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Evaluation of Ecosystem Funding Instruments and Partnership Model

Evaluation by Technopolis B.V. & 4Front

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Management Summary / Policy Brief

This evaluation assignment

The role of Business Finland is to promote the prosperity of Finland by stimulating the emergence of new and innovative initiatives and by supporting the internationalization of the Finnish industry. Business Finland's strategy, updated in 2020, outlines three core areas of prosperity: economic growth, sustainability, and competitiveness. Ecosystems are identified as one of the main tools to advance all three core areas.

Business Finland has four ecosystem instruments that are aimed at building and strengthening the ecosystems. Three are funding instruments: the two types of Growth Engine instruments - the Capital Loan and the Orchestration Funding - and the Leading Company Initiative (known in Finnish as Veturi). The fourth instrument is the Partnership Model, which is a cooperation initiative between Business Finland and the Academy of Finland. Next to the ecosystem instruments, many ecosystem members use other (R&D) instruments from Business Finland.

In this evaluation the suitability and impact of the ecosystem funding instruments and the Partnership Model are analysed in relation to the strategic goals. The timing of this evaluation allows for an early impact assessment of the Growth Engines, and a design evaluation of the Leading Company Initiative and Partnership Model. The approach used in this impact study of the ecosystem policy consists of a balanced mix of qualitative and quantitative methodologies. Main methodologies used include desk research, interviews, case studies, network analysis based on webscraping, and econometric analysis. The study was overseen by Business Finland and a Steering Group, and executed by independent evaluation consultants from Technopolis Group and 4Front.

Importance of the ecosystem instruments for Finland

Ecosystems provide a structure for companies to outline strategic goals, collaborate in R&D, innovation and internationalisation projects and activities, interact with academia, address key bottlenecks and act upon shared opportunities. The instruments of Business Finland are a key driving force for the ecosystems in Finland. Each instrument provides different value to the ecosystem development and performance:

- **The Growth Engine Capital Loan** provides opportunities for radical renewal, as it initiates ecosystems around platform companies. The high-risk-high-reward concepts provide an avenue for developing new business concepts within the economy of Finland.
- **The Growth Engine Orchestration Funding** provides funds for supporting services to develop ecosystems and collaboration within the ecosystems. Overall, companies often lack in coordination and funds for the early development stages and operations of ecosystems.
- **The Leading Company Initiative** provides companies with large R&D subsidies organized in a strategic way through a centralized roadmap. The Leading Company, often a large multinational, provides members with an avenue to collaborately invest in strategic innovation activities. The Leading Company itself receives a large financial impulse as well, stimulating them to invest in R&D activities within Finland.
- **The Partnership Model** mainly supports the link between companies with academia and their key activities as part the Flagship Programme of the Academy of Finland.

Importance of the ecosystem instruments for businesses

The ecosystem instruments overall provide support for important collaboration structures for companies and strategic partners such as knowledge institutions. Within that scope, each instrument plays a different role for companies:

- **The Growth Engine Capital Loan** provides access to capital for platform companies in their start-up/scale-up phase. In this phase companies are often in need of capital to invest in their business and business models. Other companies benefit from the company development as they can launch new products/services through the platform concepts.
- **The Growth Engine Orchestration** Funding provides funds for supporting services to develop ecosystems and collaboration within the ecosystems. Overall, companies often lack in coordination and funds for the early development stages and operations of ecosystems.
- **The Leading Company Initiative** provides companies with large R&D subsidies organized in a strategic way through a centralized roadmap. The Leading Company, often a large multinational, provides members with an avenue to collaborately invest in strategic innovation activities. The Leading Company itself receives a large financial impulse as well, stimulating them to invest in R&D activities within Finland.
- **The Partnership Model** mainly supports the link between companies with academia and their key activities as part the Flagship Programme of the Academy of Finland.

Role of Business Finland regarding the ecosystem instruments

With regard to the instruments, Business Finland is most importantly fulfilling the role of funder. Across the different instruments this concern loans for the Capital Loan and subsidies for the other funding instruments. Business Finland also assesses many project proposals for R&D projects, either through their separate R&D instruments or through the earmarked funds for ecosystem members of the Leading Company Initiative.

Next to the role as funder, Business Finland provides the ecosystems with non-financial support (sparring partner, account management, monitoring, etc.). Overall, this role has been limited due to a lack of capacity and in some cases limited knowledge of the business area. Business Finland has not signaled strong support or given constructive feedback to the ecosystems.

Results and impacts

- **The Growth Engine - Capital Loan:** The supported platform companies are often in their start-up/scale-up stage of development, their capacity to also address the challenges of ecosystem development & member performance is very limited. Many of these concepts are high-risk-high-reward, meaning many will not be successful, but a success can have a large impact. As such, at portfolio level no ecosystem effect were found. The platform companies are not always able to effectively use the funds, partly due to their size, but mainly as there is (perceived) unclarity about when investments are relevant for the ecosystem (and not only for the company). There is a potential for conflict of interest between the use of the funds for ecosystem development and business development. The debt created by the Capital Loan also makes it harder for these companies to attract further private capital.
- **The Growth Engine - Orchestration Funding:** The central management of the ecosystem creates clear governance that benefits the ecosystem, the neutral position of the orchestrator makes sure the ecosystem works for the benefit of all members. The activities of the orchestrators (networking, etc.) are quite distant from the high-level goals set by the

instrument, including R&D and innovation results, as well as business results such as export. Orchestrators often perform well on some, but not all, of these aspects.

- **The Leading Company Initiative:** The ecosystems have a strong sense of direction due to the driving role of the Leading Companies and the roadmap that sets out the vision. This helps to improve the long-term perspective and direction of R&D funding. The role of the Leading Companies is however quite dominant, creating limited transparency regarding and commitment for future collaboration with members. With limited incentives to spend efforts on ecosystem development, this leads to mixed results. The R&D investments are strongly supported and connections are built at project level. Overall, the ecosystems are very project-driven, coupled with the pressure of the national 4% R&D investment target, creates some concerns with regards to oversaturation and haste as well as a lack of cohesion and synergy between projects.
- **The Partnership Model:** The potential of the Partnership Model is quite large, but in practice no real alignment has been achieved between the Leading Company Initiative and the Flagship programme. There are plenty of opportunities to align existing ecosystems and flagships that work on similar topics. Deeper alignment will require a shared vision on increasing the utilization of R&D between Business Finland and the Academy of Finland.

In the table below a reflection is given on the ecosystem policy from the perspectives of different types of additionality.

Input additionality: effects of resources provided through the ecosystem instruments.

A key aspect of input additionality is the potential of the ecosystems. While this is inherently difficult to analyze, especially this early in the development of the ecosystems, there are some core aspects that indicate that the potential of the supported ecosystem is high. Compared to the overall economy, the ecosystems clearly include the higher performing companies active in Finland. Small and upcoming companies participate strongly in the ecosystems, yet the positioning, role and support for these companies requires more attention. Further improving the interaction between academics and companies, for instance through the Partnership Model, can further strengthen the influx of new knowledge and ideas that can lead to industrial transformations.

The potential for the development of the ecosystem is strongly tied to the role of the leading actors in the ecosystems. While each of the instruments have very different leading actors, it is clear that strong leadership is required for the ecosystems to excel. The capacity to lead is clearly too low in the Capital Loan ecosystems. For the Orchestration Funding the leadership is organizationally strong and neutral, while weaker on the business strategy side. The leadership in the Leading Company Initiative is organizationally strong although not neutral. In the context of long-term ecosystem development, capacity building remains an area of concern.

The public funding provided clearly has a strong impact on private activities. The Capital Loan is used to work towards success of high-risk-high-reward platform concepts, although the design of this instrument is not fitting for start-up companies. In case of the Orchestration Funding, network activities are organized, projects are set up and information is shared. For the Leading Company Initiative ecosystems strong private investments in R&D are undoubtedly present. The size of the funding does however raise some concerns regarding the focus on realizing R&D projects rather than on those projects with the best prospects and best fit with other activities.

While the individual instruments have their challenges, collectively the instruments include the aspects needed to support ecosystems: leadership, orchestration, strategy, (radical) renewal, coherence, R&D investments, room for collective dialogue, etc.

Behavioural additionality: change in the behaviour & processes of companies/ecosystems.

The role of the leading organization is key in setting the tone for the ecosystem. Overall, the evaluation shows that ecosystems with clear leadership and a clear strategy have better performance. Ecosystems that are still exploring their key business strategy struggle the most with aligning ecosystem activities, activating ecosystem members and reaching results. In some cases, the leadership can also be quite dominant. This can push things forwards, but can also lead to a lack of commitment of members. In many ecosystems, the role and responsibilities of the central actor remain unclear to the ecosystem members. At the same time, the (often many) objectives (KPIs) of the instruments can be a source for unclarities.

Across the ecosystems, quite a large private investment in R&D is observed, in those with less R&D other relevant activities are performed, such as building international connections for increasing export. The R&D activities performed often are more research than development oriented. The knowledge exchange between companies is therefore more fundamental, moving closer to the market (shared product/service development) remains challenging.

The steps towards long-term ecosystem development were less clear. Overall, ecosystems need a lot of time and shared commitment in order to build towards self-sustainable ecosystems. Many ecosystems in the portfolio, especially the Leading Company Initiative, have a temporary nature according to interviewees.

Output additionality: the results that are realized due to the ecosystem instruments.

Output additionality is too early to judge for the Leading Company Initiative, although the high investments in R&D can be perceived as good prospects for the future. Also the Growth Engines need more time to reach results as many only exist for 2-4 years versus a horizon of 10 years of support. For the Capital Loan not many results are expected at portfolio level due to the high-risk-high-reward nature of the platform companies. In case of success the results can however be very large. For the Orchestration Funding the results will be mixed across the different ecosystems given the large differences between them. Overall, the orchestration activities are quite distant from business effects, as orchestration activities support the preconditions for business activities that in turn need to lead to effects. Nevertheless, across the ecosystems we find positive quantitative effects regarding export and export intensity. While not all ecosystems have focused on R&D projects, these export results can also hardly be an effect of R&D activities given short timeframe to translate R&D results into exportable products/services.

Socio-economic impact: impacts on economic growth, sustainability, and competitiveness.

For the contribution to competitiveness and growth the instruments provide a strong R&D impulse, with the Leading Company Initiative as largest contributor. Besides the R&D impulse, it is unclear how much space there is within the instrument to support other types of activities. Ecosystems should be able to address a wider range of aspects (more than R&D) to work towards competitiveness and growth as they provide a platform for members to collectively address key opportunities and challenges across a wide range of topics – also beyond R&D.

In terms of R&D, the efforts of the Leading Company Initiative can be cutting edge, however, in large part the roadmap follows the development paths of established businesses. For radical renewal, business concepts and innovations that challenge established businesses, there is limited support in the current instruments. The Capital Loan does focus on such concepts, but does not function well in terms of ecosystem development and is only aimed at high-risk-high-reward platform companies. At the same time, through the strong positioning of knowledge institutes knowledge does flow into the ecosystems, which can be improved by more boldly putting the Partnership Model into practice.

Overall, the ecosystems can add clear value to the economy and society of Finland. The financial means are sufficient and the instruments collectively provide a good basis to support the key functions of ecosystems.

Current state of play

The instruments provide value to the objectives of Business Finland, while still having their individual challenges. Collectively the instruments include the aspects needed to support ecosystems and there are clear insights on how the instruments can be further improved. Overall, supporting ecosystems requires a long-term approach. At this stage the Growth Engine instruments supported ecosystems for about 2-4 years, while the Leading Company Initiative and the Partnership Model have just been introduced. This shows that the time for results to materialize has been limited. Evaluation findings should be used to further refine the approach, while long-term commitment of public support towards the ecosystems should be maintained. Interaction with the key stakeholders within the ecosystems should be nurtured as within the dialogue Business Finland can continuously learn more about the realities of managing and collaborating within ecosystems and about the role and impact of the instruments.

KEY OBSERVATIONS (selection)

- The Growth Engine - Capital Loan: The Capital Loan allows for investment in new strengths for the economy (radical renewal). Investments have the potential for high returns: in case the platform company is a success, returns can be large. At the same time, the platform companies concern high-risk ventures for which many external factors will determine the success. Theoretically combining ecosystem and business development is a win-win. The three somewhat separate objectives (business development, ecosystem development, and ecosystem member performance) are, however, too much to ask from a start-up. As a results effects within the ecosystem are secondary: 1) funding is only aimed at the platform company, 2) the platform company has little control over activities of ecosystem member, and 3) ecosystem members are not involved in the ecosystem strategy.

- The Growth Engine - Orchestration Funding: The orchestration Funding creates specific attention for ecosystem development (versus focus on R&D, business, etc.). The central neutral orchestrator provides clear management and all members have equal access to the ecosystem functionalities. Ecosystems can, however, be orchestrator and KPI driven (export, R&D projects, etc.) instead driven by business needs. At the same time, the link between orchestration activities and these types of results are often somewhat intangible. Nevertheless, some positive econometric positive associations for export, mainly on export intensity were found. The strong focus on R&D and export does not incentivize other ecosystem activities (human capital development, standardization, regulation, etc.). For long term development, the pay-as-you-go service model will be difficult to sustain.
- The Leading Company Initiative: Ecosystems have a strategic approach revolving around a clear roadmap, this creates a longer term cycle, a sense of direction and members can rally around a specific 'mission'. Ecosystems have a clear driver with commitment and capabilities. Leading Companies bring in a lot of experience and stability. The Leading Companies do have a dominant role within the ecosystems, without specific incentives for facilitating the ecosystem and providing equal opportunity. The ecosystems are not very attractive for SMEs, who are looking to develop products and services, but they cannot sell these to the Leading Companies. Overall, the instrument clearly secures R&D investments in Finland. The R&D performed is focused more heavily on the research side of R&D. Closer to the market, companies are less willing to collaborate and share knowledge. The role of universities / knowledge institutions is quite large.
- The Partnership Model: The Partnership Model has large potential and there are low hanging fruit opportunities for stronger alignment. So far no real alignment has been realized. A shared vision on increasing utilization R&D between Business Finland and the Academy of Finland seems like an important next step.

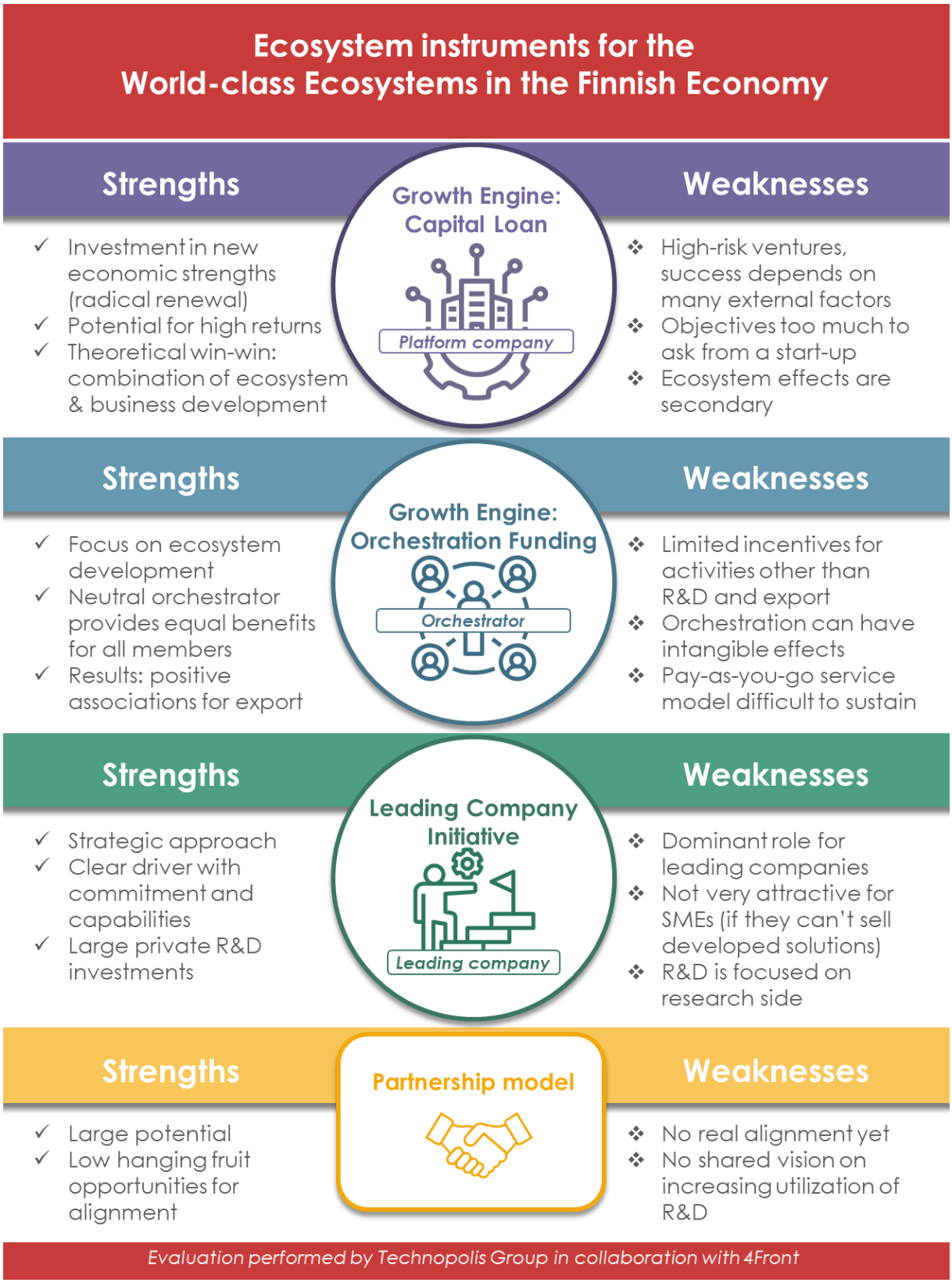
Forward looking statement and recommendations

The evaluation gives some clear indications on how the instruments can be further improved. Recommendations are numerous as they are provided at instrument level and across the instruments. Below a selection of recommendation is presented.

RECOMMENDATIONS (selection)

1. Business Finland should encourage and demand from the ecosystems to have stronger leadership and set up mutually agreed specific strategic objectives.
2. Business Finland should streamline its ecosystem instruments towards a set of key functions within ecosystems (R&D investments, ecosystem development, permanent R&D capabilities and infrastructure, enabling radical renewal).
3. Business Finland should take an active role in outlining & realizing the ecosystem strategies, by being a strategic partner within the ecosystems.
4. Capacity building within the ecosystems and Business Finland needs to be made a priority.
5. Growth Engine - Capital Loan: Support radical renewal within ecosystems, but separate this from the support for ecosystem development.
6. Growth Engine – Orchestration Funding: Specify more clearly the added value of orchestration activities towards overall ecosystem objectives, without undervaluing the value of orchestration.
7. Leading Company Initiative: Maintain the strength of generating large private R&D investments while improving transparency for and commitment of ecosystem members.
8. Partnership Model: Prioritize active alignment of the Leading Company Initiative with the Flagship programme of Academy of Finland.

Infographic of main results



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1 Overview of the evaluation

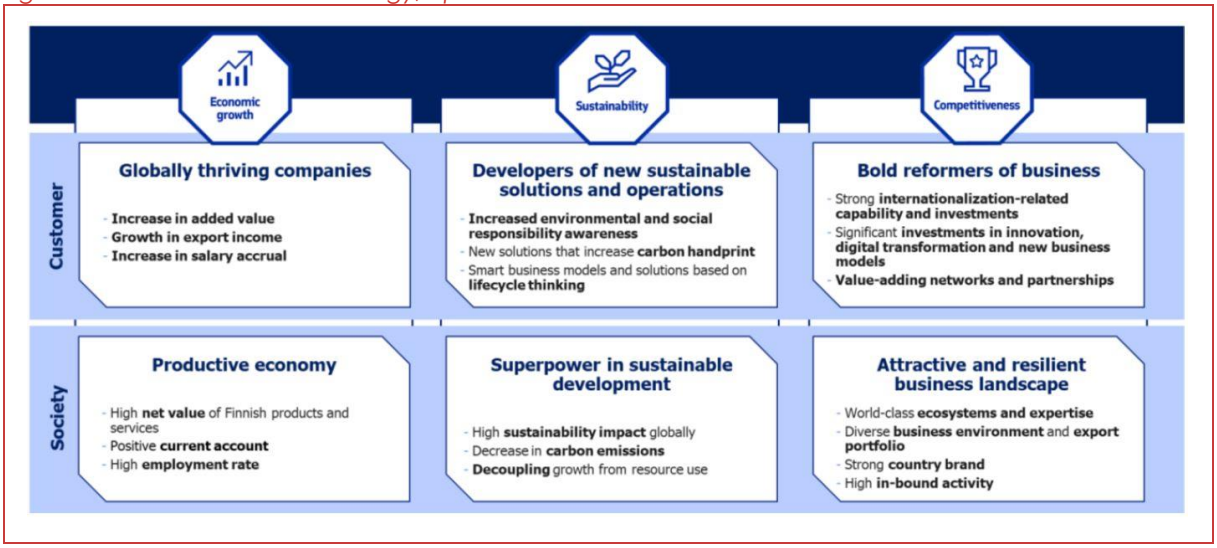
This is the introductory chapter of this evaluation report regarding the ecosystem funding instruments and partnership model of Business Finland. Here we introduce the aim and scope of this evaluation and outlines the evaluation questions, impact framework and methodologies used. At the end we provide a reading guide for this report.

1.1 Aims and scope of the evaluation

The basis of Finnish wellbeing stems from the wealth and jobs created by the success of Finnish companies in the global market. The role of Business Finland is to promote the prosperity of Finland by stimulating the emergence of new and innovative initiatives and by supporting the internationalization of the Finnish industry.

Business Finland's strategy was updated in 2020. The updated strategy outlines three core areas of prosperity that are economic growth (globally thriving companies; productive economy), sustainability (new sustainable solutions en operations; sustainable development), and competitiveness (bold reformers of business; attractive and resilient business landscape). Ecosystems are identified as one of the main tools to advance all three core areas. The updated strategy is presented visually in Figure 1.

Figure 1 Business Finland's strategy, updated in 2020.



Business Finland 2020

1.1.1 Four ecosystem instruments

Business Finland has four ecosystem instruments that are aimed at building and strengthening the ecosystems. Three are funding instruments: the two types of Growth Engine instruments - the Capital Loan and the Orchestration Funding - and the Leading Company Initiative (known in Finnish as Veturi). Next to that there is the Partnership Model, which mainly is a cooperation initiative between Business Finland and the Academy of Finland. In the Partnership Model the main objective is to align the Leading Company Initiative from Business Finland with the Flagship Programme from the Academy of Finland.

Next to the ecosystem instruments, many ecosystem members use other (R&D) instruments from Business Finland. Through these instruments many projects are funded as well.

1.1.2 *Two types of evaluations*

In this evaluation the suitability and impact of the ecosystem funding instruments and the Partnership Model are analysed in relation to the strategic goals. The timing of this evaluation allows for an early impact assessment of the Growth Engines, as these ecosystems are now supported for 2-4 years. It should be needed that for impact, this is still a relatively short period of time. For the Leading Company Initiative and Partnership Model, it concern a design evaluation both instruments just started: the first round of ecosystems started their operations in 2020.

1.1.3 *Analysis of additionality and impact*

The evaluation model of Business Finland revolves around four types of additionalities and impacts. The model helps to clarify the positive and negative impacts of the instruments on the core areas from the strategy, including impacts on key aspects such as competition, market behaviour and trade. The four types of additionalities and impacts are:

1) **input additionality**, i.e. what is the impact of public funding and other activities (interventions) on private RDI and other investments;
2) **behavioural additionality**, i.e. what is the impact of interventions on the behaviour of companies and research organisations (level of ambition, quality of RDI, collaboration and networking, competences, etc.);
3) **output additionality**, i.e. what are the impacts on the results and outcomes of the interventions; and
4) **socio-economic impact**, i.e. what are the impacts on economic growth, sustainability, and competitiveness.

For these additionalities and impacts the main topics to address in the evaluation were outlined by Business Finland. An overview of these main topics are resented in Table 1. For many of these topics the evaluation will reflect on the main evaluation findings (conclusions), the role of Business Finland and the perspective on the future (recommendations).

