEA based on data from OECD (2022).

Figure 4 New patents in energy-relateted business in Finland 1995-2019 (IEA 2023)

For Finland as a whole, the key competitive advantage lies in affordable and reliable energy, which is processed into export-oriented industrial products. These include traditional sectors such as forestry, metals, and engineering, as well as emerging growth areas such as data centres. Finland’s electricity system is relatively low-carbon (94 % from renewable and nuclear sources year 2023, Statistics Finland 2024) and, in 2025, among the most competitively priced in the European Union. This has attracted energy-intensive investments to the country. Figure 5 illustrates Finland’s domestic energy production, supply structure, and overall energy consumption.



* *Other renewables* include hydro, wind and solar.
Source: IEA (2022).

Figure 5 Energy production, supply and demand in Finland 2021 (IEA 2023)

Electrification is also a significant structural trend in Finland. The availability and competitive price of electricity have become critical prerequisites for industrial development. Compared with many other countries, Finland possesses a comprehensive high-voltage transmission grid, enabling electricity transmission across regions. The transmission network has been further strengthened in recent years, partly due to investments in wind power.

However, in Eastern Finland, the 410 kV transmission network is still incomplete in several areas (Fig. 6). In addition, wind power development has been constrained in parts of Eastern Finland due to defence-related radar considerations. Nevertheless, strengthening the electricity grid and more efficient utilisation of national resources would also require increased industrial investment in Eastern Finland. One potential policy option is the development of Special Economic Zones (SEZs), which could also facilitate and attract industrial investment to the region.

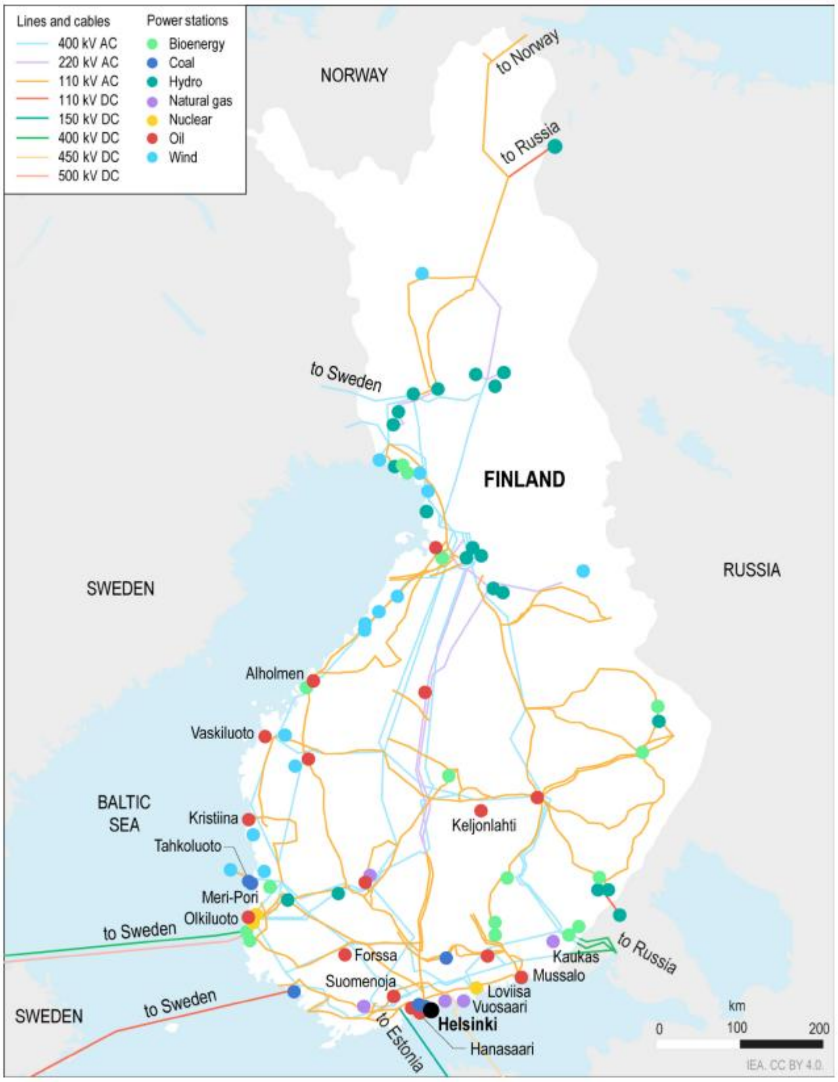


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Figure 6. Electricity infrastructure in Finland (IEA 2023)

5. Findings and results

Preliminary insights from pilot Delphi expert interviews and conceptual testing suggest that the Delphi–BCG framework offers several advantages for industrial and innovation policy design

Identification of emerging opportunities

The Delphi rounds help identify emerging technological areas—such as SMRs, hydrogen solutions, waste heat recovery, and advanced heat pump systems—that may not yet be fully recognised in current policy frameworks.

Table 1 The Finnish energy cluster in the light of the Delphi-BCG analysis (Delphi panel 1st round of interviews)

The Finnish energy cluster in the light of the Delphi-BCG analysis (Delphi panel 1st round of interviews)

SUNRISE PRODUCT AREAS 2045 *Low turnover now – high potential growth*	STAR CLUSTERS 2045 *High turnover + rapid growth*
1. Utilisation of space data in energy systems	1. System-level energy optimization (AI + digital twin)
2. Applications of quantum computing in energy networks	2. Industrial waste heat recovery and high-temperature heat pumps
3. Thermal modules for SMR small nuclear power plants	3. Electricity storage (BESS + hybrid models)
4. Local closed ecosystems of hydrogen (ports, steel)	4. DC Networks and Smart Microgrids
5. Power-to-X Synthetic Fuels	5. Clean marine fuels (ammonia, methanol)
6. Circular economy-based battery second life industry	6. Photonics in energy data infrastructure
7. 3D printed energy industry components	7. Demand response platforms and energy community services
8. Bio-based materials with a high degree of added value (forest + chemistry)	8. Arctic energy technology (resilience conditions)
9. Autonomous "dark factories" in the energy industry	9. Industrial Carbon Capture and Utilisation (CCU)
10. Data-heat-food integration (data center + greenhouses)	10. Heat storage (sand accumulators, high-temperature solutions)
PETS (Dogs) *Low market share + weak growth / structural problems*	CASH FLOW SOURCES 2045 ("Dairy cows") *High net sales, stable market position, moderate growth*
1. Long-distance hydrogen pipeline networks in Finland	1. Power transmission and network technologies (transformers, HVDC, shielding)
2. Hydrogen as a mass solution for passenger cars	2. Drives & Power Electronics (AC/DC Solutions)
3. Oversized offshore wind projects in the Baltic Sea without cost control	3. Life cycle services for marine engines and power plants
4. A subsidy-driven hype hydrogen economy without an industrial anchor	4. District heating networks and the heat pump ecosystem
5. Project-oriented one-time delivery model without service business	5. Wind power operation and maintenance services
6. Ideological cleantech pilots without scalability	6. Industrial Energy Efficiency Solutions
7. Single-product strategy ('new Nokia' risk)	7. Energy data and optimization services (legacy systems)
	8. Conventional power generation (nuclear + bio-CHP)
	9. Electrification solutions for energy-intensive industries
	10. Basic data center infrastructure (electricity + cooling)

According to the BCG analysis based on Delphi expert interviews, the sectors of sunrise that will rise in 2045 include (Table 1): 1) Utilisation of space data in energy systems, 2) Applications of quantum computing in energy networks, 3) Thermal modules for SMR small nuclear power plants, 4) Local closed ecosystems of hydrogen (ports, steel), 5) Power-to-X Synthetic Fuels, 6) Circular economy-based battery second life industry, 7) 3D printed energy industry components, 8) Bio-based materials with a high degree of added value (forest + chemistry), 9) Autonomous "dark factories" in the energy industry and 10) Data-heat-food integration (data center + greenhouses) (see Table 1). These are sectors that can be considered to be the target of the RDI activities to be funded at that time and most likely to be in need of external funding, the cash flow is negative according to traditional thinking.

At that time, star clusters may already be generating positive cash flow. In connection with these, the time for RDI activities is earlier, and these could be considered to be the areas of activity in which growth-seeking companies should currently invest in RDI activities. These may be start-up companies at the moment. The themes in this group according to Table 1 are as follows: 1) System-level energy optimization (AI + digital twin), 2) Industrial waste heat recovery and high-temperature heat pumps, 3) Electricity storage (BESS + hybrid models), 4) DC Networks and Smart Microgrids, 5) Clean marine fuels (ammonia, methanol), 6) Photonics in energy data infrastructure, 7) Demand response platforms and energy community services, 8) Arctic energy technology (resilience conditions), 9) Industrial Carbon Capture and Utilisation (CCU) and 10) Heat storage (sand accumulators, high-temperature solutions).

Clarification of strategic priorities

The BCG matrix provides a structured map of technological and capability areas, enabling policymakers to distinguish between areas requiring investment, experimentation, scaling, or divestment.

Strengthening alignment between national and regional policy

The framework highlights the central role of regional ecosystems in industrial renewal, demonstrating how national policy can better leverage regional strengths.