Table 1 Overview of the main evaluation topics

Adiditionality & impact	Evaluation topics
Input additionality	Resources in the ecosystems; Ecosystem potential; Impact on private R&D investments; Public support and self-sufficiency of ecosystems; Suitability of the instruments; Functioning of the Partnership Model
Behavioural additionality	Role and capabilities of different ecosystem actors; Capabilities for creating successful ecosystem; Impact on ecosystem operators' behaviour; Sustainable development of the ecosystems (sustainability & long-term ecosystem development)
Output additionality	Business models and added value; Creation of business effects (employment, turnover, jobs, added value, export, etc.); Role of multinationals and foreign owned companies
Impacts to the Finnish Economy and Society	Contribution to competitiveness and growth; Ecosystem excellence; Attracting global actors to Finland; Sufficiency of resources for creating *"world class ecosystems"*

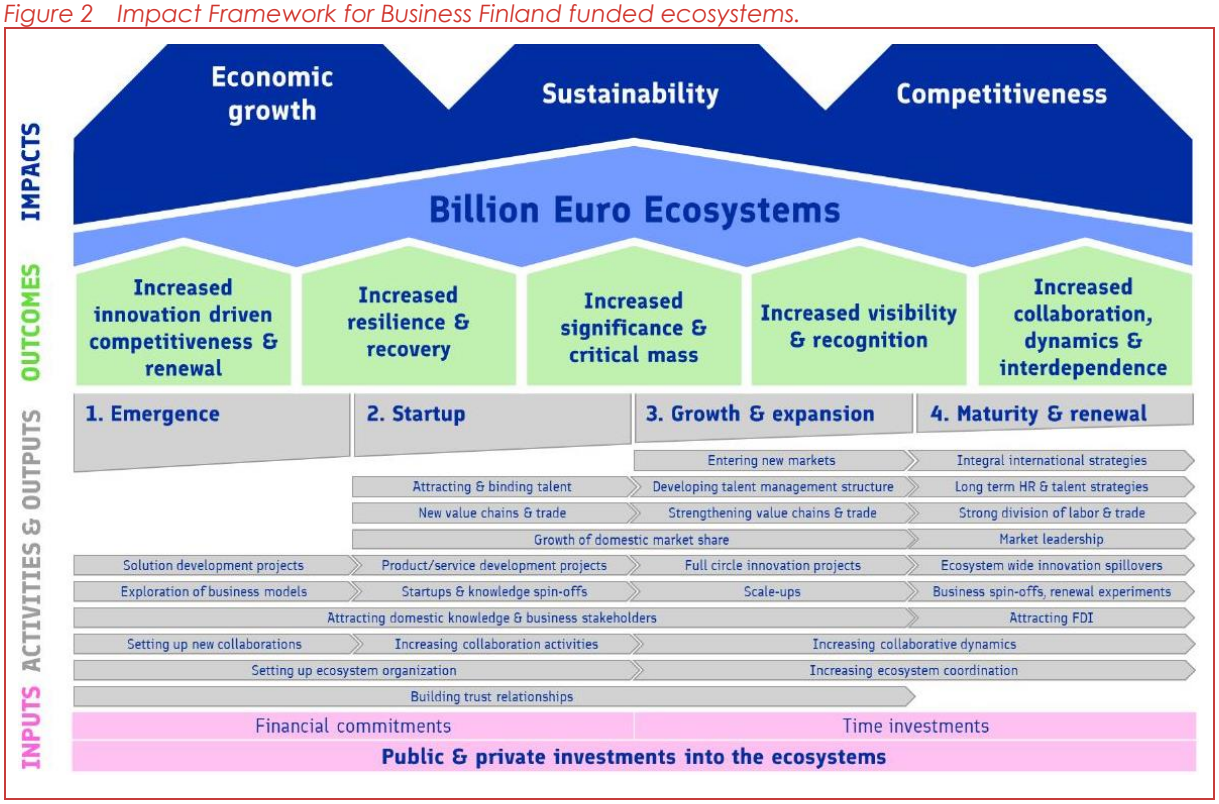
Technopolis Group & 4Front 2022, based on input from Business Finland

1.2 Methodology of the evaluation

For guiding the evaluation of the ecosystem instruments the impact framework for funded ecosystems was used. The impact framework, shown in Figure 2, shows how ecosystems, across

stages of maturity, can contribute to key outcomes and eventually impacts through a wide range of activities. These activities comprise of ecosystem development activities, such as building trust relationships and setting up the ecosystem coordination, as well as business activities, such as R&D and market expansion.

Figure 2 Impact Framework for Business Finland funded ecosystems.

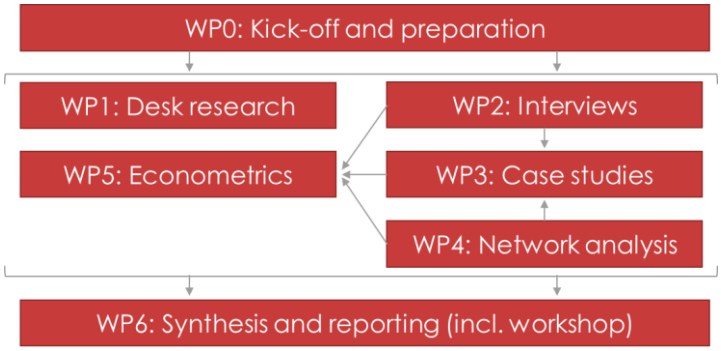


Business Finland 2021, based on the work of Piirainen et al 2020 & Zegel et al 2021

1.2.1 Methodologies used in the evaluation

In the evaluation a mix of qualitative and quantitative methods was used. In the methodology mix desk research was used to make use of the existing knowledge base and to analyse the (design of the) instruments. Interviews were preformed with key staff from Business Finland and the Academy of Finland to discuss the design, the challenges/opportunities and the coherence between instruments. Next to that nearly forty impact interviews were performed with companies to analyse how their participation in the ecosystem contributed to business effects. Eighth extensive case studies were preformed to analyse the ecosystems and the instruments supporting them in high detail. The case studies were instrumental to understand the instrument in a large variety of contexts, each with their own unique organisational structure, key members, etc. More quantitatively, an econometric analysis was performed to analyse the effects for companies on a set of core indicators and to perform more descriptive analyses. In the network analysis, the websites of ecosystem members were scraped to identify cross references to names of other ecosystem members, based on this data ecosystem networks were plotted. Internet history was used to see which connections were present before joining the ecosystem. Figure 2 provides a schematic overview. In the annexes A, B, C and D-K, more details are provide for the methodologies. These include the drafted case studies, econometric analysis, network analysis results, and an overview of the interviews.

Figure 3 Overview of the methodologies used in the evaluation



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1.2.2 Key methodological limitations

While the mix of methodologies provide a strong basis for evaluative analysis and conclusions, the methodologies do have some key limitations that need to be taken into account. These are:

- The evaluation has a complex structure as in essence it is a combination of four evaluations. Combined with the different styles in evaluation (impact versus design) puts pressure on the evidence base and the way to present the results in the report.
- There are some specific data limitations that limit the ability to perform very extensive econometric analyses to determine effects. To start, many of the high performing companies participate in the ecosystems, as such, it is quite challenging to find a suitable control group. The way ecosystems work, as opposed to other types of instruments, also excludes some models, for instance some that revolve around 'selection scores'. Some of the main indicators to use in these models, such as R&D intensity, are not available for the companies. Furthermore, no indicators are available for their role in the ecosystem, such as indicator about activeness in the ecosystem, date of joining, participation in ecosystem activities, etc.
- Some data limitations also impacted the network analysis based on webscraping. Many websites have been manually added, but not all were available / could be found. The webscraping methodology provided useful data to plot connections, but the data does not provide the full picture of collaborations. The history data adds an interesting perspective regarding the growth of connections. However, growth compared to todays figures can be attributed to different aspects. Next to new formed connections, it can also be partly due to missing/not-stored data, changes in website structures over the years, and new companies or (change in) company names.
- For the evaluation it was opted not to use a survey, as in previous studies it was very challenging to obtain a strong response from the companies. Therefore, the number of interviews was increased to gather information from a larger base of companies. While this number was decently high (nearly forty), the responses were distributed across the instruments, making samples per instrument limited. This was partly countered by performing additional interviews in the context of the case studies. The qualitative results overall are very rich, but insight remain to some extent anecdotical given the strong differences between ecosystems.

1.3 Reading guide

The report is structured as follows. First, in chapter 2, an overview of the instruments and ecosystems is presented. Afterwards we present an analysis at instrument level. These chapters presents the main evaluation findings for per instrument, describing the main findings with regards to the ecosystem operations and development as well as ecosystem results from the perspective of each instrument. The Growth Engine instruments are presented in chapter 3, for the Capital Loan, and chapter 4, for the Orchestration Funding. The Leading Company Initiative and Partnership Model are presented in chapters 5 and 6.

In chapter 7 conclusions are first presented at instrument level, afterwards conclusions are drawn across the instruments with regards to the additionalities & impact, addressing the evaluation topics for each. In chapter 8, based on the findings and conclusions, the main recommendations are presented.

2 Overview of the instruments and ecosystems

2.1 The ecosystem (funding) instruments

In this chapter we present a concise description of the four ecosystem instruments, as outlined in sections 2.1.1 to 2.1.4. The four instruments consist of three funding instruments and one cooperation initiative between Business Finland and the Academy of Finland. The Growth Engine instruments have been actively supporting ecosystems for the past 2-4 years. The Leading Company Initiative started supporting ecosystems from 2020 onwards. The Partnership Model is linked to the Leading Company Initiative. In Table 2 an overview of the instruments is presented.

Table 2 Overview of the ecosystem instruments

Instrument	Description
Growth Engine Captial Loan	A loan provided to platform companies in order to develop their business and business model. The platform concept needs to provide opportunities for ecosystem members to launch new products/services. The platform company is expected to invest in the development of the ecosystem.
Growth Engine Orchestration Funding	A subsidy for a neutral orchestrating actor that leads the ecosystem by providing services to the ecosystem members. Activities are strongly aimed at collaboration, sharing information and professional competences and developing (R&D) projects between members.
Leading Company Initiative (Veturi in Finnish)	A large subsidy for a centrally placed Leading Company for R&D activities, as well as a large subsidy budget for R&D projects of ecosystem members. The Leading company sets up a strategic roadmap to outline the direction fo the ecosystem. Leading Companies can use part of their budget to develop the ecosystem.
Partnership Model	A collaboration concept between Business Finland van the Academy of Finland, specifically aimed at creating synergies between the Leading Company Initiative and the Flagship programme. Collaboration is aimed at long-term commitments to R&D cooperation to improve the utilization of R&D activities by companies.

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2.1.1 *Instrument description: Growth Engine - Capital Loan*

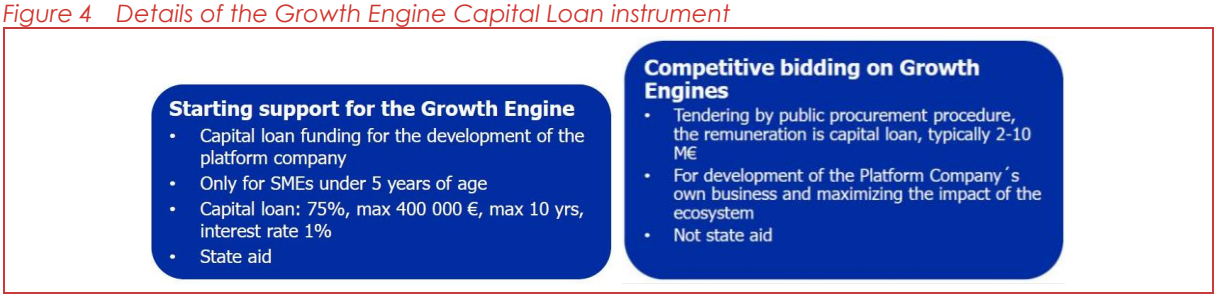
The Growth Engine Capital Loan consists of two types of loans: a starting loan[1] and a loan as part of a competitive bidding[2], both aimed at supporting platform companies. In Figure 4 the details of the instrument are presented. Ecosystems are aimed at creating ≥ €1 billion new business, exports and/or investments.

Platform companies for the starting loan need to SMEs under 5 years of age and for the competitive bidding there are no restrictions, in practise platform companies are typically start-up or scale-up companies.

Funds from the Capital Loan can be used to invest in business development of the platform company, in the preparation of network effects and generating impacts. Specifically for the starting loan it is specified that funding cannot be used for operations related to exports. For the competitive bidding funded activities are less defined, as long as activities contribute to developing the company's business and generating impact.

The platform concept needs to create a solution for the ecosystem, allowing ecosystem members to develop new business (products/services) that make use of the concept. In essence there are three objectives linked to the loan: 1) development of the company; 2) development of the ecosystem; and 3) increasing the economic performance of ecosystem members.

Figure 4 Details of the Growth Engine Capital Loan instrument



Business Finland 2018, *Business Finland services for Growth Engines*

2.1.2 *Instrument description: Growth Engine – Orchestration Funding*

With the Growth Engine Orchestration Funding instrument Business Finland supports orchestration actors that provide services to ecosystem members.[3] The instrument is aimed at business spearheads with a potential of creating ≥ €1 billion exports. Figure 5 shows the details of the instrument.

The funding is mostly aimed at companies, associations or foundations to fullfill the role of orchestrator in the ecosystem. However, research organisations or other public actors are not explicitly excluded. Typically, orchestrators are companies that have high organisational strengths, but are typically not active within the business area itself. Often these are consultancy type of companies.

[1] https://www.businessfinland.fi/en/for-finnish-customers/services/funding/growth-engines/starting-support-for-the-growth-engine-platform-company-by-provision-of-capital-loans

[2] https://www.businessfinland.fi/en/for-finnish-customers/services/funding/growth-engines/competitive-bidding-on-growth-engines

[3] https://www.businessfinland.fi/en/for-finnish-customers/services/funding/growth-engines/funding-for-the-orchestration-of-growth-engines

Funding is to be used for strengthening the network of ecosystem members, stimulating information exchange, supporting international cooperation and other (international) collaborative efforts. Orchestrators are also tasked to activate the network to set up joint research, pilot and demo projects. Funding is typically provided in rounds of two-year periods for a maximam of ten years.

Activities within the orchestrated ecosystem need to support a common goal, described in a joint growth vision and action plan. Activities need to be goal-oriented and need to revolve around collaboration between members. Innovation cooperation and information sharing are two key aspects listed in the instrument description. Results and impacts of the ecosystem are, however, defined in terms of business operations, exports, job creation, and investments and the global market potential of the ecosystem is stressed. Finally, a plan for "self-sufficiency" needs to be part of the overall ecosystem development.

Figure 5 Details of the Growth Engine Orchestration Funding instrument

Business Finland 2018, *Business Finland services for Growth Engines*

2.1.3 Instrument description: Leading Company Initiative (Veturi)

The Leading Company Initiative provides a large subsidy to a Leading Company to perform R&D in line with their strategy and developed roadmap.[4] This subsidy can have a maximum of €20 milion and typically this is the amount companies aim for during the competitive challenge to acquire the grant. Next to this large subsidy, Business Finland provides funding for R&D projects form a subsidy budget of up to €50 million to ecsosytem members during a period of five years.

Funding is specifically aimed at performing R&D. Leading Companies can however, spend 20% of these funds for activities that support their R&D activities. In this space Leading Companies are expected to support the development of the ecosystem.

Objectives are not specified at the level of the instrument. Rather, the development roadmap should outline how the ecosystem intends to generate results and impacts. The instrument does outline that roadmaps should be aimed at significant future challenges.

2.1.4 Instrument description: Partnership Model

The partnership model is a cooperation initiative between Business Finland and the Academy of Finland.[5] The model is specifically aimed at creating synergies between the Leading Company Initiative and the Flagship programme. Through the cooperation it is foreseen to

[4] https://www.businessfinland.fi/en/for-finnish-customers/services/funding/funding-for-leading-companies-and-ecosystems

[5] https://www.businessfinland.fi/en/whats-new/calls/2021/partnership-model-funding-call-for-companies-and-research-organizations

create better conditions for long-term R&D cooperation by creating more predictable partnerships and long-term commitments and objectives between academia and companies. Ultimately, the aim is to improve the utilization of R&D findings. In order to achieve this, Business Finland and the Academy of Finland are expected to intensify their cross-administrative cooperation.

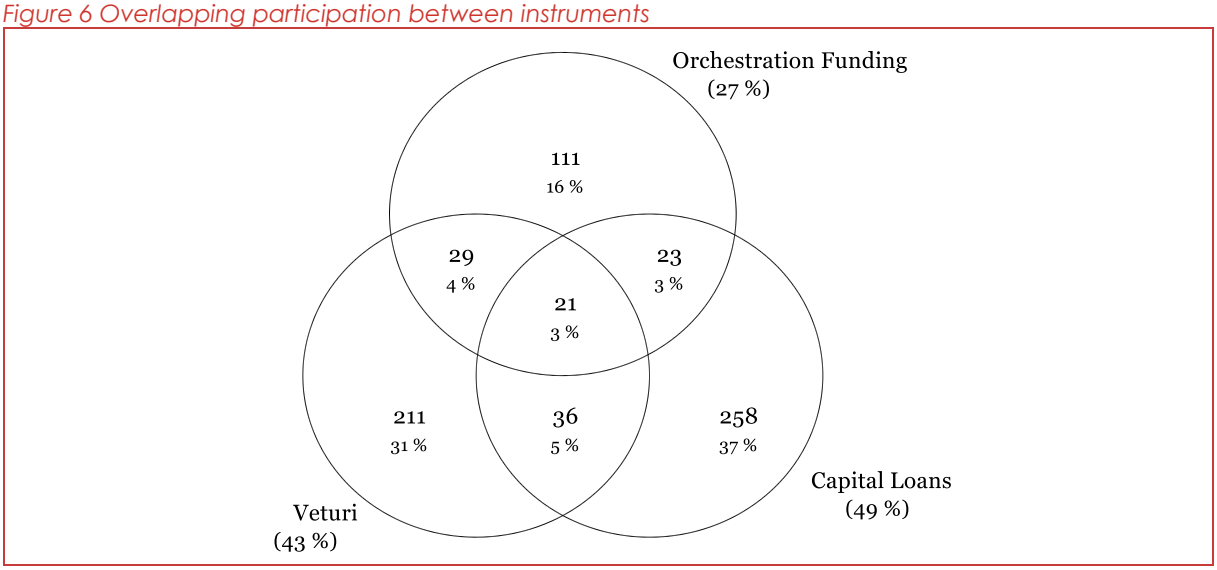
The subsidy budget for ecosystem members of the Leading Company Initiative, as described in section 2.1.3, is strongly tied to the partnership model. Leading Companies are tasked with encouraging ecocystem members, both companies and research organisations, to develop R&D projects to contribute to the mission of the roadmap. These projects can have different structures: 1) individual RDI projects; 2) co-Innovation projects involving several companies; or 3) co-Innovation projects involving companies and research organizations.

2.2 The ecosystems

Although this evaluation is aimed at the (funding) instruments for ecosystems, many of the ecosystems have been analysed as part of this evaluation to identify the effects of the instruments. In total 34 supported ecosystem were part of the analysis of this evaluation: 13 ecosystems are supported by the Growth Engine Captial Loan; 9 ecosystem are supported by the Growth Engine Orchestration Funding; and 12 ecosystems are supported by the Leading Company Initiative and Partnership Model. The Growth Engine typically started between 2018 and 2020, whereas half of the Leading Company Initiative ecosystems started in 2020 and the rest in 2021 and 2022.

The data analysis performed mainly covers the ecosystems that started in or before 2020. From recently started ecosystems no data was gathered yet at the time of this evaluation. In the analysed ecosytems nearly 700 actors are active, with some overlap of participation across the ecosystems supported by the different instruments. In Figure 6 a Venn diagram is presented to give an overview.

Figure 6 Overlapping participation between instruments

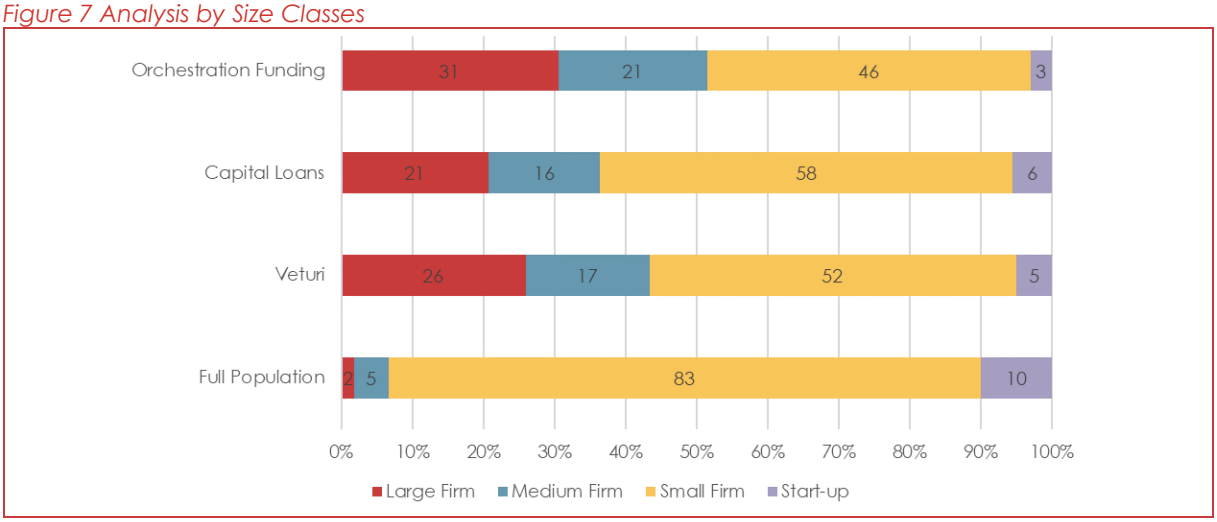


Technopolis Group 2022, based on company data

Looking at the (economic) characteristics of the ecosystem members it becomes clear that the companies in the ecosystems supported by the Growth Engine Orchestration Funding

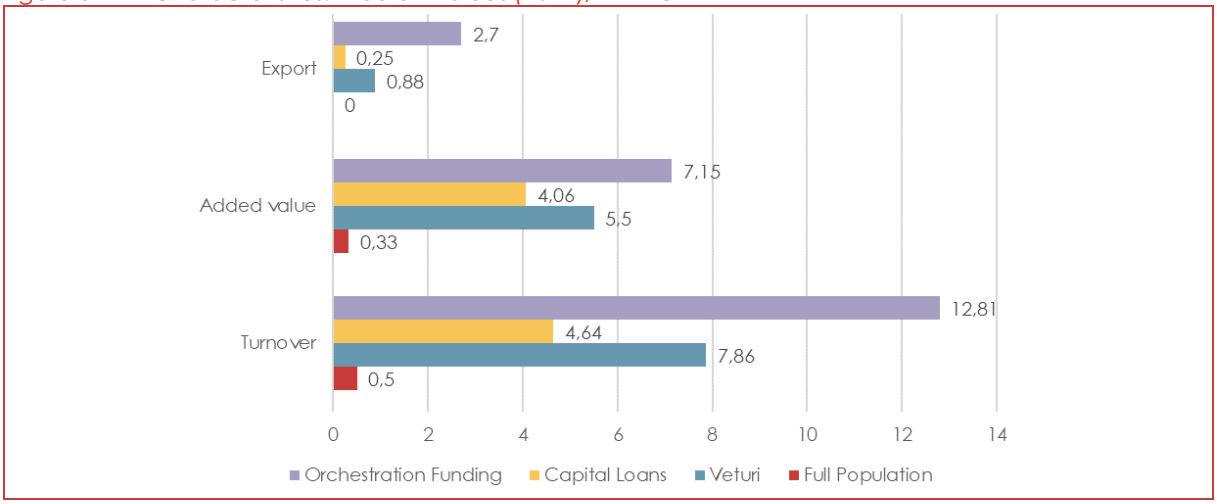
instrument are the largest and most mature. The median[6] value of their turnover and export are a lot higher than for the ecosystems supported by the other instruments. Comparably, the difference between the levels of added value is a lot lower, although Orchestration Funding ecosystem members still show the highest median value. Members of the ecosystems supported by the Leading Company Initaitive also perform really high, however, these ecosystems have more smaller company members in relation to the Orchestration Funding ecosystems. The members of the Capital Loan ecosystems score still quite high considering that the business area is often very new, likely members will have more mature business activites in other/related business areas. Compared to the full population of companies in Finland, all ecosystem members are high performers. See Figure 7 and Figure 8.

Figure 7 Analysis by Size Classes



Technopolis Group 2022, based on company data

Figure 8 Firm Characteristics: Median values (2021), in mEUR



Technopolis Group 2022, based on company data

[6] The median value is the middle number in a sorted list of numbers. In this case if all companies from an ecosystem are ranked based on for instance turnover, the company in the middle of the ranking is selected. Typically this value is more indicative of the population than the average are large figures from multinationals and low figures from start-ups can strongly distort the average value.

The company characteristic show us what type of members the ecosystems have. At the same time these characteristics can be used to analyse which characteristics are predictors for ecosystem participation. The results of this analysis, as shown in Table 3, indicate that the members of the ecosystems supported by the Capital Loan and the Leading Company Initiative have a similar profile. High levels of added value and export intensity (export as part of overall turnover) are shown very clearly. Although innovation and R&D intensity are not available in the company data, the level of export intensity is often used as a proxy variable for innovativeness. For the members of the ecosystems supported by the Growth Engine Orchestrtion Funding, we however see a different pattern. For these members added value and export are the strongest predictors. The high indicator of export shows that thes companies are more focused on large export volumes. Coupled with a negative predictor for labour productivity (also often associated with innovation) shows that these companies are likely less focused on innovation and R&D than companies in the other ecosystems.

Table 3 Predictive analysis

variable	Veturi (2020)	Capital Loans (2016)	Orchestration Funding (2016)
Turnover	-	-	
Added value	++	++	++
FTE			
Labour Productivity			-
Export	+	+	++
Export Intensity	++	++	
Company Age			

Technopolis Group 2022, based on company data

Appendix B provides additional descriptive statistics about the ecosystems supported by the ecosystem instruments.

3 Evaluation findings: Growth Engine - Capital Loan

In this chapter the evaluative analysis is presented regarding the Capital Loan of the Growth Engine instrument. In chapter 4 the evaluative analysis is presented regarding the Orchestration Funding of the Growth Engine instrument.

3.1 Ecosystem operations and development

3.1.1 Ecosystem members

The ecosystems funded through the Growth Engine Capital Loan instrument have a different structure then the ecosystems supported by the other instruments. The funding of the instrument is aimed solely at a central platform company, these companies typically have objectives for ecosystem development and member engagement. The platform companies often have a business model that aims to leverage digitalization in existing industries. Other ecosystem members are often companies from other industries that are potential customers for the platform company. In the case companies are from the same industry, they often have some

level of competition, many companies are still looking for their place as technologies and business models are still in development. As a result, quite some ecosystem members are not fully aware of the ecosystem structure, the funding received by the platform company and what can be expected from them.

The awareness of individual ecosystem members seems to strongly depends on their proximity to the core of the ecosystem, the further the distance the less awareness was found in the evaluation. In general, many ecosystem members can more easily distinguish (co-innovation) projects they are involved in than the ecosystem as a whole. Besides working on specific projects, related to the ecosystem business area, many of the interviewed ecosystem members are mostly inactive members within the ecosystems.

3.1.2 The platform companies

In the design of the Capital Loan instrument the development of the platform company needs to be linked to the development of the ecosystem. In essence the concept of the platform company needs to provide a solution that is needed for the ecosystem to flourish, allowing ecosystem members to benefit and increase competitiveness through innovation and business development linked to the solution. This means that the platform company has three challenges to address: 1) development of their own company; 2) development of the ecosystem; and 3) performance of ecosystem members linked to their platform concept.

Many of the platform companies can be characterized as start-ups or scale-ups. In the evaluation it was found that these companies have their hands full with their own development challenge and typically do not have the people and competences in house to run an ecosystem. Their attention for ecosystem development and transforming the business area to open up opportunities for members is therefore, overall, found to be limited. This is not an unexpected result, nor should this be perceived as a failure from the platform companies, as the challenge of making a start-up or scale-up into a success is already very difficult without the additional responsibilities of building an ecosystem.

3.1.3 Funding by Business Finland

Overall, the funding provided by Business Finland in the context of the Capital Loan ecosystems, including the innovation funding, is seen as an enabler for R&D and enterprise development. The funding provided specifically through the Capital Loan is also perceived as positive. Many interviewees share the view that it is important to make capital available for these platform concepts as they could open up new opportunities. The way the Capital Loan was designed did, however, create quite some challenges when used in practice, both from the financial as from the ecosystem development perspective.

From the financial perspective, on the one hand the loan structure is seen as positive as opposed to a subsidy structure. As the funding is aimed a single company, the loan structure makes sure it does not create (too much) unfair competition with other companies. On the other hand, the loan structure can make it difficult for the platform company to access funding from private financial markets as private investors often do not want to invest in companies with a lot of debt. Additionally, in some business areas the influx of finance through the Capital Loan was quite substantial, making some interviewees worry about some potential distorting effects on the capital market of specific business areas. In general the size of the Capital Loan funding is perceived as (very) substantial which enables focusing on refining the solution and value proposition, but can also be a challenging amount to manage as a start-up company.

From the ecosystem development perspective, as described, it is clear that there are too many challenges for the platform companies to address. It is quite complex for the platform

companies to get a grasp on which costs can be labelled as investments into the development of the ecosystem versus investments into their business. Creating mutual benefit, combined company and ecosystem development, at once is in practice quite difficult to realize effectively. Platform companies do not have incentives to use many resources on ecosystem development, especially as these resources are burdened by an interest rate of a loan. Shareholders and owners of the platform companies emphasise the need to focus mainly on the development of the company. The (perceived) unclarity and required balance between company and ecosystem objectives, made that some platform companies were also hesitant to use the funds provided by the Capital Loan.

3.1.4 Non-financial support by Business Finland

The relation between the funding provided by Business Finland and the financial strength of the platform companies also requires Business Finland account managers to have knowledge of and experience with investment management. Such skills are more common in the private market with actors like venture capitalists, that can provide business advice at the level of individual businesses as well as manage a portfolio of (high-)risk investments.

3.2 Ecosystem results

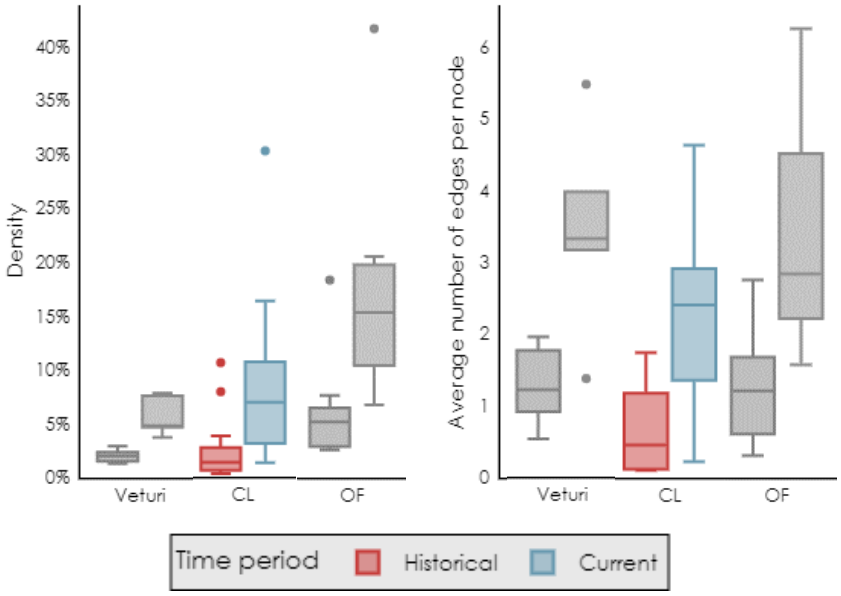
3.2.1 Ecosystem networks

In the ecosystems supported by the Capital Loan we see that, based on cross references of names on websites of ecosystem members, many ecosystem members have about 2-4 connections to other ecosystem members. Figure 9 shows the density (the total number of connections as percentage of the total number of possible connections) as well as the number of edges per node (the average number of connections per ecosystem member). While there are different size networks for the ecosystems, in general they are relatively small. This means that network density is naturally higher (there are fewer actors to connect). In relation to the history data presented, we see a large increase in connections, note that due to data imperfections part of this increase will not represent new connections made[7].

As described in section 3.1, many of the members can be labelled as 'inactive' in the ecosystem. Collaboration mainly takes place in collaborative (R&D) projects in the business area of the ecosystems. As such it can be expected that many of the 2-4 relationships are related to the partners of such projects. As many platform companies have the potential of becoming a linking pin between many ecosystem members as soon as their concept becomes a success, it is likely that many of the ecosystem connections will also be strengthened at that stage.

[7] History data is based on the internet archive. Growth compared to todays figures can be attributed to different aspects. Next to new formed connections, it can also be partly due to missing/not-stored data, changes in website structures over the years, and new companies or (change in) company names.

Figure 9 Overview of ecosystem network density and edges per node (links between a single ecosystem member and other members). Time data is based on internet history. Coloured bars indicate the Capital Loan ecosystems.



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3.2.2 *Added value*

The added value and impact of these ecosystems is linked to the success of the platform companies. Many of the concepts of the platform companies can be labelled as high-risk-high-reward. Based on the collected data, the value of the capital loan ecosystems is largely tied to the platform company, and less to the ecosystem development. According to interviewees, the challenges for the Capital Loan recipients are similar to those start- or scale-ups generally face. The main challenges are related to market formation and developing a value proposition and deliverables. The value proposition is related in a strong way to the needs of (potential) clients. Many of the platform companies focus on data and analytics, they effectively have two types of (potential) clients: 1) downstream users; and 2) upstream users in the value network. It can be recognized that the platform companies try to pivot their business towards the needs of these users.

More than one interviewee pointed out an underlying challenge in the type of platform business models that aim to leverage digitalization in existing industries. Leveraging data is fraught with challenges at various levels from compatibility between devices, protocols, formats, data structures and technical standards, to data integrity and lacking metadata, to legal and regulatory questions of privacy, ownership, etc. Additionally, interviewees from more than one ecosystem indicated that the objective to further digitalization in what might be called, traditional industries has a substantial and disruptive business proposition, but the conservatism within these industries creates resistance that hampers R&D and adoption of new technologies and solutions.

3.2.3 *Impacts*

Both from the qualitative as well as from the quantitative methodologies used in this evaluation it becomes clear that at portfolio level (across the ecosystems), specific outcomes and impacts have not yet been realized. This is partly due to the relatively short timeframe, as many concepts require more time to get to an advance stage, and effects can only develop after

the successful introduction of new products and services. It also links strongly to the high-risk-high-reward nature of the platform companies, at the level of individual ecosystems the evaluators found strong differences in terms of performance. The future remains uncertain for many of these concepts, especially as these (small) platform companies need to push for industry transformation.

In terms of the ecosystem members, some are active in the heart of the business area of the platform company, for many of them the ecosystem is seen as critical for achieving results. Many others, however, indicate that would have been able to achieve approximately the same results, but likely with a different scope or a different timeline.

4 Evaluation findings: Growth Engine – Orchestration funding

In this chapter the evaluative analysis is presented regarding the Orchestration Funding of the Growth Engine instrument. In chapter 3 the evaluative analysis is presented regarding the Capital Loan of the Growth Engine instrument.

4.1 Ecosystem operations and development

4.1.1 Ecosystem activities

The ecosystems supported with the Orchestration Funding instrument show structures in which the orchestrator is centrally placed. How this role as orchestrator is fulfilled differs quite strongly between the ecosystems. The orchestrators have a variable portfolio of activities, ranging from participation in EU-wide valorization projects, strategy and roadmapping processes, to the standard fare of repeating meetings, seminars, workshops and other events, websites, newsletters and media appearances to engage with the ecosystem members. Next to that, many employ some form of project and market development activities through their matchmaking or networking services connecting members within the ecosystem and with actors outside the ecosystem. (International) visibility, also tends to be part of the activities. Many activities are aimed at supporting business activities of ecosystem members.

4.1.2 The orchestrators

The orchestrators often have a neutral profile, being consultancy firms that are not themselves a business within the business area of the ecosystem. The neutrality creates impartial decision-making processes regarding ecosystem development and allows members to have, for a large part, equal access to the ecosystem functionalities. The profile of the orchestrators often dictates the focus of the ecosystem. As such, the ecosystems can be 'orchestrator-driven', meaning leadership is not necessarily business-minded and can be focused on maintaining a service relationship with the ecosystem members. As a result there is not always a clear business idea, objective and strategy that drives the activities of the ecosystem. Strategic alignment of ecosystem members is a challenging process and may not always be a strong priority of the orchestrators. This is, besides the natural differences between business areas, a source for the large diversity in ecosystem activities. For instance, some ecosystems seem to focus more strongly on R&D (projects), while others lean more towards building (international) connections to increase export.

4.1.3 Ecosystem members

As introduced in section 2.2, the members of the Orchestration Funding ecosystems have a different profile when compared to the ecosystems supported by the other instruments.

Overall, the members show a larger amount of total export, and, based on other indicators like labour productivity and export intensity, seem to show less of an innovation and R&D focus. Similarly as for the Capital Loan, here the evaluation findings suggest that not all ecosystem members are active within the ecosystem. For the Orchestration Funding ecosystems the relationship between the orchestrator and the members is a strong determining factor. Some ecosystems show a system where, besides some activities for all members, services are provided to individual members or small groups of members by the orchestrator. Less active members seem to be less aware of what the ecosystem focusses on and which services would be available to them. Thus, despite equal accessibility to ecosystem services, not all members benefit from them due to low level of engagement.

4.1.4 Ecosystem objectives

The central position of the orchestrator and the service relation with the members creates a situation where many ecosystem members are not well aware of the ecosystem objectives set by the Orchestration Funding instrument. Especially the relation between R&D activities and export results are not always clear. While joint research, pilot and demo projects are clearly described in the description of funded activities, the criteria for results tend to also put a lot of emphasis on business impacts, such as export, job creation and investments. Some services that focus on building (international) connections to increase export seem to bypass the step of R&D. These aspects can create some level of KPI driven behaviour, to make sure results can be shown. Similarly, while the aspect of a common goal, for instance described in a joint growth vision or action plan, is part of the Orchestration Funding instrument description, not all ecosystems seem to have a clear objective. In some cases the business area (partly) is not yet mature enough to set out a clear strategy. Nevertheless, ecosystem members are in general quite positive about the services provided by the orchestrators, as the relationships seem to be well maintained.

4.1.5 Funding by Business Finland

The financial support by Business Finland through the Orchestration Funding instrument is well-regarded by the ecosystem members. Orchestration funding specifically enables the orchestrators to offer a broad portfolio of services and to a wide audience. Without Orchestration Funding the orchestrators would have to scale down services. The evaluators have found that ecosystem members do already pay for (part of) the services provided, it is, however, not likely this will continue on the same scale without public support.

4.1.6 Non-financial support by Business Finland

The non-financial support by Business Finland has, for many of the ecosystems, been very limited. Some ecosystems could have benefited strongly from support & constructive feedback. Capacity at Business Finland, partly due to the COVID-19 crisis, as well as business area knowledge for some of the ecosystems was not sufficiently available to provide the needed support.

4.2 Ecosystem results

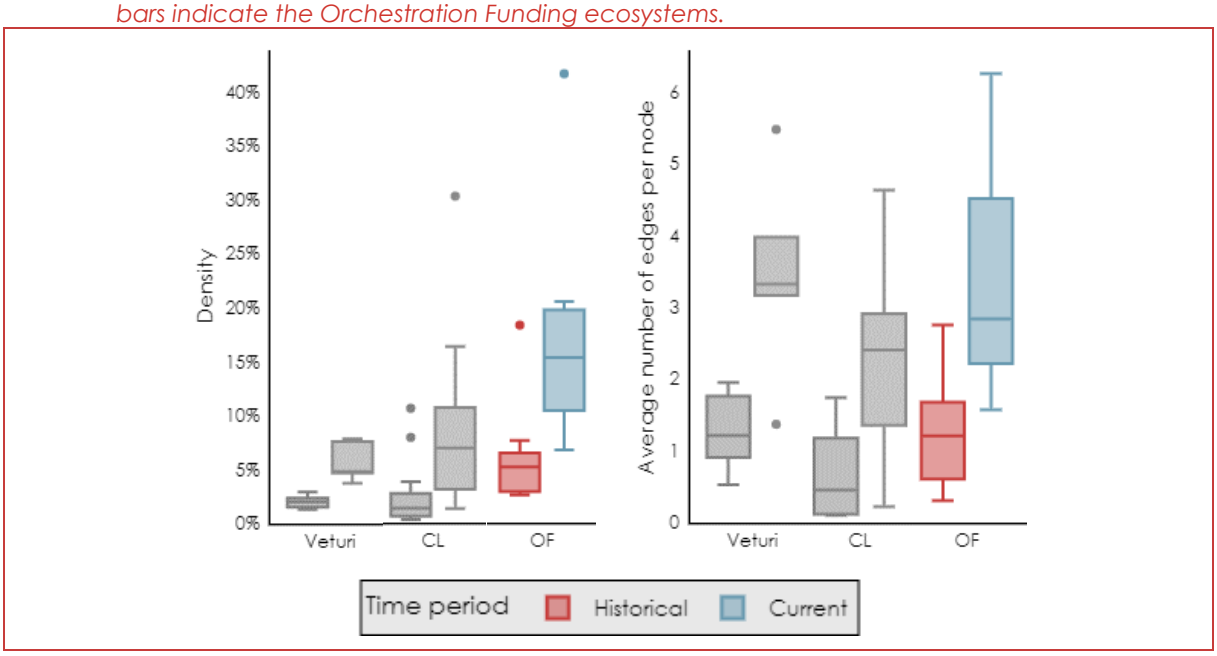
4.2.1 Ecosystem networks

The members of the ecosystems supported by the Orchestration Funding have, based on cross references of names on websites of ecosystem members, mostly 2-4 connections to other ecosystem members. Similarly to the Capital Loan, Figure 10 shows the density (the total number of connections as percentage of the total number of possible connections) as well as

the number of edges per node (the average number of connections per ecosystem member). As with the Capital Loan, we see in, relation to the history, a large increase in connections.[8]

The average size of the networks is relatively small, but there are strong differences between the sizes of the Orchestration Funding ecosystems. Looking into the networks we often see the orchestrator centrally placed in the networks. In some cases we also see knowledge institutions centrally places, yet in other networks they are absent.

Figure 10 Overview of ecosystem network density and edges per node (links between a single ecosystem member and other members). Time data is based on internet history. Coloured bars indicate the Orchestration Funding ecosystems.



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4.2.2 *Added value*

The added value of the ecosystems funded by the Orchestration Funding is for the individual ecosystem members in the provided business intelligence and network connections, within, but also with actors outside of the ecosystems. At ecosystem level the added value has a large variety. While some revolve strongly around identified gaps in the R&D portfolio and addressing these gaps as a collective, others revolve mainly around international visibility and export. Furthermore, there are also examples of addressing framework conditions for business effects, such as developing standards. While the orchestration is more distant from the R&D and business processes it is good to see that the orchestrated ecosystems have produced various strategy and roadmap documents to identify collective opportunities.

4.2.3 *Impacts*

While the Orchestration Funding ecosystems are also relatively new, the econometric analysis does show a small positive association regarding export and a stronger positive association with regard to export intensity. While there are limitations to this analysis (see annex Appendix

[8] History data is based on the internet archive. Growth compared to todays figures can be attributed to different aspects. Next to new formed connections, it can also be partly due to missing/not-stored data, changes in website structures over the years, and new companies or (change in) company names.

B), it is still an interesting finding – especially considering the short runtime of the ecosystems. The short runtime does, however, make it more likely that the exports increase due to networking and visibility services, as the route of R&D would take much longer for exports to come into effect. This is also shown in the qualitative analysis, as many interviewees indicated that commercial innovations were not ready. Furthermore, it must be noted that interviewees often associate R&D results more strongly with the (co-)innovation project, rather than with the orchestration.

5 Evaluation findings: Leading Company Initiative

In this chapter the evaluative analysis is presented regarding the Leading Company Initiative instrument. The instrument is also known under the Finnish name as the Veturi instrument.

5.1 Ecosystem operations and development

5.1.1 Ecosystem strategy

The ecosystems funded through the Leading Company Initiative (Veturi) instrument are built around one or two large (multinational) companies and their roadmap that outlines the vision and objectives for the ecosystem, including the knowledge and innovation to be developed. The roadmap provides the ecosystem with a strategic approach. The ecosystems are working in a long-term cycle (across a multitude of projects) as opposed to the shorter cycle of independent projects. Overall, interviewees mention this as a 'sense of direction' and some even as a 'mission' to work towards.

5.1.2 The Leading Company

The Leading Company fulfils the role as driver in the ecosystem, which shows a stable commitment and brings business capabilities to the ecosystem. The experience and stability of the Leading Companies helps radiate the overall strategy and direction of the ecosystem. Leading Companies are well-positioned to attract many partners and ecosystem members and stimulate linkages between them. The governance and orchestration of the ecosystem are expected to be arranged by the Leading Company. The funding provided to the Leading Companies is only aimed at R&D, yet they can spend about a fifth of these funds on activities that support their R&D activities. While some Leading Companies take good steps towards creating functional ecosystem dynamics, many of the Leading Companies put limited efforts in these overarching ecosystem organisational activities. As a result, many ecosystem members don't seem to have a clear view on the governance structure of the Leading Company Initiative ecosystems. When asked about the ecosystem as a whole, a lack of communication, interaction, organisation and management was often mentioned by interviewees. Similarly, as for the Growth Engine instruments, ecosystem members that have closer ties to the Leading Companies have a more positive view, due to stronger informal communication channels, than those who participate at a greater distance from the Leading Company.

5.1.3 Ecosystem projects

While the Leading Company is often known, the ecosystem members have a far stronger connection to the R&D and innovation projects they participate in. These projects sometimes even have their own separate names and branding distancing them from the overarching ecosystem. These projects are overall perceived as traditional R&D projects. Given the project-oriented structure, many ecosystem members mainly have interactions with the Leading Company in the context of co-innovation projects where the Leading Company participates

in. At ecosystem level this creates overall a compartmentalized type of collaboration, where mainly the Leading Company has the overview of the ecosystem as well as of ecosystem results.

As stated, some Leading Companies do create ecosystem dynamics by investing in the interaction between and alignment of ecosystem members. For these ecosystems the evaluators observe a stronger involvement of ecosystem members in outlining the ecosystem objectives and direction, either in the context of the ecosystem or even in related platforms for networking and building trust. It is also these ecosystems where members seem to have a stronger grasp of the overall added value of the ecosystem and the results generated across the ecosystem (rather than just the project they were involved in).

While for all the Leading Company Initiative ecosystems collaboration is still early stage, many members joined just a year ago, it must be noted that quite some members have known each other from past collaborations. To some extent this is to be expected as parties that collaborated in the past are more likely to connect again for new collaborative projects, especially at the start. With a few exceptions, as outlined in the paragraph above, many of the ecosystems do not yet provide a platform for the dynamics needed for networking and collaboration beyond the project level. Nevertheless, the project structure does allow existing collaboration partners to enrich their consortium with additional partners, which creates fruitful new connections at a smaller scale.

5.1.4 Funding by Business Finland

The support provided by Business Finland is viewed as very important and is linked strongly to the provided funding for performing R&D. For the large companies, Leading Companies and large ecosystem members, this was strong emphasized as the funding allows them to commit to larger R&D investments. Other members often reacted more strongly on the R&D funding provided for the project level, many have a limited view on the support provided to the Leading Company and what can be expected from them as ecosystem member. At ecosystem level, there are some concerns about the large volume of the funding. The funding seems to be driven by the pressure of the 4% R&D spending target at national level, resulting in a strong focus to realize new R&D projects with too little regard for the cohesion of and synergies between projects.

5.1.5 Non-financial support by Business Finland

Not many interviewees mention non-funding support by Business Finland. Overall, the ecosystems seem to be managed by the Leading Companies without a lot of involvement of Business Finland. Some companies did mention the role of Business Finland as sparring partners in the project development phase during preparation of funding applications as valuable. This role seems to depend on the specific account manager from Business Finland and their knowledge base of the business area. While this role is appreciated, the sparring seemed to be more of 'sounding board' nature rather than being of 'strategic' nature.

5.2 Ecosystem results

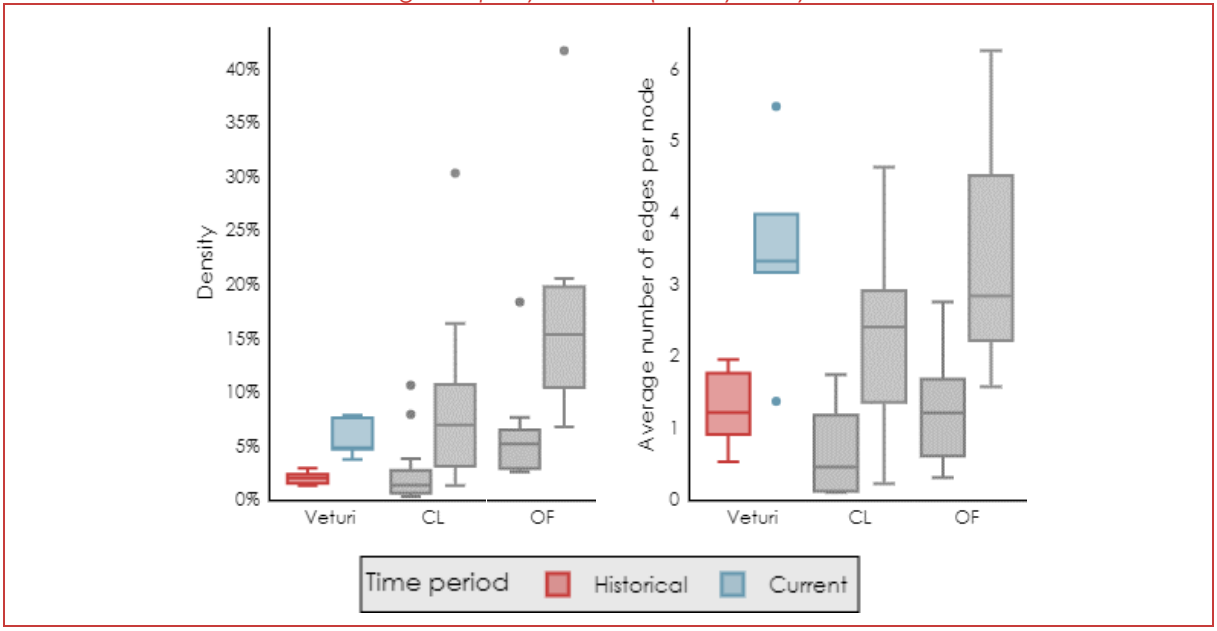
5.2.1 Ecosystem networks

The members of the ecosystems supported by the Leading Company Initiative have, based on cross references of names on websites of ecosystem members, mostly 3-5 connections to other ecosystem members. As for the Growth Engine instruments, Figure 11 shows the density (the total number of connections as percentage of the total number of possible connections) as well as the number of edges per node (the average number of connections per ecosystem

member). Similarly, related to the history, we see a large increase in connections over time.[9] The timeframe of these changes is, however, much shorter than for the Growth Engines instruments. Next to that, the number of connections is, on average, already higher for the Leading Company Initiative ecosystem members.