According to this analysis, the realisation of the BCG vision requires coordinated decision-making between national and regional authorities. The main follow-up actions are as follows: (1) North Karelia 400 kV grid investment; (2) pilot legislation for a Special Economic Area in Eastern Finland (EEA); (3) harnessing local energy sources and strengthening regional vitality; (4) an Authorisation Process Acceleration Package (the '90-day model'); (5) a data centre and district heating integration model, alongside the further development and commercialisation of waste heat utilisation technologies; (6) Ostrobothnia's ZERO Valley – a net zero area; (7) a photonics and energy collaboration system; (8) a Nordic metacluster platform; (9) enhanced cooperation between Ostrobothnia and Sweden as a strategic resource; (10) a forecasting project addressing the regional competence, education and RDI needs of the energy cluster; (11) a requirement for the Defence Forces to set out the conditions for wind power construction from their perspective; and (12) an RDI programme for energy system integration.

Follow-up actions can be classified in several ways and according to different criteria. In this context, the aim has been to distinguish between actions that can be implemented rapidly and are likely to have an immediate impact, taking into account, among other factors, the ongoing preparation of the next Government Programme for Parliament of Finland. Such proposals include, in particular, follow-up actions 1–6. By contrast, follow-up actions 7–12 require a longer timeframe and are expected to yield effects over the longer term.

For example, summaries of the results have been entered into the Finnish Parliament's shared database to inform the preparation of the next Government Programme. The cooperation group of the parliamentary parties' information policy actors asked the authors for initiatives related to the topics of information and technology policy (tietopolitiikka.fi) of the next Government Programme, which were edited by the authors. Relevant initiatives include, in particular, actions 1, 2, 7 and 9. In addition, a seminar was held in Parliament in spring 2026 to discuss the potential of photonics and the energy cluster, in line with action 7.

One approach to prioritising follow-up actions, with reference to the results of the BCG matrix, is to direct research and innovation investments towards 'sunrise' and 'star' clusters, while focusing education investments on established sources of cash flow, given their significance in terms of employment and overall volume.

Supporting growth-path development

The combination of foresight and portfolio analysis provides a foundation for constructing growth pathways using the Six-Stage Model for Driving Profitable Growth (the SSMPG model).

When applying The six-stage model of profitable growth model to the analysis, the focus should be on the sunrise industries that are currently in the start-up phase and the related companies and product areas, which in 2045 should be in the stellar phase, i.e. continue to grow strongly and already have relatively large areas of activity and operations. Such sectors include: According to Table 1: 1) System-level energy optimization (AI + digital twin), 2) Industrial waste heat recovery and high-temperature heat pumps, 3) Electricity storage (BESS + hybrid models), 4) DC Networks and Smart Microgrids, 5) Clean marine fuels (ammonia, methanol), 6) Photonics in energy data infrastructure, 7) Demand response platforms and energy community services, 8) Arctic energy technology (resilience conditions), 9) Industrial Carbon Capture and Utilisation (CCU) and 10) Heat storage (sand accumulators, high-temperature solutions).

The six-stage model of profitable growth is applied in such a way that the company's current situation in terms of growth, which is most often described by the number of employees. Education, coaching and business development will be directed at the stages of growth, for example, with the support of actors in the public innovation environment, so that the bottlenecks to growth related to the phases will be removed. Figure 3 shows a brief and outline description of the critical growth drivers of the six-stage model of profitable growth, taking into account the stage of growth (Figure 3, Myllylä & Kaivo-oja 2024b, 2025). Figure 6 models which phases of the Six-Stage Model of Profitable Growth and their identified critical growth factors for each step, for example, are always related to the BCG matrix. The integration model is preliminary and will be tested and refined in the STRAIND project.

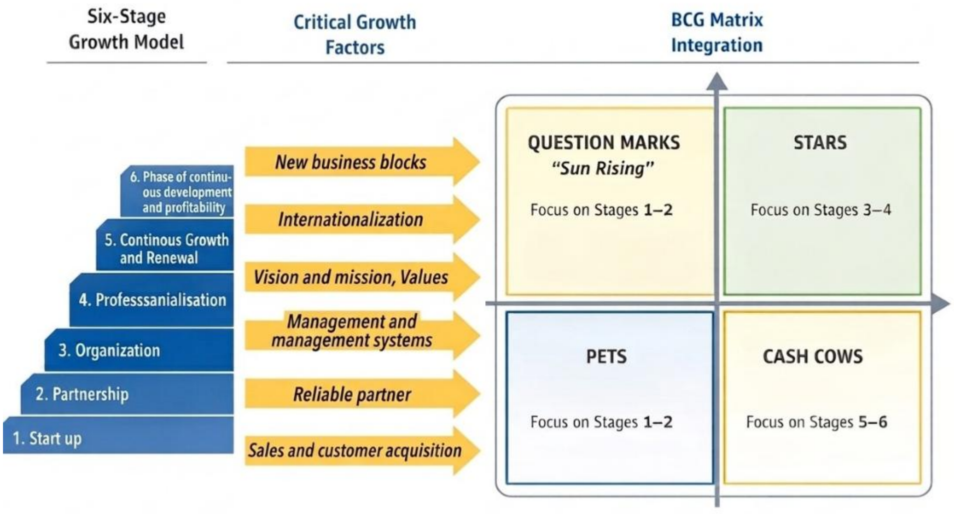

Figure 6 Preliminary integration model of the Six-Stage Model of Profitable Growth and the BCG matrix (Source: Myllylä & Kaivo-oja 2026)

6. Contribution

This paper contributes to research on innovation and industrial policy in three principal ways.