The average size of the networks is a lot larger than for the Growth Engines ecosystems, on average twice the size. Therefore, the density of the networks of the Leading Company Initiative ecosystems is also a lot lower (a lot more possible connections). This shows, just as the qualitative evidence, the nature of the project-based collaborations between partners. Many ecosystem members are connected to a handful of others with which they collaborate in project setting. In the networks we see that large companies and research organisations are generally centrally placed.

Figure 11 Overview of ecosystem network density and edges per node (links between a single ecosystem member and other members). Time data is based on internet history. Coloured bars indicate the Leading Company Initiative (Veturi) ecosystems.



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5.2.2 *Added value*

The R&D activities that the Leading Company Initiative enables are seen as very important. There is clear evidence that private investment in R&D is increased through the instrument. The funding lowers the risks of R&D activities, allowing companies to invest more easily. That the instrument is aimed at realising investments from large companies, rather than focusing on subcontracting, is a way to access their R&D potential. Especially for the Leading Companies, the funding enables them to invest more heavily in R&D in Finland. Knowing that many other EU Member States also provide R&D support, these companies can choose where to increase/decrease R&D activities depending on favourable conditions for business. In a sense,

[9] History data is based on the internet archive. Growth compared to todays figures can be attributed to different aspects. Next to new formed connections, it can also be partly due to missing/not-stored data, changes in website structures over the years, and new companies or (change in) company names.

the Leading Company Initiative allows Finland to bridge the 'competitive advantage gap' regarding other countries.

Working with key partners/clients is another key strength for many ecosystem members. The large volume of the Leading Company Initiative enables investments from ecosystem members and allows for active collaboration between ecosystem members. Knowledge institutions have a very central role in the ecosystems. Smaller companies (start-ups and SMEs) see opportunities in the context of the Leading Company Initiative to work closely with their key clients. Some even argue that it is a must for them to stay relevant for their clients, and that it is their main motivation to participate. A key critique from these smaller companies is that the Leading Company Initiative does not enable the Leading Company to buy developed products from these member companies. In turn, this also lowers the incentive for product development by these smaller companies.

Access to business intelligence (e.g., new knowledge, ideas) and shared resources (e.g. infrastructure) is also of added value in the ecosystems. However, many interviewees argued that overall the ecosystems are too research-driven and research-oriented. The R&D performed is often aimed more strongly at research rather than development, so R&D at lower TRL levels[10]. The strong position of large companies and research organisations is seen as a source for the focus on research, however, some argue that companies are also not as willing to collaborate and share knowledge that is closer to the market as they want to protect their business models.

While this can be beneficial for the long-term to focus on research, many smaller actors need to act closer to the market in order to keep their cash flow healthy. Their feedback shows that they often have little grasp of the overall business case of the ecosystem, indicating that to them the business case seems to be missing. The evaluation shows that the Leading Company is the main player in the ecosystem with the overview across the various projects being performed. They have insight into the added value across the ecosystem, whereas for many members this is not transparent. As many smaller companies are dependent on large companies they need to cope with unclarity about the future commitment to ecosystem results.

5.2.3 Impacts

Results are too early to provide a clear view on the (potential) impact. This was also not the evaluation focus for this instrument, we performed a design evaluation for the Leading Company Initiative (see section 1.1). The interviews show a high level of uncertainly of results and variety between ecosystem members. Many interviewees indicate that projects are expected to lead to results in the next few years, once they are completed or in a more advanced stage. Expected business impacts, for instance on turnover, are not expected before 2025. The potential of results is very difficult to grasp as some companies indicated turnover growth will likely not exceed a few percentage points, while others indicated that successful project results could potentially lead to doubling in turnover. Whether this can be attributed to 'being part of the ecosystem' remains a difficult question for many to answer as they link the value of the ecosystem very strongly to specific projects (which could have been receiving funding in a different format). Nevertheless, the feedback with regards to this

[10] TRL levels are used to indicate how close to market R&D activities are. Lower TRL means that research is more fundamental and will have a longer time to market. Development at higher TRL levels often relates to demonstrating key concepts or even product as well as scaling up concepts to production levels.

question was also very varied, ranging all the way from 'the ecosystem is not essential (0% attribution)' to 'the ecosystem is critical (100% attribution)'.

Regarding the future potential of the ecosystem, some argue that the ecosystem roadmaps have a temporary nature. As soon as the goals set for the ecosystems are achieved, companies will likely retain their core partners in the value chain and move onto the next R&D objectives. Some members do see the opportunity for longer lasting relationships, but then the ecosystem needs to broaden its scope beyond the roadmap. In order to get to a subscription type of ecosystem structure, the provided services would need to be improved significantly.

6 Evaluation findings: Partnership Model

The Partnership Model is aimed at creating the conditions for long-term R&D cooperation, to secure long-term commitments and set long-term objectives. Overall, the goals is to improve the utilization of R&D activities by bringing the research performed by research organisations closer to companies. A key challenge the Partnership Model is bridging the gap between the research world and the business world, not only in practice, but also between governmental organisations: Business Finland and the Academy of Finland. Both organisations have a very clear perspective on their respective target groups of businesses and knowledge institutions and the way they work.

From the performed interviews it shows that Business Finland and the Academy of Finland have not yet been able to let go of their own perspectives to form a shared vision on how to increase the utilization of R&D to create impact in societal and economic terms. While this concerns core values, such as the autonomy of researchers and the business minded view on innovation, in practice opportunities are missed. The dialogue between Business Finland and the Academy of Finland has increased, but clear alignment of the Leading Company Initiative and the Flagship programme has not yet been realized. Meanwhile, there are ecosystems and flagships active on very similar topics (e.g. 5G/6G) that do not explicitly benefit from the potential of having both.

The step towards full alignment might not be easy, but there is clear potential for added value. It seems that discussions boil down to elemental questions regarding core values and definitions of concepts, such as ecosystems. Meanwhile, low hanging fruit is not being utilized. To give a few examples: 1) academic researchers could benefit from having a dialogue with user panels filled with companies willing to share their perspective from practice; 2) shared research facilities could allow for pooling of investments or cost savings; 3) yearly knowledge exchange events could lead to useful networking and follow-up partnerships; or 4) more contract research could likely be performed once connections are made (private investments).

Achieving further alignment, like which flagships and ecosystem should be funded, will require a lot more effort. As programmes are often of temporary nature, the question is whether this can be achieved in the short term. Perhaps the low hanging fruit can already provide sufficient value to start building towards long-term improvement of utilization of R&D activities, as strong relationships between researchers and companies can be maintained over time. The practice of the ecosystem and flagships could also be further improved to further strengthen this, especially with regards to the aspects of visibility and transparency. Making it easier for academics and business to look for synergies in their fields of expertise and contact each other to explore opportunities is a key step to take. If a deeper alignment is foreseen, a clear and shared vision on increasing the utilization of R&D is required.

7 Conclusions

In this chapter the conclusions are presented, first at instrument level and afterwards across the instruments with regards to the additionalities and impacts.

7.1 Conclusions for the instruments

7.1.1 Instrument strengths & weaknesses: Growth Engine - Capital Loan

The Capital Loan is an instrument that provides opportunities to high-risk-high-reward platform concepts through a large amount of capital. The mutual benefit of developing such concept for the platform company itself as well as the wider ecosystem is in theory a win-win situation. In practice, these platform companies often are in their start-up/scale-up stage of development, meaning their capacity to also address the challenges of ecosystem development & member performance is very limited. The platform companies are not always able to effectively use the funds, partly due to their size, but mainly as there is (perceived) unclarity about when investments are relevant for the ecosystem. There is a potential for conflict of interest between the use of the funds for ecosystem development and business development of the platform company. The debt created by the Capital Loan also makes it harder for these companies to attract further private capital.

In Table 4 an overview is presented of the strengths and weaknesses of the instrument.

Table 4 Strengths and weaknesses of the Growth Engine - Capital Loan, top 3 points in bold

Strengths	Weaknesses
• Potential to access financing for start-ups/platform companies • **Allows for investment in new strengths for the economy (radical renewal)** • **Potential for high returns: in case the platform company is a success, returns can be large** • **Theoretically combining ecosystem and business development is a win-win: successful concepts can create opportunities for ecosystem members** • Aim for multiplier effect through ecosystem member effects: breakthrough innovations can have effects for the economy/society at a whole • Public investment in a private entity is justifiable as a loan (not a grant)	• **High-risk ventures with many external factors that will determine the success of the platform company** • At the moment no econometric results & limited qualitative results (some exceptions) • Complex structure & criteria of the funding, setting milestones is challenging for development with much uncertainty • **The three somewhat separate objectives (business development, ecosystem development, and ecosystem member performance) too much to ask from a start-up** • Potential for conflict of interest between ecosystem development and business development of the platform company • **Effects within the ecosystem are secondary: 1) funding is only aimed at the platform company, 2) the platform company has little control over activities of ecosystem member, and 3) ecosystem members are not involved in the ecosystem strategy** • Limited coherence with private financing instruments (debt burden). May be an obstacle in securing further funding from the financial markets (debt stacking). • Requires investment management capabilities from Business Finland (like VCs)

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7.1.2 *Instrument strengths & weaknesses: Growth Engine – Orchestration funding*

The Orchestration Funding makes it possible to set up ecosystem collaborations across a wide range of topics and business areas. The central management of the ecosystem creates clear governance that benefits the ecosystem, their neutral position makes sure the ecosystem works for the benefit of all members. The activities of the orchestrators (networking, etc.) are quire distant from the wide range of goals set by the instrument, including R&D and innovation results, as wel as business results such as export. From the evaluation it becomes clear that orchestrators often cannot perform well on all these aspects, for example those who have strength in building international connections may not be well-positioned to drive an R&D agenda. However, the results show that orchestrators are often able to create success in some of these areas, for export some quantitative positive associations are even found. As many of these orchestrators are independent consultancies, not tied directly to the business members, it is likely that not much sustainable capacity building is taking place.

In Table 5 an overview is presented of the strengths and weaknesses of the instrument.

Table 5 Strengths and weaknesses of the Growth Engine - Orchestration Funding, top 3 points in bold

Strengths	Weaknesses
• **Specific attention for ecosystem development (versus focus on R&D, business, etc.)** • Wide range of ecosystems can be supported as the instrument is not limited to specific types of actors or business areas • **Clear management through central orchestrator and all members have equal access to the ecosystem functionalities** • Ecosystems show strengthened relationships, create common ground (potential avenues for new business), set up shared resources & have increased visibility • **Some positive econometric positive associations for export, mainly on export intensity** • Support of business activities that lead to results: focus can be on business aspects beyond just R&D • Sustainability: some private payments observed	• Instrument goals not always well-translated: not all ecosystem focus on R&D activities that should lead to export (some focus directly on export) • **The focus on R&D and export does not incentivize other ecosystem activities (human capital development, standardisation, regulation, etc.)** • **Ecosystems can be orchestrator and KPI driven (export, R&D projects, etc.) instead driven by business needs. The link between orchestration activities and these types of results are often somewhat intangible** • **Pay-as-you-go service model is difficult to sustain and Business Finland has not signalled strong support and given constructive feedback for the orchestrators** • The portfolio is heterogeneous: – Some ecosystems appear to be 'orchestrator-driven', as they do not have business-minded leadership and show a service relationship between the orchestrator and the members – In some areas business maturity and corporate commitment has created more readiness for orchestration and ecosystem activities

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7.1.3 *Instrument strengths & weaknesses: Leading Company Initiative (Veturi)*

The ecosystems have a strong sense of direction due to the driving role of the Leading Companies and the roadmap that sets out the vision. This helps to improve the long-term perspective and direction of R&D funding. The role of the Leading Companies is however quite dominant, creating limited transparency regarding and commitment for future collaboration with members. With limited incentives to spend efforts on ecosystem development, this leads to mixed results. The R&D investments are strongly supported and connections are built at project level. Overall, the ecosystems are very project-driven, coupled with the pressure of the national 4% R&D investment target, creates some concerns with regards to oversaturation and

haste as well as a lack of cohesion and synergy between projects. The R&D performed is of large scale, yet aims mainly at research instead of development.

In Table 6 an overview is presented of the strengths and weaknesses of the instrument.

Table 6 Strengths and weaknesses of the Leading Company Initiative (Veturi), top 3 points in bold

Strengths	Weaknesses
• **Ecosystems have a strategic approach revolving around a clear roadmap, this creates longer term cycle, a sense of direction and members can rally around a specific 'mission'.** • **Ecosystems have a clear driver with commitment and capabilities. Leading Companies bring in a lot of experience and stability.** • **The instrument secures more R&D investments in Finland** by: – 1) lowering risks of R&D activities through funding, – 2) bridging the 'competitive advantage gap' regarding other countries, – 3) enabling large companies' own R&D (not just subcontracting), and – 4) providing large volumes to enable investments of ecosystem members. • Active collaboration between ecosystem members is stimulates. Leading Companies are well positioned to attract partners/members and to stimulate linkages between them. • While there is limited incentive for orchestration, some ecosystems create strong dynamics and include the ecosystem members in the strategic decision-making process of the ecosystem. • Strong links with research organisations also opens up opportunities for collaboration in the area of human capital, such as informing the educational sector on industry needs.	• **Leading Companies have a dominant role within the ecosystems, without specific incentives for facilitating the ecosystem.** – Goals and the range of activities tend to be invisible for the members, many members can only "see" their own co-innovation project and call that "the ecosystem" – Very strong focus on R&D investment and related KPI, less on quality of activities, capacity building. No specific incentives are created for orchestration and there is limited support (framework/guidelines/KPIs). – Cohesion and synergy between projects can sometimes be unclear. Ecosystems revolve (too) strongly around stand-alone R&D projects, while the expectations at project level (KPIs) go beyond R&D (e.g. export targets). • The large volume is challenging to manage, creating risks of oversaturation and haste. • **The ecosystems are not very attractive for SMEs, who are looking to develop products and services to their clients, but they cannot sell to the leading companies.** • **The R&D performed is focused more heavily on the research side of R&D. It stays at lower TRL levels, at higher TRL levels companies are less willing to collaborate and share knowledge. The role of universities / knowledge institutions is quite large.** • Ecosystem development needs to be linked to R&D activity of the Leading Company. The project based nature of the ecosystems make them feel like temporary. • There is limited strategic management from Business Finland side. Mostly Business Finland applies a "company knows best" mentality. Account manager have varying levels of in-depth substance knowledge/experience to provide strategic support.

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7.1.4 Conclusions for Partnership Model

The potential of the Partnership Model is quite large, but in practice no real alignment has been achieved between the Leading Company Initiative and the Flagship programme. There are plenty of low hanging fruit opportunities to align existing ecosystems and flagships that work on similar topics. Deeper alignment will require shared vision on increasing the utilization of R&D between Business Finland and the Academy of Finland.

7.2 Conclusions across the additionalities and impacts

7.2.1 Input additionality

Input additionality: effects of resources provided through the ecosystem instruments.

A key aspect of input additionality is the *potential* of the ecosystems. While this is inherently difficult to analyse, especially this early in the development of the ecosystems, there are some core aspects that indicate that the potential of the supported ecosystem is high.

Compared to the overall economy, the ecosystems clearly include the higher performing companies active in Finland (see Appendix B Econometric analysis). Furthermore, for most ecosystems, we can see that companies outperformed others in the economy after the COVID-19 crisis, showing the resilience of the ecosystem companies. Small and upcoming companies also participate strongly in many of the ecosystems. While this is a good thing, we have also seen in the analyses of the instruments (chapters 3, 4 and 5) that the positioning, role and support for these companies within the ecosystems requires more attention.

Two key aspects with regards to the potential is the way in which these companies can benefit from ecosystem effects as well as their role in challenging established businesses through radical new business concepts and innovations. For radical renewal the link to academics is also important. Knowledge institutions are, in general, well presented in the ecosystem networks. Further improving the interaction between academics and companies, for instance through the Partnership Model, can further strengthen the influx of new knowledge and ideas that can lead to industrial transformations.

The potential for the development of the ecosystem is strongly tied to the role of the leading actors in the ecosystem. While each of the instruments have very different leading actors, it is clear that strong leadership is required for the ecosystems to excel. The capacity to lead is clearly too low in the Capital Loan ecosystems. For the Orchestration Funding the leadership in organisationally strong and neutral, while weaker on the side of the overall business strategy and development of joint business opportunities. The Leading Company initiative is somewhat the opposite of the Orchestration Funding. While the Leading Companies are without question organisationally strong (although not neutral), they have limited incentives to use their capacity to stir up the dynamics within the ecosystems, nor will they guard values like equal access to ecosystem functionalities for all members. In the context of long-term of ecosystem development, the aspect of capacity building both on the side of the ecosystems as well as on the side of Business Finland remains an area of concern.

The public funding provided clearly has a strong impact on private activities. The Capital Loan is used to work towards success of high-risk-high-reward platform concepts. The design of this instrument is, however, not well aligned with the nature of the, often start-up, platform companies. In case of the Orchestration Funding, effects were found in the quantitative analysis of export and more strongly export intensity. While there is no clear quantitative indicator for R&D and innovation, export intensity is often associated with innovation in economic studies. From the qualitative research we know that some of the Orchestration Funding ecosystems are more R&D heavy than others. The Leading Company Initiative ecosystem clearly has the strongest R&D focus, here the private investments in R&D as result of the public funding are undoubtedly present. The size of the funding does however raise some concerns regarding the focus on realising R&D projects rather than on those projects with the best prospects and best fit with other activities.

While the individual instruments have their challenges, collectively the instruments include the aspects needed to support ecosystems: leadership, orchestration, strategy, (radical) renewal, coherence, R&D investments, room for collective dialogue, etc.

7.2.2 Behavioural additionality

Behavioural additionality: change in the behaviour & processes of companies/ecosystems.

The role of the leading organisation is key in setting the tone for the ecosystem. Overall, the evaluation shows that ecosystems with clear leadership and a clear strategy have better performance. Ecosystems that are still exploring their key business strategy struggle the most with aligning ecosystem activities, activating ecosystem members and reaching results. In some cases, the leadership can also be quite dominant. This can push things forwards, but can also lead to a lack of commitment of members in orchestrator-driven ecosystems or ecosystems in which only the Leading Company has the strategic overview.

In many ecosystems, across all three instruments, the role and responsibilities of the central actor remain unclear to the ecosystem members. Many interviewees did not know exactly what could be expected from leading actors and indicate this was never clearly communicated. Looking at the (often many) responsibilities, incentives and objectives (KPIs) provided from the instruments quite some unclarities were discussed in the analyses of the instruments (chapters 3, 4 and 5). Nevertheless, most analysed ecosystems sticked quite close to the instrument design in their activities, or in the case of the Capital Loan did not fully use the funding to make sure they did not misuse it.

Across the ecosystems, quite a large private investment in R&D is observed, in those with less R&D other relevant activities are performed, such as building international connections for increasing export. Knowledge institutions often have quite a central role, while smaller companies tend to follow larger companies and these knowledge institutions. The R&D activities performed often are more research than development oriented. The knowledge exchange between ecosystem members is therefore more fundamental, moving closer to the market (shared product/service development) remains challenging.

The steps towards long-term ecosystem development were less clear. Overall ecosystems need a lot of time and shared commitment in order to build towards self-sustainable ecosystems. Many ecosystems in the portfolio, especially the Leading Company Initiative, have a temporary nature according to the interviewees. Building long-term trust is often not well embedded, even if very useful (long-term) relationships are being formed. The lack of collectively drafted strategies in which all members feel a sense of ownership and commitment was clearly found.

In many ecosystems, Business Finland did not provide strong strategic support. While this is partly due to capacity, knowledge and expertise constrains, it is also a missed opportunity. The ecosystems present Business Finland with a clear forum for discussion with high performing companies from Finland. Collectively addressing key opportunities and challenges for growth is also part of strategic support, especially for innovative activities that often run into the boundaries of regulations, standardisations, facilities, etc.

7.2.3 Output additionality

Output additionality: the results that are realized due to the ecosystem instruments.

Output additionality is too early to judge for the Leading Company Initiative, although the high investments in R&D can be perceived as good prospects for the future. Also the Growth Engines need more time to reach results as many only exist for 2-4 years versus a horizon of 10 years of support. For the Capital Loan not many results are expected at portfolio level due to the high-risk-high-reward nature of the platform companies. In case of success the results can however be very large. For the Orchestration Funding the results will be mixed across the different ecosystems given the large differences between them. Overall, the orchestration activities are quite distant from business effects, as orchestration activities share the preconditions for business activities that in turn need to lead to effects. Nevertheless, across the ecosystems we find positive quantitative effects regarding export and export intensity. While not all ecosystems have focused on R&D projects, these export results can hardly be an effect of R&D activities given short timeframe to translate R&D results into products/services that can be exported.

The role of multinationals is, especially in the Leading Company Initiative, quite important. The public funding provided allows these companies to set up R&D activities within Finland. As such, the instrument allows Finland to bridge the 'competitive advantage gap' with regards to other EU Member States that provide R&D support. The reality is, however, that, in the international competition, the capacity in Finland will only stay if the public support stays. Furthermore, the effect is mainly aimed at the R&D capacity of these companies, it is difficult to say if the R&D in Finland will also result in a turnover increase in Finland as the production of developed products/services can take place elsewhere.

7.2.4 Socio-economic impact

Socio-economic impact: impacts on economic growth, sustainability, and competitiveness.

For the contribution to competitiveness and growth the instruments provide a strong R&D impulse, with the Leading Company Initiative as largest contributor. Besides the R&D impulse, it is unclear how much space there is for other types of activities. Where the Orchestration Funding does provide an impulse for export and export intensity, some of the ecosystems are seen as "not performing well" as they produce very few R&D projects. Ecosystems should be able to provide larger value towards competitiveness and growth as they provide a platform for members to collectively address key opportunities and challenges across a wide range of topics (as also presented in the impact framework of Business Finland). For instance, topics such as 'attracting global actors' can be supported through attractive strong ecosystems, but requires an overarching strategy to materialize into results. Companies are not in the business of attracting global actors to Finland. Similarly, is also quite common for ecosystems to address the topic of human capital by introducing apprenticeship programmes between company and knowledge institution members.

In terms of R&D, the efforts of the Leading Company Initiative can be cutting edge, however, in large part the roadmap follows the development paths of established businesses. For radical renewal, business concepts and innovations that challenge established businesses, there is limited support in the current instruments. The Capital Loan does focus on such concepts, but does not function well in terms of ecosystem development and is only aimed at high-risk-high-reward platform companies. At the same time, through the strong positioning of knowledge institutes knowledge does flow into the ecosystems, which can be improved by more boldly putting the Partnership Model into practice.

Overall, the ecosystems can add clear value to the economy and society of Finland. The financial means are sufficient to realize this and the instruments collectively provide a good basis to support the key functions of ecosystems. The evaluation gives some clear indication on

how the instruments can be further improved, as will be further outlined in the recommendations, chapter 8.

8 Recommendations

In this chapter, first recommendations are presented at instrument level. Afterwards more general recommendations are outlined, that provide directions across the instruments.

8.1 Recommendations at instrument level

8.1.1 Improvements for Growth Engine - Capital Loan

- **Support radical renewal within ecosystems, but separate this from the support for ecosystem development.** Platform companies can play an important role in unlocking the potential for business models, products and services. The availability of funds for concepts that can lead to radical renewal is important in the overall RDI policy mix, however, the types of funded platform companies that are start-ups or scale-ups are not well positioned to build and coordinate ecosystems on top of business and market development. In practice, Capital Loan can be – in some cases – a useful instrument for Business Finland to support emerging platform companies, but it should not be considered as an instrument for supporting broader ecosystems.
- **Align Business Finland Capital Loan instrument with Climate Fund activities to avoid potential overlaps.** Climate Fund is also supporting companies and initiatives with capital loan, with the mission to counter climate change and support digitalisation. Evaluating the coherence with other organisations' instruments was not at the focus of this evaluation, but there is already some overlap.
- **Clarify the objectives of the instrument, the activities that are supported, and how these relate to performance KPIs.** Clarity is needed regarding the (mix of) objectives of the instrument and the way the funds can be spent in practice, taking into account the realities of high uncertainty and the high-risk-high-reward nature of these concepts. The KPIs should focus on the development of the platform company instead on the development of the broader ecosystem.
- **More synergies should be explored with the private financial market.** Better alignment of funding in individual firms with the private financial market could solve constraints regarding debt for platform companies, the balance of available finance in the business area, as well as enrich the available competences to support the companies and manage the portfolio of investments. One option could be to introduce an expert panel with representatives from private investors (similar to NIY funding).

8.1.2 Improvements for Growth Engine – Orchestration Funding

- **Keep supporting the role of a neutral orchestrator within ecosystems.** The neutral and central role of the orchestrator has clear benefits to drive the ecosystem forward and to provide equal access to the ecosystem services/functions to all members. It can furthermore help to organize processes in which all ecosystems members are more actively involved in (outlining) the strategic direction and overall activities of the ecosystems.
- **Make the orchestration funding more industry-driven.** Business Finland should ensure that the orchestration funding is channelled to support the implementation of the (industry-led) ecosystem roadmaps. Neutral orchestrators are not well positioned to take a leading role in outlining the strategic direction of the ecosystem**.** An orchestrator-driven ecosystem that

focuses on service provision to ecosystem members can add value, but will not as likely lead to long-term commitment to a shared business idea, objective or strategy. Neutral orchestrators can organize the process to involve the members more actively in the strategy development, but the ecosystems need business managers/leaders to underwrite the goals and risk-taking. One way forward could be to align the current orchestration funding with LCI funding to support orchestration within the LCI ecosystems.

- **Specify more clearly the added value of orchestration activities towards overall ecosystem objectives, without undervaluing the value of orchestration.** The impact pathway of the orchestration should be made more explicit: how are (often soft) services leading to the required results? The cohesion, interactions, and trust levels between members as well as the overall involvement and commitment of members are highly important conditional factors for ecosystem success. These aspects are, however, less tangible and therefore more challenging to monitor and evaluate in relation to measurable business effects. Specifying more clearly the activities that are expected from orchestration and more actively monitoring at the level of activities and outputs is recommended.
- **Increase the flexibility of the funding by more strongly linking funded activities to the eocsystem strategy (based on business needs). When appropriate this should provide more space for activities outside the scope of R&D and innovation and business impacts such as export.** The wide range of objectives for the ecosystems and the emphasis on R&D may not always align with the business needs. The common goal for the members should also allow activities outside the scope of those objectives, in areas such as addressing human capital development, standardisation, regulation, etc. These can provide conditions for business effects on the long-term.
- **Increase the long-term funding commitment for orchestration of ecosystems with high potential, as it will take a long time to create effects. Remain realistic when the long-term commitment is not viable.** It should be acknowledged that orchestration services can lay the ground work for other effects, activities and longer term commitment if they are aimed at building trust, shared understanding of key business challenges and objectives, etc. Activities can now be KPI driven (realising R&D projects, export, etc.), making them less aimed at such more intangible effects that can amplify the effect of other instruments (such as co-innovation funding, etc.).

8.1.3 Improvements for Leading Company Initiative

- **The strength of generated large private R&D investments should be maintained. Large companies play a large role in generating these private R&D investments.** R&D investments are a key strength of the Leading Company Initiative that should be maintained, even when addressing aspects presented in the other recommendations. Business Finland should keep a sharp eye on how much funding can be absorbed to stimulate R&D, as there is a decreasing marginal benefit to funding in a given area, realising more projects is not always better for impact or efficiency.
- **Start planning for the next phase for Leading Company Initiative.** Business Finland should already start planning for the continuation of the Leading Company Initiative in order to ensure the continuity of the funding. Since the number potential leading companies in Finland is limited, the continuation of the initiative in its current form is unlikely to be a feasible option. However, it is important to ensure the continuity of the instrument in some form. One option could be to launch calls for groups of companies (instead of single companies) when the current LCI funding period is running out.
- **Commitment of the ecosystem members should be improved by setting up shared roadmaps and increasing transparency.** Commitment starts with ecosystem member

selection and making sure members have a clear role and position within the ecosystem. Further transparency and communication, such as involving members in drafting and updating the roadmap can create a sense of ownership. Updating the roadmap over the course of time can also support addressing the temporary nature of the ecosystems. This has been already conducted to some extent in some of the ecosystems but the process should be more systematic and transparent with more robust guidance and instructions form Business Finland.

- **Investigate how performed R&D can be aimed more at development rather than mainly research.** The focus on R&D, mainly research, is very strong. A dialogue with companies is needed to explore if more development, closer to the market, is possible. The upcoming evaluation of the co-innovation and co-creation instruments can be a first step in investigating this in more detail. Attention should go towards the incentives companies have to collectively work on development in relation to (the interpretation of) funding terms and state aid rules. At the same time, within the context of the ecosystems, knowledge exchange can be improved by increasing trust levels and increasing the commitment towards a shared roadmap.
- **Increase the role of SMEs within the ecosystems by addressing their incentives.** SMEs often participate from a position of dependency on larger companies, as these larger companies are often (prospective) client. In general, SMEs have fewer buffers to spend time on activities that are not directly tied to their business model and cash flow. The role of SMEs within ecosystems can be important to strengthen the effects of ecosystems in the larger business community of Finland. In practice, Business Finland should explore opportunities to adjust LCI funding so that it would allow SMEs and startups to get better access to their clients (large companies) as part of the LCI ecosystems.
- **Ecosystem development needs to be made a priority in case long-term development of the ecosystems is an objective.** While the driving force of the Leading Companies is a strength, not all of them spend sufficient attention on ecosystem development. Naturally they have only limited incentives for orchestration activities, nor can they provide equal opportunities to all members from a position of neutrality. Creating wider ecosystem activities can address the (temporary) project-based nature of the current ecosystems. One solution could be the integration/connection of LCI funding with the Orchestration Funding (see section 8.1.2).
- **Consider increasing the scope of the funding beyond R&D.** Next to R&D, other potential ecosystem benefits get limited attention given that the funding is aimed at R&D. If Business Finland wants outcomes and impacts in terms of ecosystem development, the different aspects of ecosystem development, such as investments into skills and people, investment into joint R&D infrastructures, pilot and demonstration facilities among other should be KPIs just like the project volume, exports, etc.
- **Take a larger role in providing non-financial support to increase the value of financial investments.** Overall, Business Finland applies a 'the company knows best' mentality when addressing the ecosystems, as the Leading Companies have a lot of knowledge of the business area. With regard to a more hands-on ecosystem development, this is, however, not a given. The lack of non-financial support with regards to ecosystem development (training, frameworks, guidelines, KPIs, etc.) seems like a missed opportunity, especially as there are no clear incentives for the Leading Companies to invest strongly in the ecosystem dynamics. Next to that, the ecosystems supported by the Leading Company Initiative can benefit from a strategic dialogue with Business Finland (and other key ecosystem players) in order to collectively identify and address key opportunities and bottlenecks for upcoming

innovations. Again, one option could be to better align orchestration funding with the LCI funding to leverage orchestration companies' expertise in ecosystem development.

8.1.4 *Improvements for Partnership Model*

- **Active alignment of the Leading Company Initiative with the Flagship programme of Academy of Finland should be made a priority.** When the Leading Company Initiative ecosystems and Flagships align thematically, many opportunities are available for creating active synergies.
- **In the short term, activate the alignment by experimenting with quickly to achieve opportunities for ecosystems and flagships that already align thematically**. Examples of opportunities are: academic research that can benefit from user panels, yearly knowledge exchange events, more contract research (private investments), etc.
- **For the long term, a shared vision on increasing the utilization of R&D between Business Finland and the Academy of Finland need to be drafted.** In this vision core differences between the organisation need to be addressed without drifting away from organisational strengths and core values. Making sure the management level is involved in drafting the vision may help to provide the agency for follow-up actions.

8.2 Overall recommendations

8.2.1 *Strategy and leadership*

- **Business Finland should encourage and demand that the ecosystems revolve around clear strategic *mutually agreed* specific objectives, formulated in a written document (vision, roadmap, plan, etc.).** The strategy should be jointly agreed within the ecosystem and periodically reviewed in a set process that is presented to Business Finland. Likely Business Finland would benefit from a stronger strategic approach in coaching the ecosystems, using for example the framework set in the recent MEAE Growth Portfolio and Business Finland's own strategy.
- **Business Finland should encourage and demand the ecosystems to have stronger leadership, both on the business side as well as on the side of neutral orchestration.** Ecosystems need clear business leadership, but also benefit from a neutral party that supports and involves and activates members that would otherwise be(come) inactive.

8.2.2 *The portfolio of instruments*

- **Business Finland should streamline its ecosystem instruments towards a set of key functions within ecosystems.** Key ecosystem functions include (1) long term investment in R&D, (2) ecosystem development and orchestration (3) setting up permanent R&D capabilities and infrastructure (laboratories, test, pilot and demonstration sites, as well as training facilities, permanent staff, interaction forums, development of curricula and degree programmes, etc.), and (4) enabling radical renewal. The current instruments cover three out of four functions, but none explicitly incentivizes capacity building and none of the ecosystems have coverage from more than two and most only one function. Used in isolation, the strengths and weaknesses of each instrument are not well addressed. For likely the best impact, all three instruments' key features should be combined for each ecosystem Business Finland is supporting, e.g. the radical renewal nature of Capital Loans, the professional ecosystem services from the Orchestration Funding, and the strong platform and volume of the Leading Company Initiative.
- **Business Finland should develop stronger incentives for investing in the long-term ecosystem development.** All of the instruments say they focus on ecosystems, but they do

not have specific incentive structure to drive building lasting partnerships and world class R&D capabilities beyond what other Business Finland instruments already do (with the partial exception of the orchestration funding). Both instrument KPIs and intrinsic business incentives play an important role.

- **Business Finland should focus ecosystem support on ecosystems that revolve around a mature business area.** Mature business areas have established business activities to build upon and companies with capabilities to perform R&D. Non-ecosystem instruments can be used to fund specific actors, instruments and/or initiatives within the ecosystems to reach other objectives, such as more radical renewal that goes beyond R&D that follows the development paths of established businesses.

8.2.3 The role of Business Finland

- **Business Finland should take an active role in outlining and fulfilling the strategy of the ecosystems.** Business Finland should be actively engaged in discussions with the ecosystem members about key challenges for achieving the agreed goals and objectives and opportunities. Business Finland should also in its part coach and facilitate the ecosystems in addressing challenges that arise from regulation/compliance and standardization.

8.2.4 The portfolio of supported ecosystems

- **Business Finland needs to manage its ecosystems as an investment portfolio.** Provided funding needs to be managed in the form of active monitoring and strategic support. Business Finland should actively ask the question how many ecosystems can effectively be active within Finland and how many can be actively supported with available Business Finland staff.
- **Capacity building within Business Finland with regard to (strategically) supporting ecosystems and managing the portfolio of ecosystems should be made a priority**. In case long-term development of the ecosystems is foreseen it is important that Business Finland has the means available to manage that.
- **Capacity building at ecosystem level with regards to formulating a clear strategy, building trust and realising commitment among members, orchestration and long-term development should be made a priority.** In case long-term development of the ecosystems is foreseen the ecosystems need the have the means available to take these steps.

Appendix A Interviews

As part of the evaluation, in total of 37 impact interviews were conducted. The interviews were targeted to the member companies of the funded ecosystems, excluding the 'core companies' such as the Veturi companies or Growth Engine companies. Also, research organisations, public sector organisations and NGOs were excluded from the impact interviews. These organisations were included in the interviews for the case studies. The objective of the impact interviews was to gather additional quantitative (e.g. expected turnover growth) and qualitative (e.g. views on instruments' strengths and weaknesses) data to analyse the added value and impact of the BF-funded ecosystems on their member companies. The interviews were conducted as semi-structured interviews, consisting of both structured and open-ended questions.

Some challenges were encountered in conducting the interviews. First, the coverage and quality of member companies' contact details was not as good as expected and significant additional work by Business Finland and the evaluation team was needed to acquire more relevant contact details for ecosystem members. Second, the fact that many companies did not recognize the ecosystem in question – or did not consider themselves as members of the ecosystem – also significantly affected their willingness to take part in interviews. For these reasons, the number of interviews conducted (37) was lower than originally planned (48).

The interviews were balanced across the different types of instruments used to support the ecosystems (Leading Company Initiative, Growth Engine Capital Loan and Growth Engine Orchestration Funding). However, this balance was somewhat affected by the difficulties in scheduling the interviews. The following table presents the number of interviews conducted for the different ecosystems and funding instruments. For the ecosystems covered in the case studies, additional interviews were conducted.

Table 7 Number of impact interviews conducted

Ecosystem / instrument	Number of impact interviews
Leading Company Initiative (Veturi)	**18**
Fortum&Metsä	6
KONE	5
Nokia	3
Sandvik	2
ABB	1
Neste	1
Growth Engine Capital Loan	**8**
Lamor	3
Vastuu Group	2
Iceye	2
Awake.AI	1
Growth Engine Orchestration Funding	**11**
OneSea	5
Green E2	3
4Recycling	2
Indoor Air Quality	1

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Appendix B Econometric analysis

B.1 Descriptive Statistics

B.1.1 Instrument Portfolio Analysis

In total 830 firms are participating in the ecosystem according to Business Finland Data. Figure 12 shows an overview of the number of projects firms are active in. In total 141 (17%) are not included in any Ecosystem (project), and 538 (65.8%) are active in one project, with 151 (18.2%) firms participating in more than one project (see also Venn Diagram, in Figure 13). Out of 689 participating firms, 21 (3%) participate in all three ecosystem types. There is a modest positive significant pairwise correlation between firm size and the number of participations (.25).

Figure 12 Participation rates

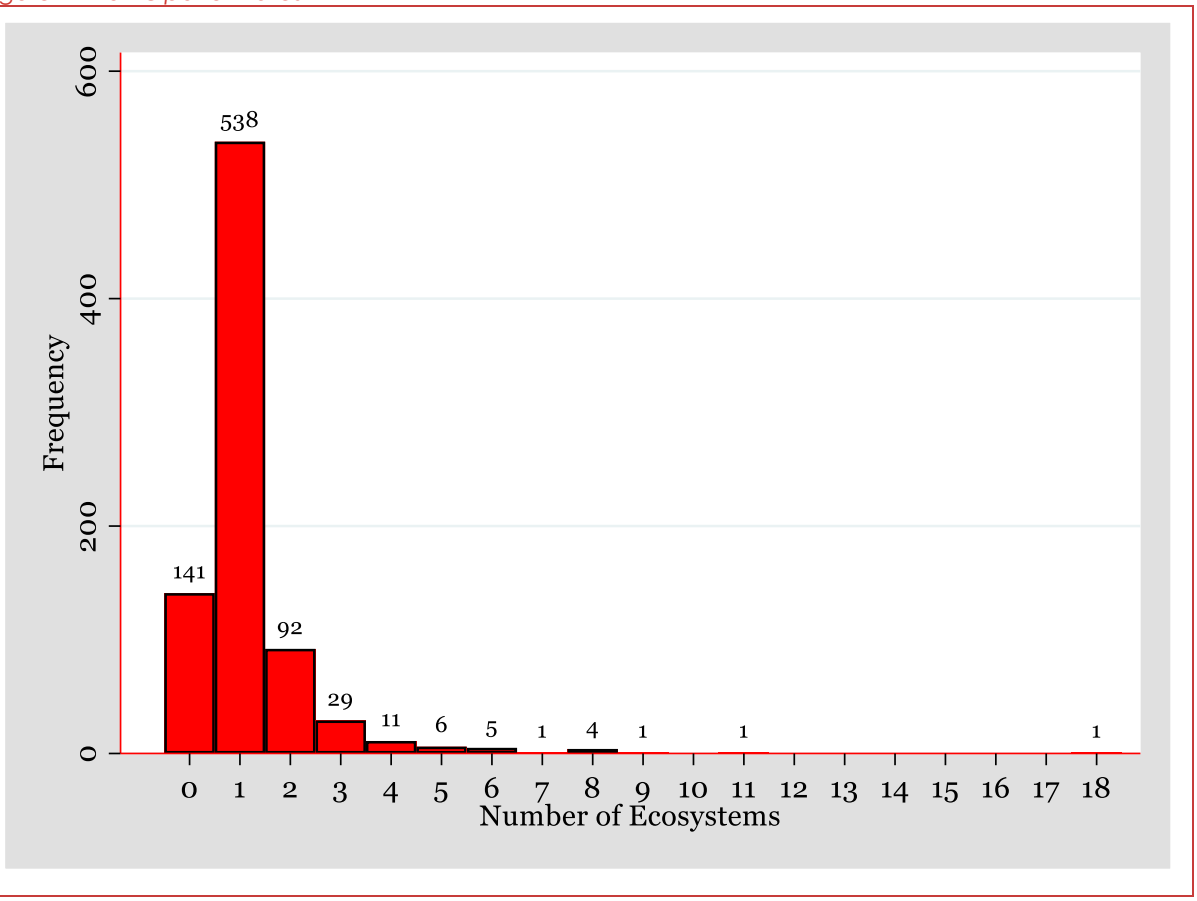

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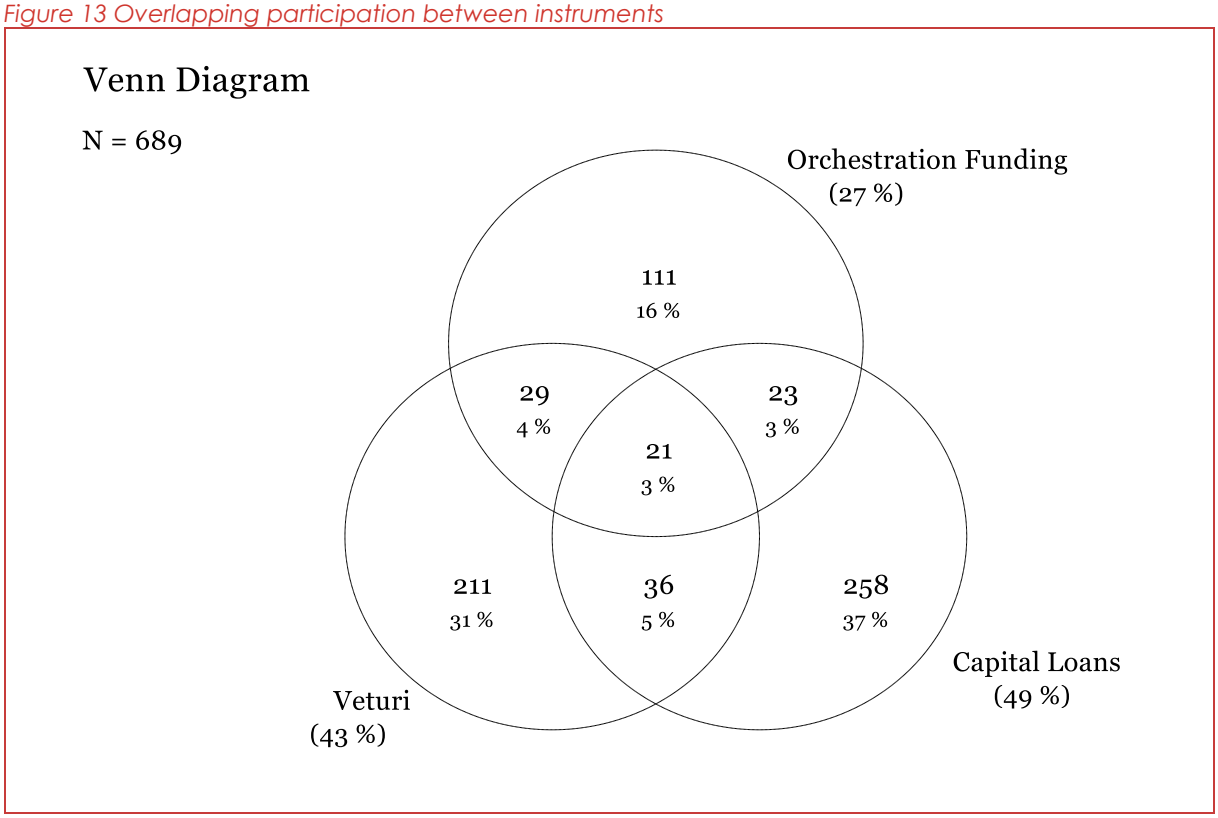
Figure 13 Overlapping participation between instruments



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B.1.2 Member Characteristics in 2021

Out of the 689 participating firm, no financial data is available for 155 firms, leaving us with a sample of 534 firms (78%). This sample is the basis for the financial analysis and characteristics analysis. We compare this with the full population of firms in the Business Finland database (total of 35,470 firms) in order to get an insight into the typical characteristics of participating firms. The results are presented in Table 8 and Figure 14. Note that we present both means as well as medians, where the latter better represents the typical member. We can denote some key observations:

- Participating firms are larger by all standards (turnover, added value and FTE) compared to non-participants by roughly a factor 10-25. Orchestration Funding participants are typically the largest (median turnover of 12.81mEUR), followed by Veturi (7.86m) and then Capital Loans (4.64m)
- Participating firms are more productive by roughly a factor 2 compared to non-participating firms. Most productive, in terms of median labour productivity are Orchestration Funding Participants (72.96 kEUR per annum), closely followed by Veturi participants (72.67 kEUR per annum) and then Capital Loans (69.8 kEUR per annum).
- Participating firms are much more export oriented than non-participating firms. Using mean values (as median values for non-participating are too small to even compare with), we see that participating firms have an export intensity roughly 3 times higher than non-participating firms. Orchestration Funding participants have the highest export intensity (22%), followed by Veturi (17%) and Capital Loans participants (12%).

Table 8 Firm Characteristics

Indicator	Full Population		Veturi		Capital Loans		Orchestration Funding	
	Median	*mean*	*Median*	*mean*	*Median*	*mean*	median	mean
Turnover (mEUR)	0.50	10.14	7.86	231.93	4.64	193.71	12.81	429.28
Added value (mEUR)	0.33	6.91	5.50	157.65	4.06	98.17	7.15	299.19
FTE ('000)	6.00	32.84	52.00	438.23	45.00	514.80	60.00	973.39
Labour Productivity (kEUR)	44.19	64.32	72.67	88.30	69.80	87.03	72.96	104.44
Export (mEUR)	0.00	3.27	0.88	125.01	0.25	86.98	2.70	221.83
Export Intensity (%)	0.00	0.12	0.17	0.34	0.12	0.29	0.22	0.38

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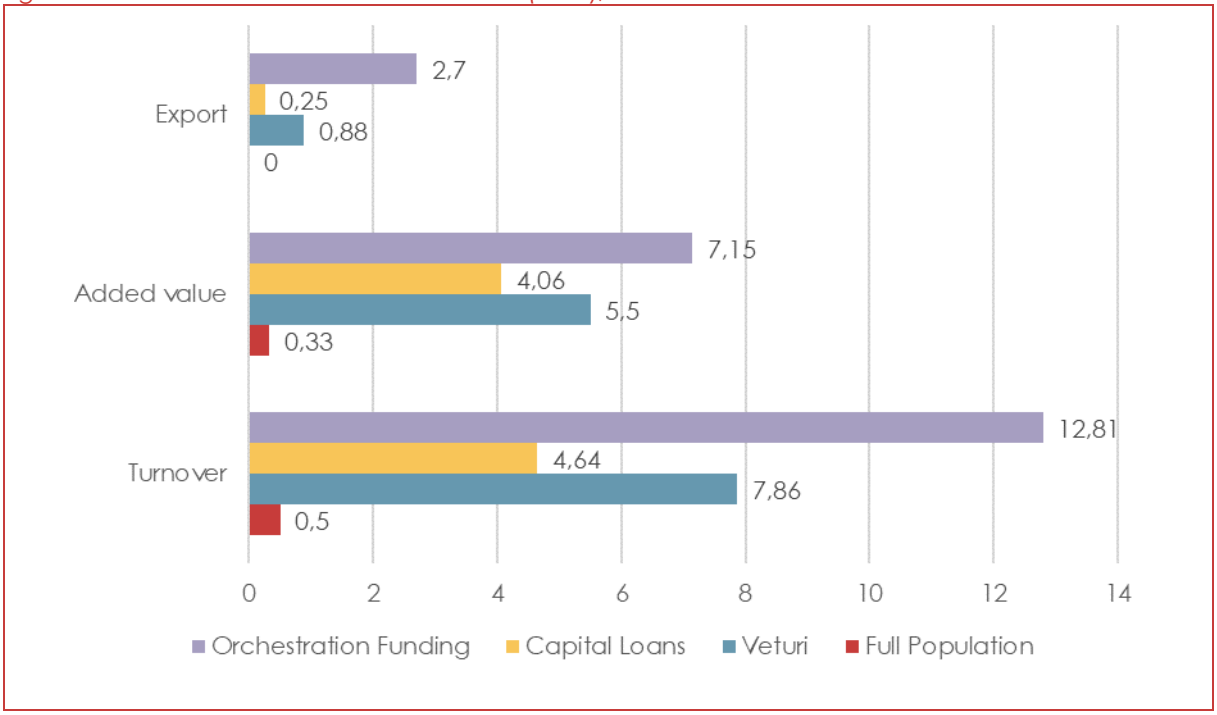
Figure 14 Firm Characteristics: Median values (2021), in mEUR



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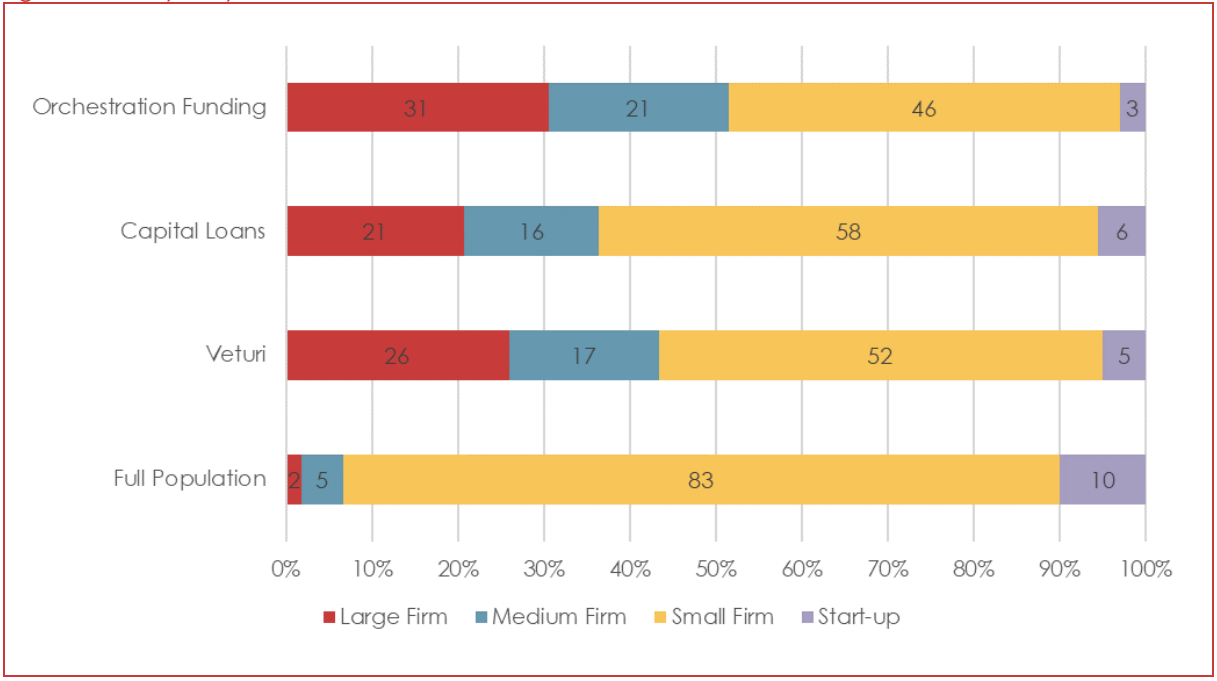
We also analyse the firm characteristics more explicitly in terms of size classes, to get a more nuanced view in particular of the participation of SMEs and start-ups. The results are presented in Figure 15 below. All size classifications follow the standard EU definitions, and start-ups are counted as small firms less than or equal to 3 years old. We can see that, as expected, large firms make up a much larger share of firms among participants (21-31%) vs the full population (2%). Start-up form a relatively small share of all instruments (3-6%).