First, the methodological contribution: the paper develops and demonstrates a novel Delphi–BCG framework that integrates expert-based foresight with portfolio-level strategic analysis. In contrast to more traditional applications, the framework enables dynamic prioritisation of emerging technologies under conditions of uncertainty, thereby linking long-term foresight insights directly to strategic investment decision-making.

Second, the theoretical and policy contribution: the paper advances the Smart Specialisation Strategy (S3) and Entrepreneurial Discovery Process (EDP) literature by operationalising mechanisms through which industrial, innovation, and spatial policies may be aligned within regional ecosystems. It demonstrates that regions function not only as implementation arenas, but also as central analytical units for strategic policy design in small, open economies.

Third, the practical contribution: the framework produces actionable policy insights by translating foresight outputs into concrete investment priorities, policy instruments, and regional development measures. The empirical application to the Finnish energy cluster illustrates how policymakers may identify high-potential "star" domains, manage uncertainty, and design coordinated national–regional interventions to support industrial renewal and the green transition.

7. Practical implications

The proposed Delphi–BCG framework provides practical value for policymakers, regional developers, and innovation actors by translating foresight insights into concrete strategic choices and policy actions.

First, the framework enables **evidence-based prioritisation under uncertainty**. By combining expert-based foresight with portfolio logic, it allows decision-makers to distinguish between emerging “Question Mark” domains requiring experimentation and high-potential “Star” domains suitable for scaling and targeted research, development, and innovation (RDI) investments. This supports more efficient allocation of public resources in rapidly evolving technological environments. In this respect, the approach is closely aligned with the Adaptable Foresight framework (Eriksson and Weber, 2008; Korpela et al., 2021), which has broad applicability within the European Union and internationally. The Adaptable Foresight approach has been developed at the intersection of foresight and adaptive strategic planning. Given that contemporary innovation processes are increasingly complex, interdependent, and uncertain, they require broad, multidisciplinary exploration and stakeholder participation. Delphi expert panels can fulfil this exploratory function, conceptually linked to Entrepreneurial Discovery Processes (EDPs). Accordingly, the adaptive planning paradigm provides a useful framework for navigating such complexity, including consideration of whether certain strategic decisions should be deferred until additional information becomes available, and whether to invest in real options that enable future implementation (in this case, towards 2045). In this way, long-term strategic decision-making can be supported in a structured and flexible manner.

Second, the framework strengthens **alignment between national industrial policy and regional innovation ecosystems**. It highlights how regionally embedded capabilities—such as those of the Finnish energy cluster—can be leveraged as strategic assets in national competitiveness. This is particularly relevant for small, open economies in which key capabilities are geographically concentrated. This observation is also consistent with the Smart Specialisation Strategy (S3) and EDP approaches of the European Union.

Third, the approach provides a **transparent and communicable decision-support tool** for complex policy environments. The visual structure of the BCG matrix, combined with Delphi-based expert validation, facilitates structured dialogue between policymakers, industry actors, and research organisations, thereby strengthening Entrepreneurial Discovery Processes (EDPs) within Smart Specialisation Strategies.

Fourth, the framework supports the design of **actionable policy measures and investment pathways**. In the Finnish context, this includes targeted infrastructure investments (e.g. electricity transmission grid development), regulatory innovations (e.g. accelerated permitting procedures), and place-based policy instruments (e.g. special economic zones and net-zero industrial regions). These examples illustrate how foresight-driven portfolio analysis can be directly translated into implementation-oriented policy design.

Fifth, the framework contributes to **long-term industrial renewal and growth pathway development**. By linking portfolio positioning with growth models such as the Six-Stage Model for Driving Profitable Growth, it provides a structured basis for supporting firms and ecosystems in transitioning from early-stage innovation towards scalable and competitive industrial activity. This integration enhances the coherence of implementation planning and growth strategy design.

Finally, the approach is both **adaptable and scalable across sectors and regions**. While demonstrated in the Finnish energy cluster, it is applicable to other domains characterised by technological uncertainty, systemic transformation, and strong regional specialisation. Accordingly, the framework offers a practical methodology for strengthening Smart Specialisation Strategies (S3) across EU Member States and for supporting more coherent, foresight-driven industrial and innovation policy design.

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