Figure 15 Analysis by Size Classes



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We also investigate to what extent the instruments are associated with specific sectors. The results are presented in Table 9 below, carried out at the 2-digit NACE level. We can conclude all instruments are relatively diverse in terms of the sectors represented (between 33 and 41 sectors, even among a relatively modest number of participants). Certain sectors, including Computer Programming, Consultancy and Research Activities (NACE 62) and Manufacturing of machinery and equipment (NACE 28) are particularly well represented.

Table 9 Sectoral analysis

variable	All Population	Veturi (2020)	Capital Loans (2016)	Orchestration Funding (2016)
Top 5 Sectors	62 (9.63%) Computer programming, consultancy and related activities 46 (7.16%) Wholesale trade 70 (5.84%) Activities of head offices; management consultancy activities 47 (5.06%) Retail trade, except of motor vehicles and motorcycles 71 (4.33%) Architectural and engineering activities; technical testing and analysis	71 (14.41%) Architectural and engineering activities; technical testing and analysis 62 (13.06%) Computer programming, consultancy and related activities 28 (11.26%) Manufacture of machinery and equipment 72 (6.31%) Scientific research and development 26 (5.86%) Manufacture of computer, electronic and optical products	62 (25.62%) Computer programming, consultancy and related activities 24 (11.82%) Manufacture of basic metals 85 (6.9%) Education 28 (5.91%) Manufacture of machinery and equipment 70 (5.42%) Activities of head offices; management consultancy activities	71 (13.18%) Architectural and engineering activities; technical testing and analysis 28 (10.85%) Manufacture of machinery and equipment 62 (10.85%) Computer programming, consultancy and related activities 72 (7.75%) Scientific research and development 20 (4.65%) Manufacture of basic chemicals, fertilisers and nitrogen

variable	All Population	Veturi (2020)	Capital Loans (2016)	Orchestration Funding (2016)
				compounds, plastics and synthetic rubber
Unique Sectors Present	81 (among 35,648 companies)	41 (among 253 companies)	33 (among 160 companies)	43 (among 294 companies)

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B.1.3 Membership determinants

Following up on the descriptive analysis presented in the previous section we also carried out a multivariable predictive analysis via a probit regression analysis, where we looked at the predictive power of individual factors taking into account all factors at once. The results are presented in Table 10 below.

Table 10 Predictive analysis

variable	Veturi (2020)	Capital Loans (2016)	Orchestration Funding (2016)
Turnover	-	-	
Added value	++	++	++
FTE			
Labour Productivity			-
Export	+	+	++
Export Intensity	++	++	
Company Age			

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We can conclude added value is a key determinant for all instruments, with export intensity also relevant for both Veturi and Capital Loans, and export itself for all three instruments as well. Turnover is to a small extent negatively associated with participation, when other factors are taken into account. Note that due to key missing variables, the findings for export intensity may also be a proxy for R&D-intensity, which are known to be correlated.

B.2 Impact analysis

B.2.1 Regression analysis of intervention impacts

We test whether members of the ecosystems perform better on key metrics in the period 2019-2021 compared to a comparable control group. The control group is constructed using a propensity-score matching procedure, where we match each participant to one non-participant (from the larger BF database) based on similar background characteristics (based on the metrics as described in Section 1).

Subsequently, we carried out a Fixed Effects analysis, where we compare growth rates between four years prior (so 2017-2021, 2016-2020 and 2015-2019) given we expect results only to start from 2018. Veturi is not included, as this intervention started later. We use log-transformed variables for turnover, added value, FTE and export, as is common practice in order to avoid overweighting larger firms. The Fixed Effects analysis was implemented via a

panel regression model (xtreg in Stata), where we applied heteroskedasticity-robust standard errors.

The model results show that the available measures provide only limited explanatory power (about 20% of the variance), but this is rather typical for business research. We should note, of course, that the omission of key variables such as R&D-expenditures results in lower explanatory power as well as create omission biases (see discussion below).

The results are presented in Table 11 below. We find a positive effect for export & export intensity growth for Orchestration Funding members, compared to their control group. We find no other effects.

Table 11 Results of Fixed Effect Analysis

variable	Combined CL + OF	Capital Loans (2016)	Orchestration Funding (2016)
Turnover			
Added value			
FTE			
Labour Productivity			
Export			+*
Export Intensity			++***

Technopolis Group 2022, based on company data

We suggest to treat these findings with care, as there a number of key limitations to this analysis:

- **Data limitations**: No data was available regarding the exact date of joining an ecosystem, nor the intensity of collaboration. We have now assumed that all firms started in 2016. This simplification will have increased the standard errors of the analysis, meaning that some smaller effects may not have been picked up. This could lead to a downward bias regarding the effects.
- **Large variance**: The period is characterized by an arguably extreme economic environment due to the COVID-19 pandemic, which resulted in large swings in output. These extreme conditions may mask effects, leading to a downward bias of the effects.
- **Violated common trend assumption**: while fixed-effects methods control for unobserved structural differences between participants and control groups, it cannot control for dynamic differences between these groups, in particular unobserved differences. This means that for instance aspects such as entrepreneurial qualities, innovation dynamism etc. are not controlled for. It is highly likely that participating firms are performing better on such aspects, therefore leading to an upward bias regarding the effects.
- **Omission bias**: We do not have data for R&D-intensity, which is correlated with productivity, export behaviour etc. It is highly likely that R&D-intensity is partially responsible for the export findings, as firms with a higher R&D-intensity are more likely to be members of ecosystems, and be likely to perform better on exports. Since R&D is a dynamic variable it falls under the violated common trend assumption, and I likely resulting in an upward bias regarding the effects.

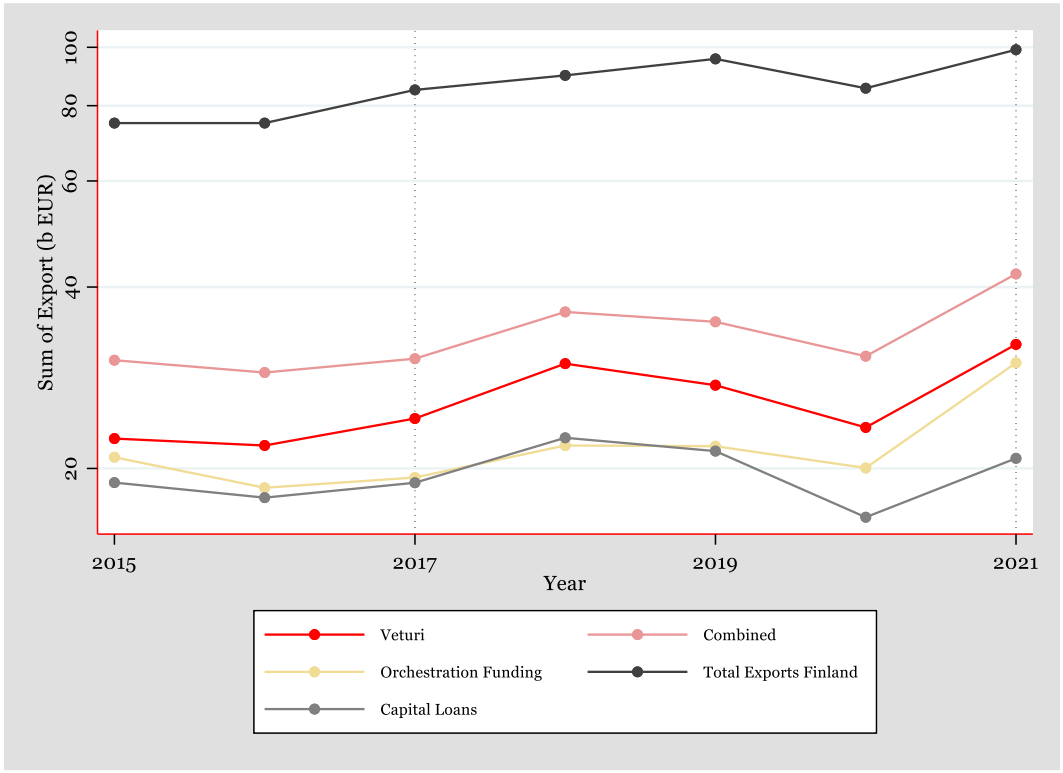
Given the biases have both upward and downward directions, we cannot reach a conclusion regarding the overall likely bias in the effect estimation.

B.2.2 *Detailed exploration aggregate export trends*

Given the finding on the potential causal effect on exports, we provide a further detailed exploration of the export trends of the instrument participants compared to the overall Finnish economy performance. The results are presented in Figure 16 (absolute volumes) and Figure 6 (index numbers), the latter being particular useful for comparing performance.

Figure 5 highlight how important the contribution of the instrument participant is to the total Finnish export performance. In 2017, all instruments together represent 30.4bEUR of exports out of the total of 85.0bEUR, or 36%. In 2021, this figure rose to 42.1bn EUR out of 99.0bEUR (42%). These are even underestimations, as no financial data was available for 22% of firms.

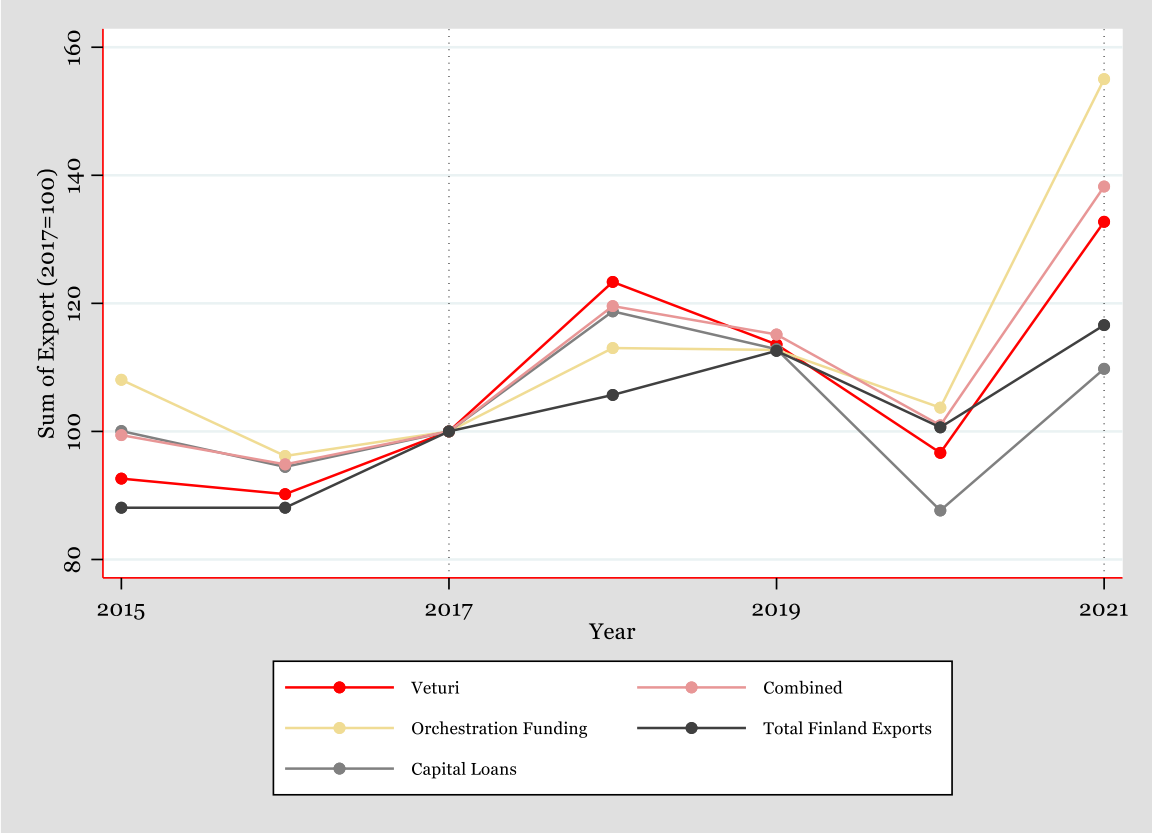
Figure 16 Total Export Volumes



Technopolis Group 2022, based on company data

The analysis based on index numbers (Figure 17) provides useful insights regarding the relative performance of the different instrument participants. We can see that all instrument participants (collectively) outperform the overall Finnish economy in terms of export, except for Capital Loan participants. Orchestration Funding participants are particularly fast-growing in terms of exports with a growth of 55% between 2017 and 2021, compared to 16% for the total economy.

Figure 17 Total Exports (Indexed)



Technopolis Group 2022, based on company data

Appendix C Network analysis

C.1 Methodological note

In this chapter we present the results of the network analysis based on webscraping the websites of ecosystem organisations. In order to get an understanding of the level of collaboration we analysed whether the websites of ecosystem members mentioned other ecosystem members. When collaboration is publicly mentioned on a website this illustrates a stronger bond than when this is not the case. Clearly, results from webscraping are primarily indicative as the data does not paint the full picture. However, as the results will show, the findings are quite insightful.

In comparison to the network analysis conducted in the earlier performed impact study on the World-Class Ecosystems in the Finnish Economy, the current evaluation takes a longitudinal perspective, in which the aim is to show developments over time. While time traveling is not possible, the Internet Archive foundation archives has been archiving most publicly available websites since the 2010s allowing us to get a historical perspective on the networks between ecosystem members. For the current study we have for each network taken a snapshot from the period before 2016 and compared it to the most recent available snapshot.

Data collection: *First the URL's of the domains (websites) of the ecosystem participants were collected as a starting point for the webscraping algorithm. The algorithm visits the pages, extracts the data, and follows the hyperlinks on each page to other pages of the same domain, on which these steps are repeated till the scraper has visited 1000 pages of each particular domain[11]. For the purpose of this study we focused on the "html" data extractions as this is the best available in the Internet Archive.*

Data analysis: *The data for each ecosystem participant was then searched for linkages to other participants of the same ecosystem. These linkages are identified in two distinct ways:*

- *Text references; the text scraped from the website is searched for references to the other ecosystem participants. Where relevant case-sensitivity and name variants (e.g. University of Jyväskylä, Jyväskylän yliopisto, JYU) were taken into account.*
- *Hyperlink references; the webscraped data is searched for URL-hyperlinks to the domains of other ecosystem participants.*

Quality control: *Combining these two searches resulted in a dataframe that provided for each ecosystem participant[12] an overview of the linkages to other participants in the same ecosystem. A random sample of these linkages has been inspected for quality control. In general the linkages indeed capture references to ongoing collaboration initiatives in an ecosystem (e.g. organisation A reporting on their website: "we are starting this exciting project in collaboration with organisation B"). Encountered obvious false positives/negatives were solved in an iterative process of adapting the code, yet some abbreviations were too common to distinct (e.g. the organisation "ITS" and the possessive pronoun "its").*

Methodological limitations: *Data is limited to the online footprint of organisations, when websites are minimalistic results will be limited. Larger organisations tend to have a larger online footprint (but also collaborate more simply due to size). The data only suggests binary collaborations (yes or no), no insights into the strengths of the collaborations are available. No insights into the type of collaborations are available (ecosystem relevant or not). Some organisation names are more prone to false positives/negatives (generic/short names).*

The use of the historical perspective also introduces some additional limitations. Organizations can change names and the URL of their website over time, which might leads us to not get a complete picture of its historical web presence. Furthermore, while the Internet Archive is quite complete, it makes some decisions in what to include in the archive. The deeper one goes into a website, the less likely a page is to be included in the internet archive.

As already mentioned, the results of this methodology should not be interpreted as the literal (missing) collaborations between the ecosystem members as no complete data on for

[11] For some very large domains the number of pages has been limited to the first 100.000 pages of the domain

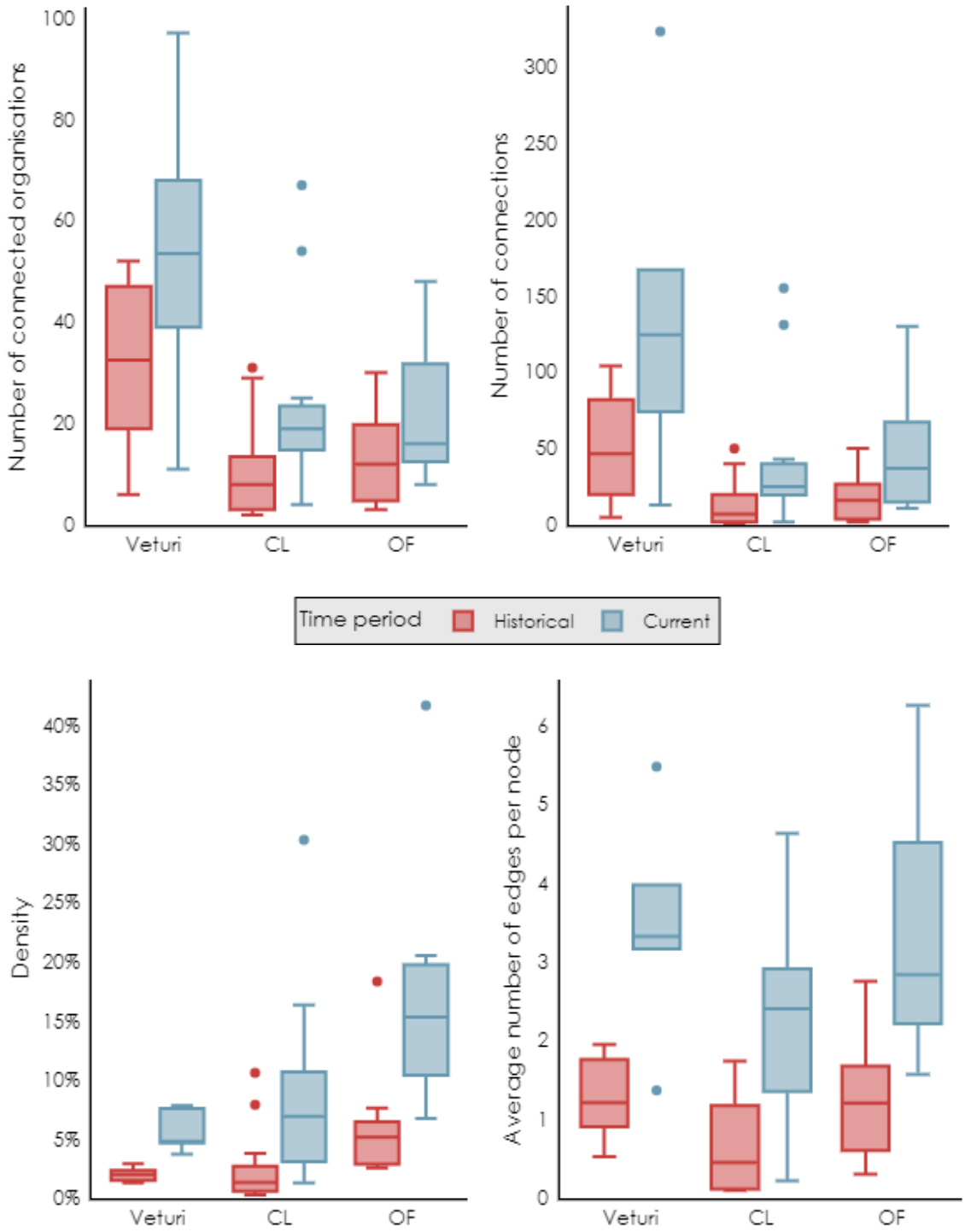
[12] The domains of four organisations could not be scraped. Yet these organisations can still be part of the network analysis, as other organisations are still able to reference them.

instance project collaborations was available. To quantify some of the network patterns, the visualisations will be accompanied by some indicators for which both the current and historical value will be presented:

- **Total number of actors:** This shows how many organisations take part in the ecosystem. Generally speaking, ecosystems with fewer members will have the tendency to show relatively more interconnections (higher network density) as it is easier to be connected to a handful of organisations than to +50 organisations. However, as the data will show, this rule of thumb is not always true as large ecosystems can also be dense and vice versa.
- **Number of connections:** The number of connections realized between the members in the network.
- **Network density:** This shows the number of interconnections in the ecosystem relative to the theoretical maximum number of possible connections. For this analysis organisations are only included if they have at least one connection to another organisation in the ecosystem. In simple words this indicator answers the question: *"Is everybody connected to everybody?"*
- **Betweenness centrality:** This indicator indicates the centrality of an individual actor in the network. For readability we do not present the value of the indicator but reflect this indicator in the size of the network nodes. Technically speaking the indicator calculates how often each organisation is on 'the shortest route' between two other organisations. In simple words this indicator answers the question: *"What is the potential of an actor to fulfil a bridging role between two other actors?"*

C.2 Indicators of the network analysis per instrument

Figure 18 Indicators by time period and instrument. Veturi = Leading Company Initiative; CL = Growth Engine Capital Loan; OF = Growth Engine Orchestration Funding

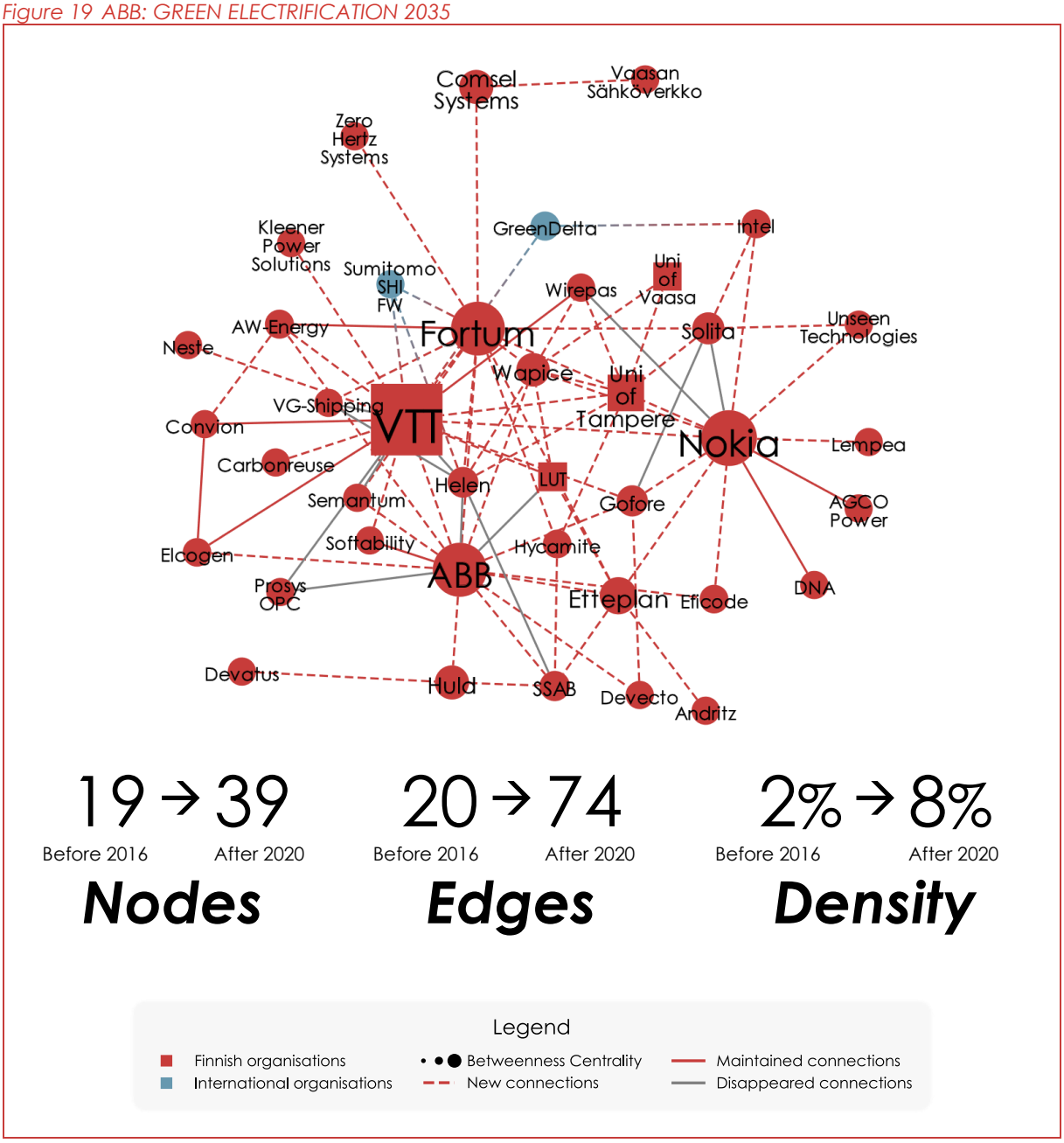


Technopolis (2022) based on data scraped from the internet archive

C.3 Veturi ecosystems

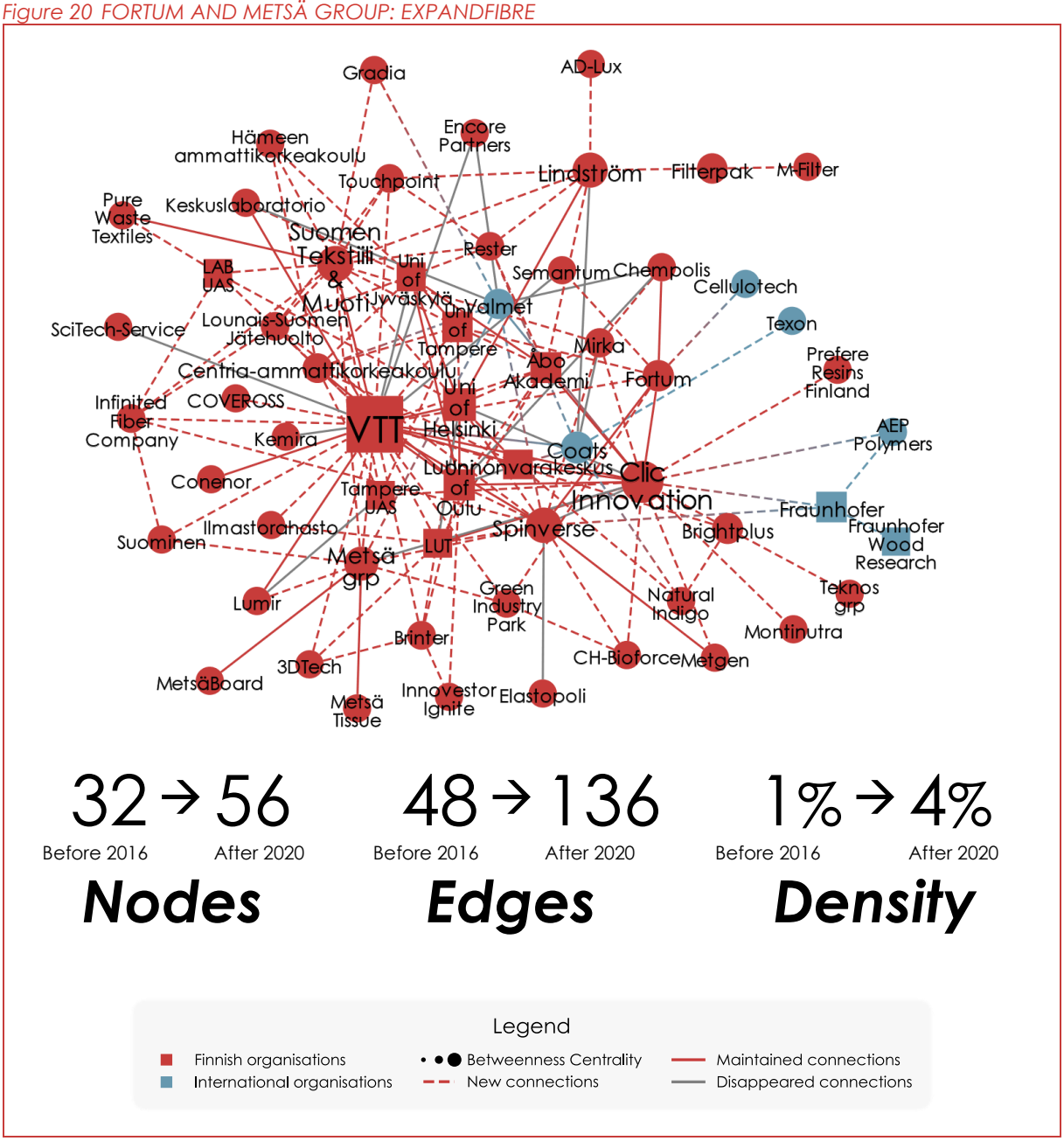
This section presents the network plots for the Veturi ecosystems.

Figure 19 ABB: GREEN ELECTRIFICATION 2035



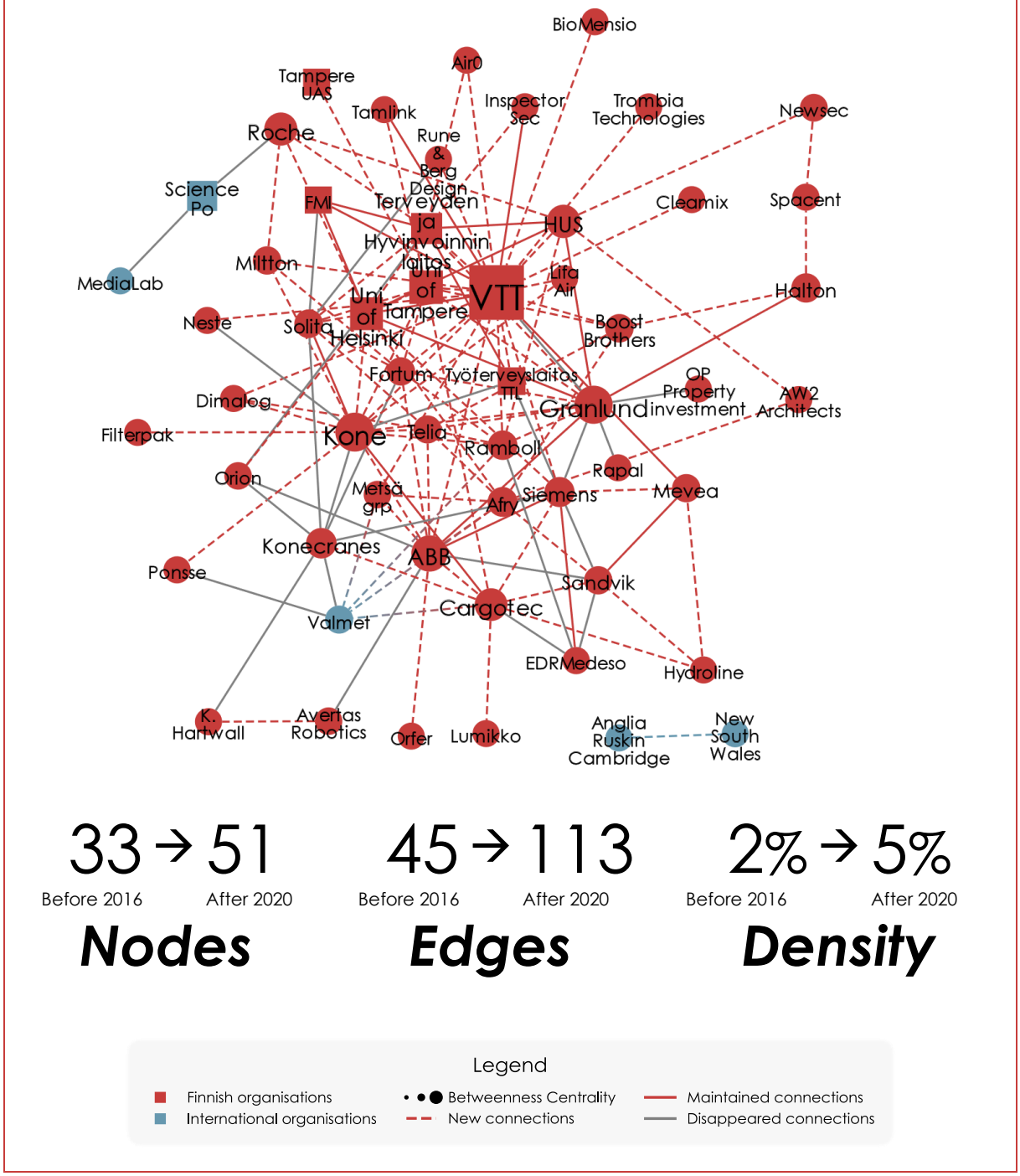
Technopolis (2022) based on data scraped from the internet archive

Figure 20 FORTUM AND METSÄ GROUP: EXPANDFIBRE



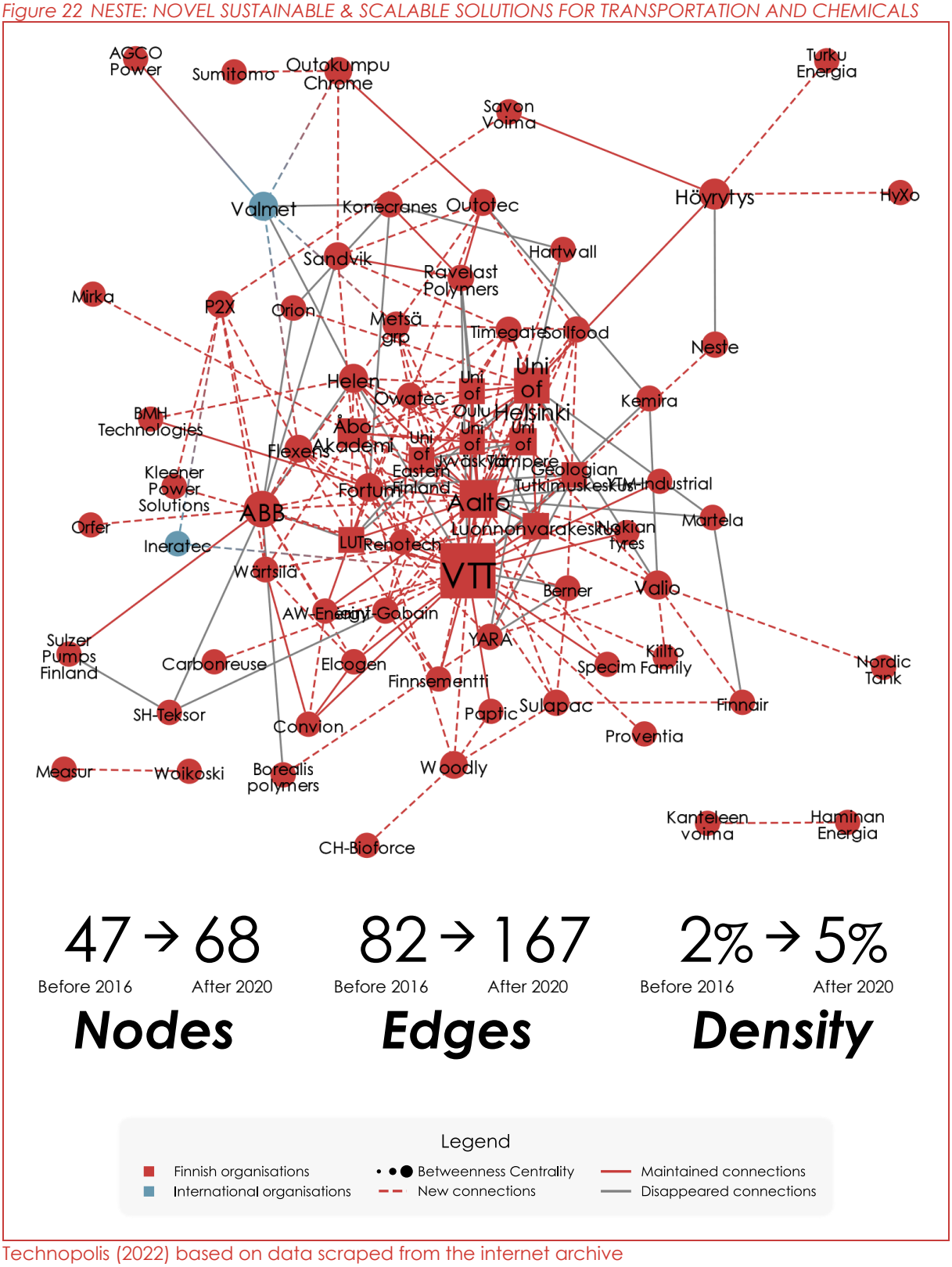
Technopolis (2022) based on data scraped from the internet archive

Figure 21 KONE: THE FLOW OF URBAN LIFE



Technopolis (2022) based on data scraped from the internet archive

Figure 22 NESTE: NOVEL SUSTAINABLE & SCALABLE SOLUTIONS FOR TRANSPORTATION AND CHEMICALS



47 → 68
Before 2016 After 2020
Nodes

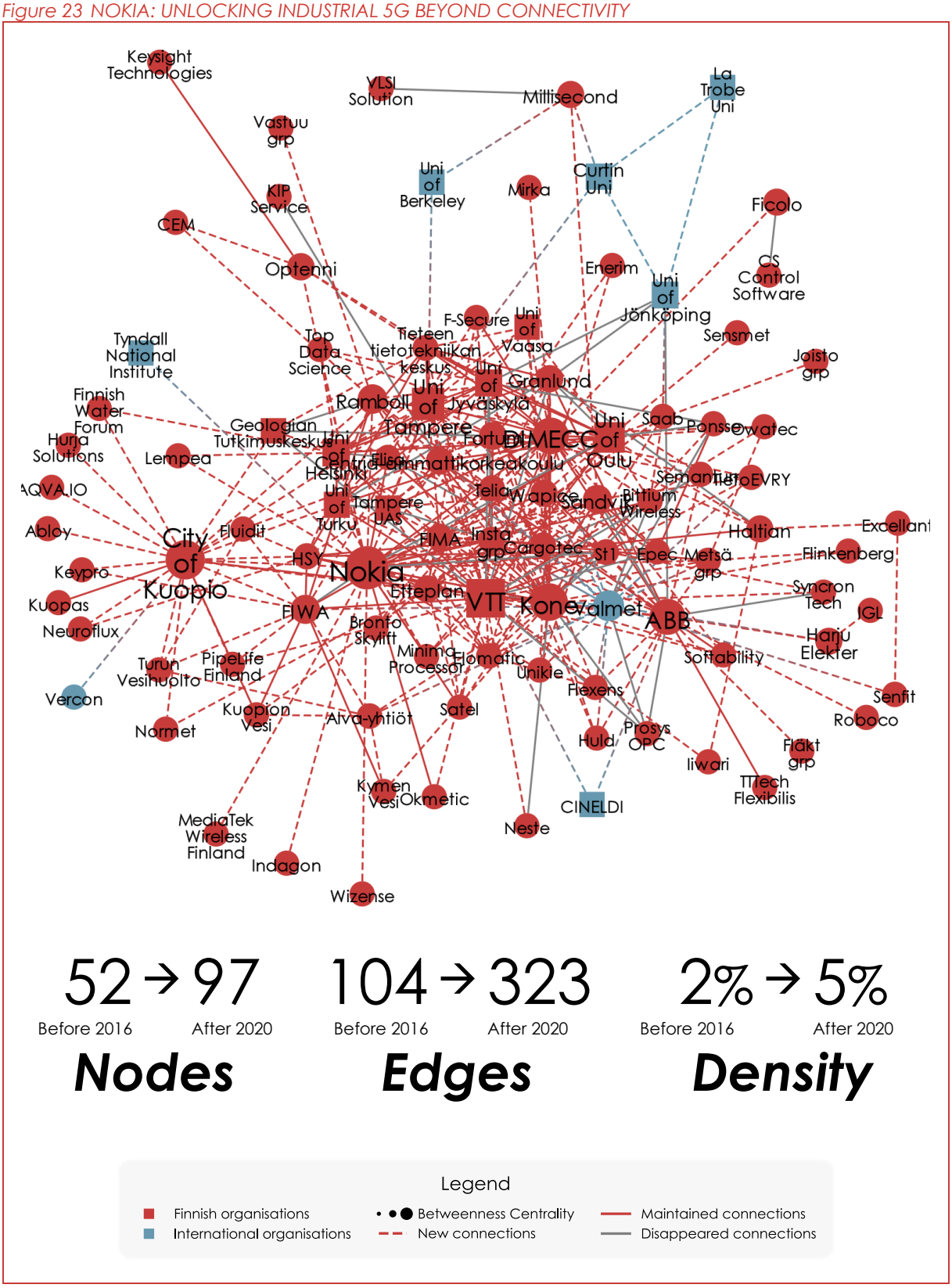
82 → 167
Before 2016 After 2020
Edges

2% → 5%
Before 2016 After 2020
Density

Legend
- Finnish organisations
- International organisations
- Betweenness Centrality
- New connections
- Maintained connections
- Disappeared connections

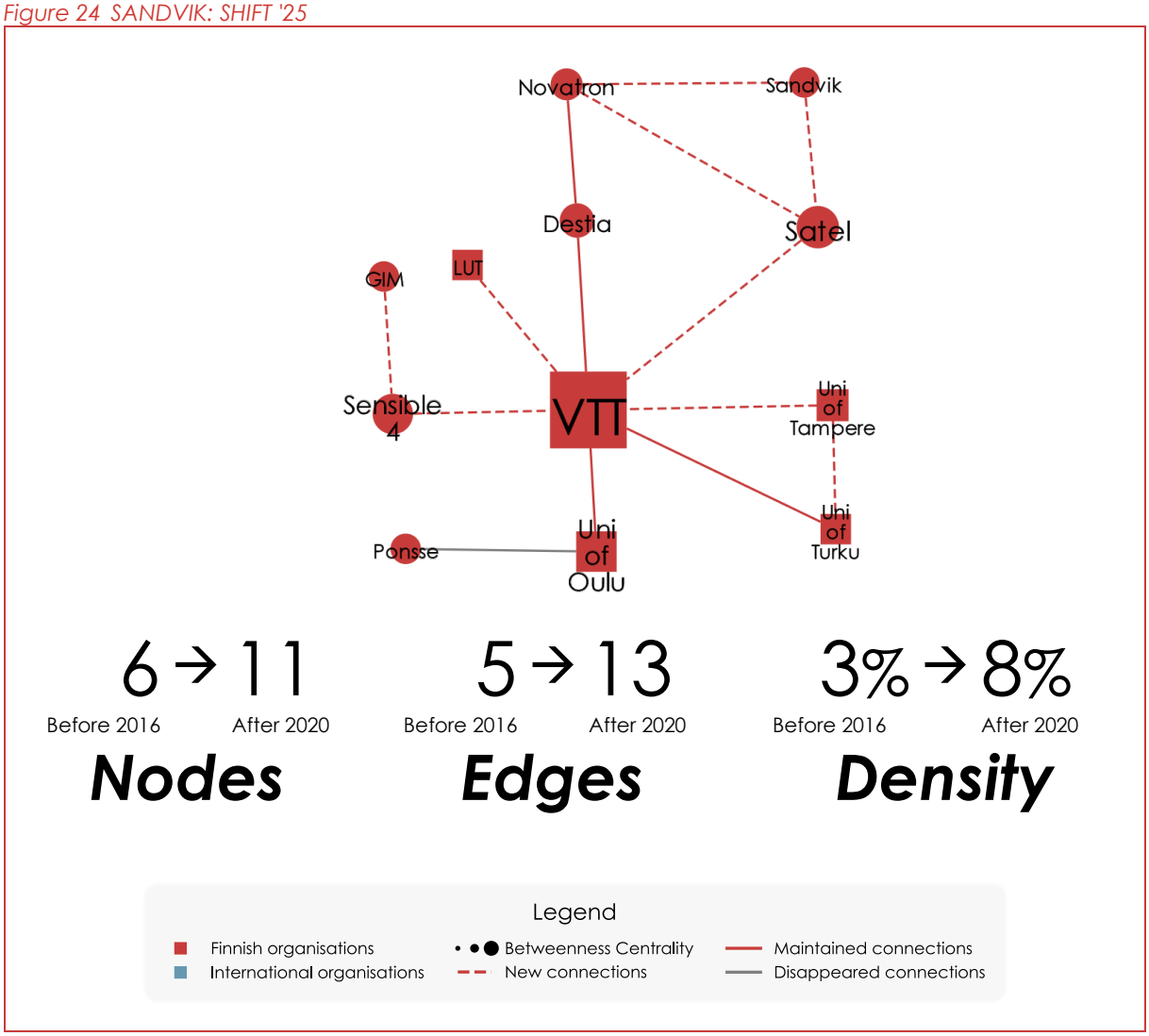
Technopolis (2022) based on data scraped from the internet archive

Figure 23 NOKIA: UNLOCKING INDUSTRIAL 5G BEYOND CONNECTIVITY



Technopolis (2022) based on data scraped from the internet archive

Figure 24 SANDVIK: SHIFT '25

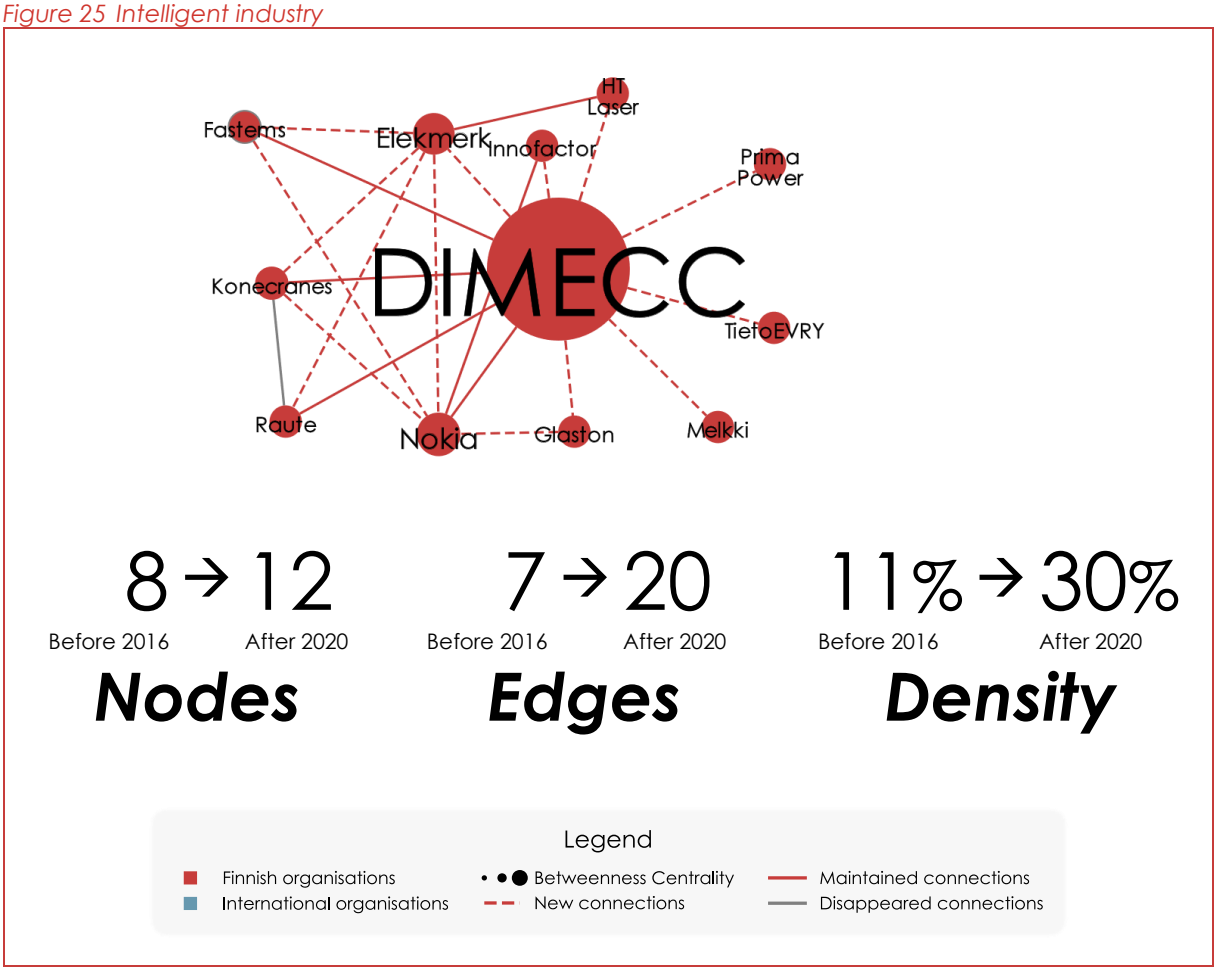


Technopolis (2022) based on data scraped from the internet archive

C.4 Growth Engine Capital Loan ecosystems

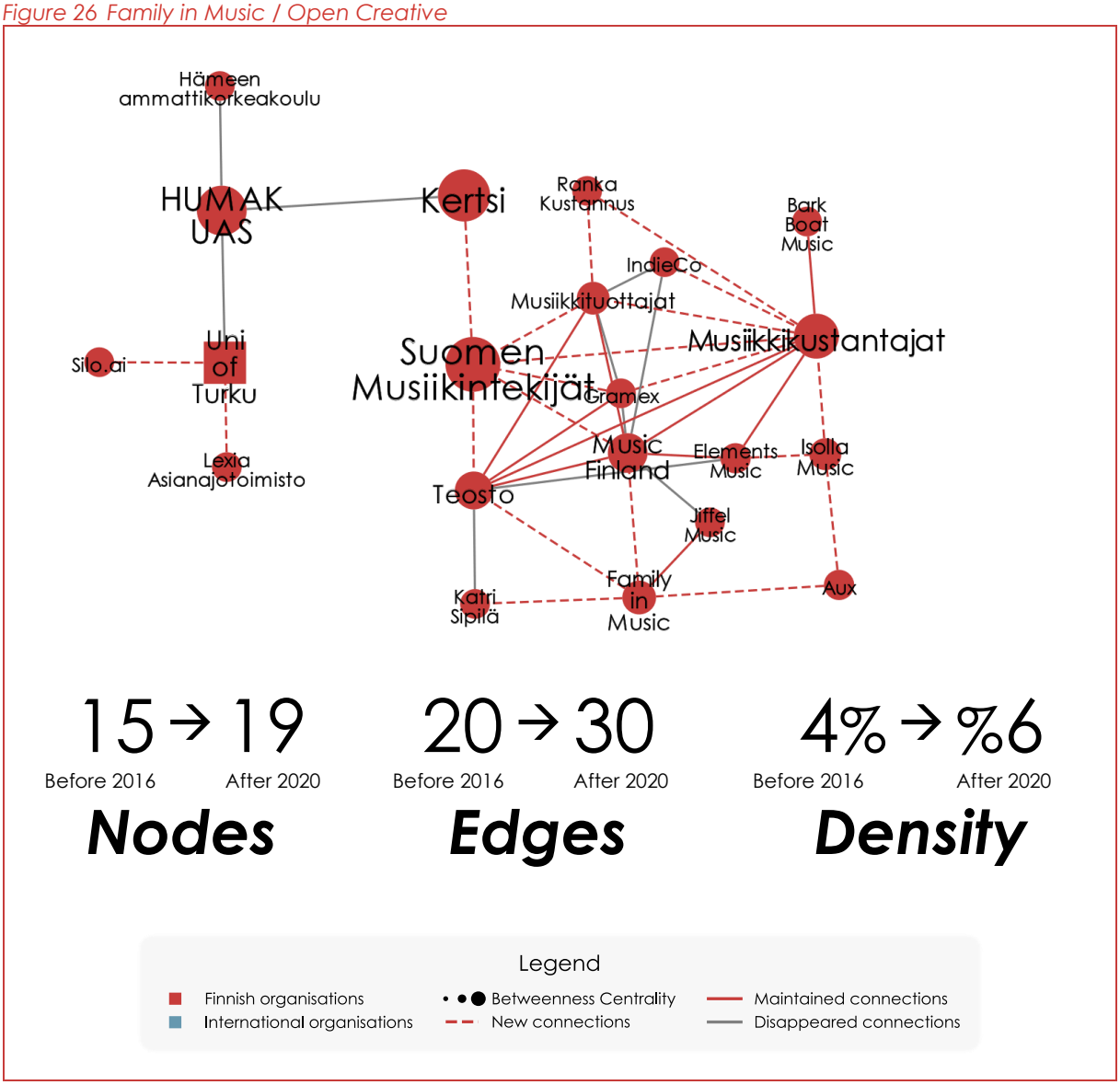
This section presents the network plots for the Growth Engine Capital Loan ecosystems.

Figure 25 Intelligent industry



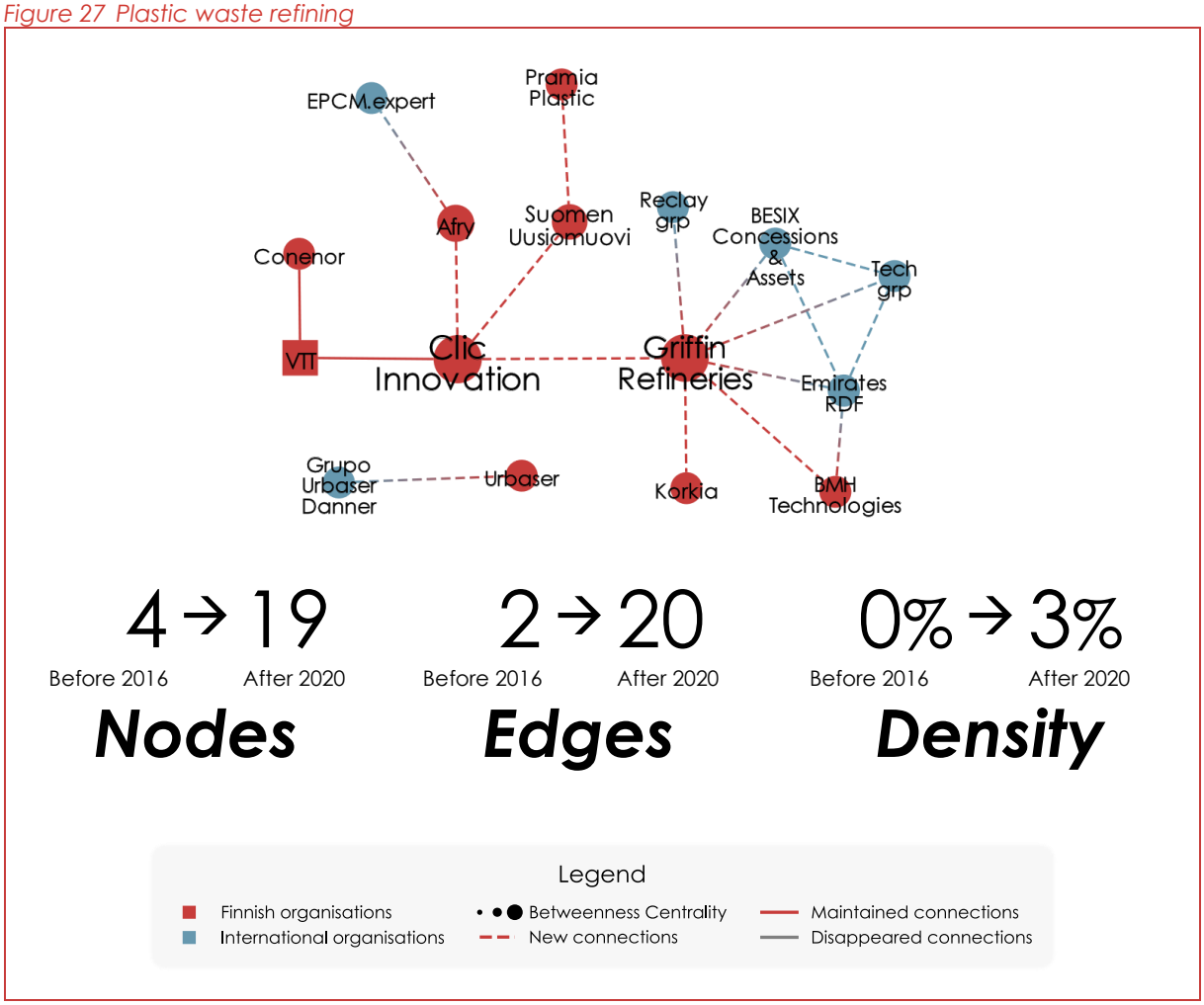
Technopolis (2022) based on data scraped from the internet archive

Figure 26 Family in Music / Open Creative



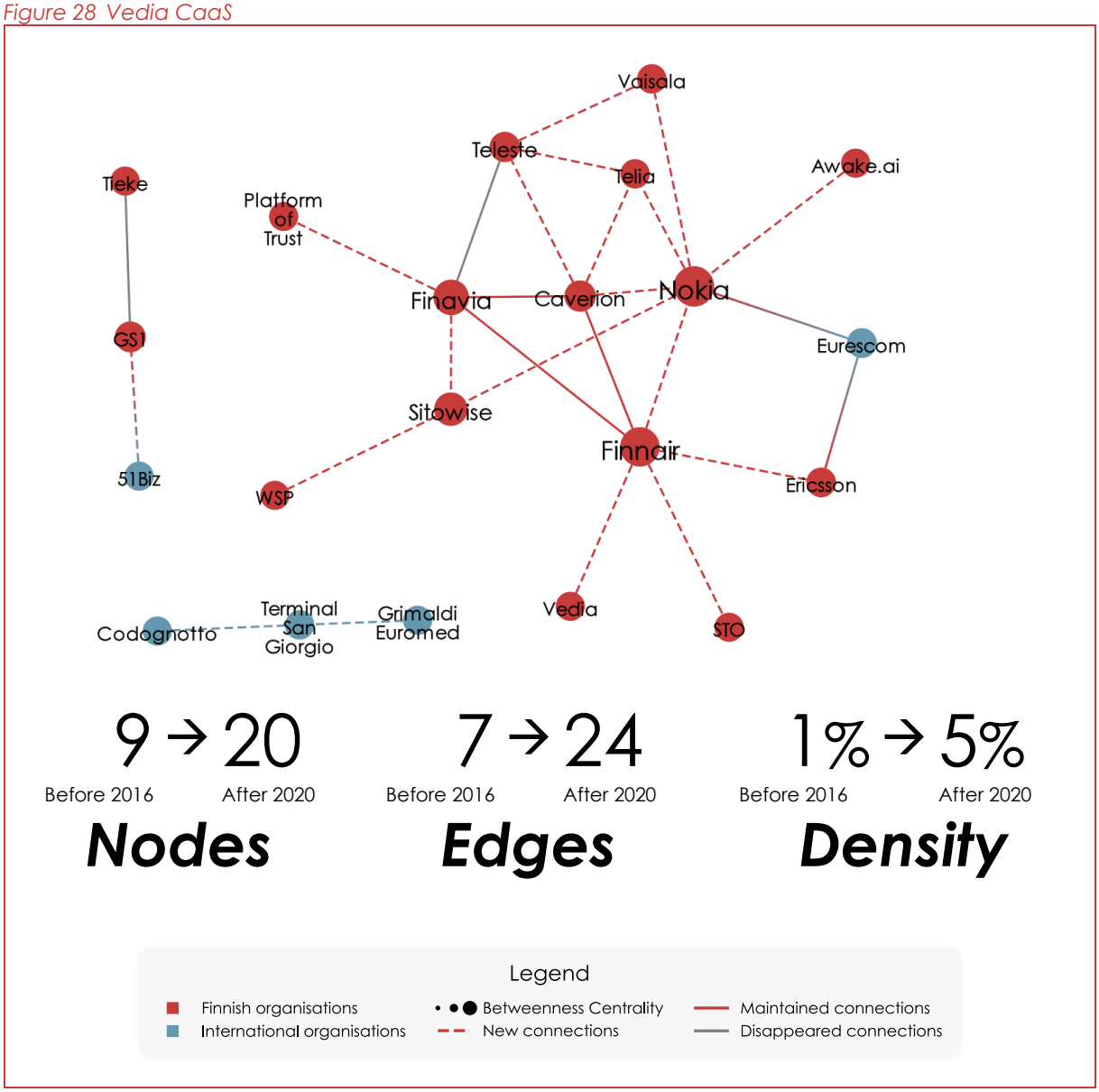
Technopolis (2022) based on data scraped from the internet archive

Figure 27 Plastic waste refining



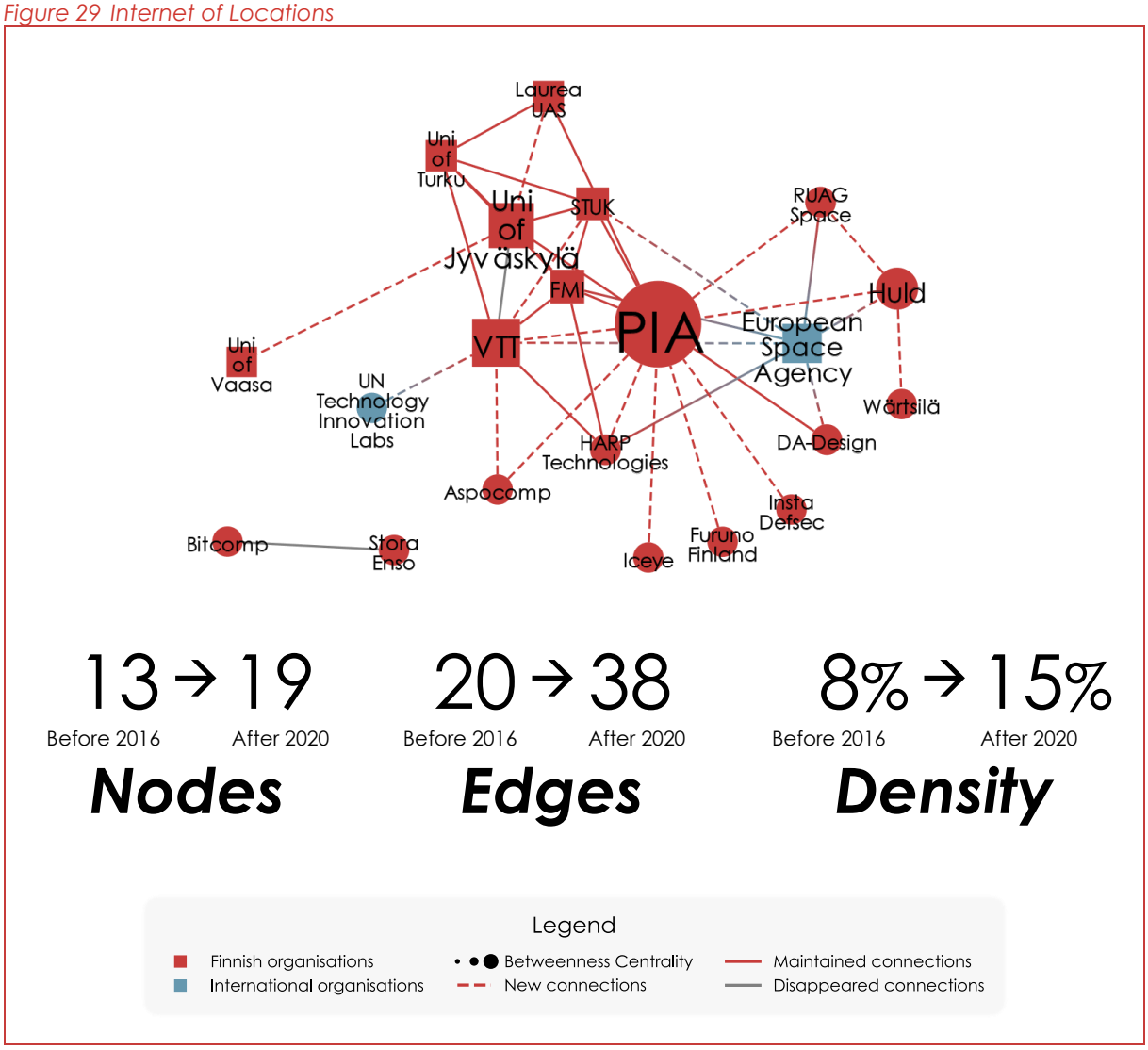
Technopolis (2022) based on data scraped from the internet archive

Figure 28 Vedia CaaS



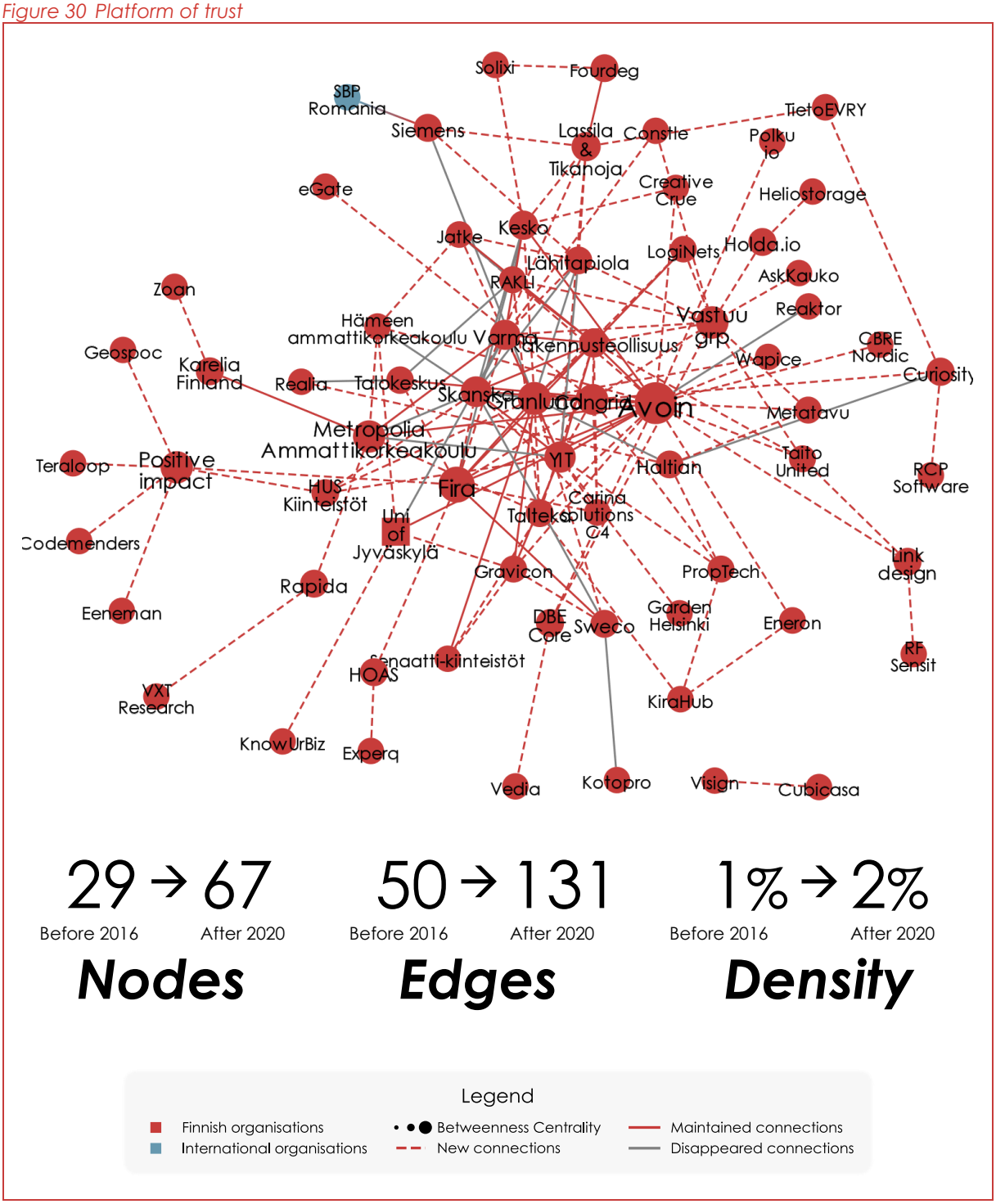
Technopolis (2022) based on data scraped from the internet archive

Figure 29 Internet of Locations



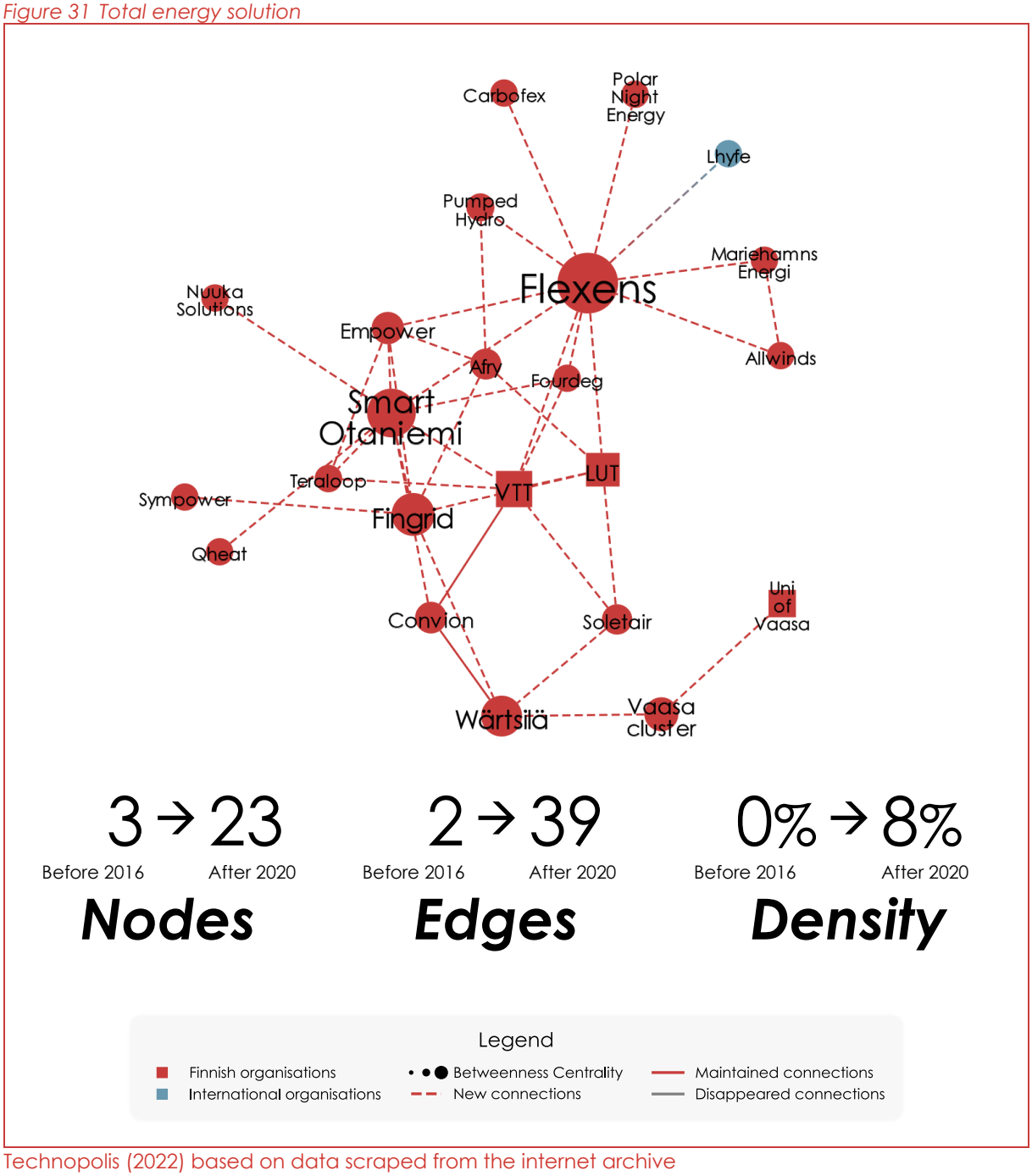
Technopolis (2022) based on data scraped from the internet archive

Figure 30 Platform of trust



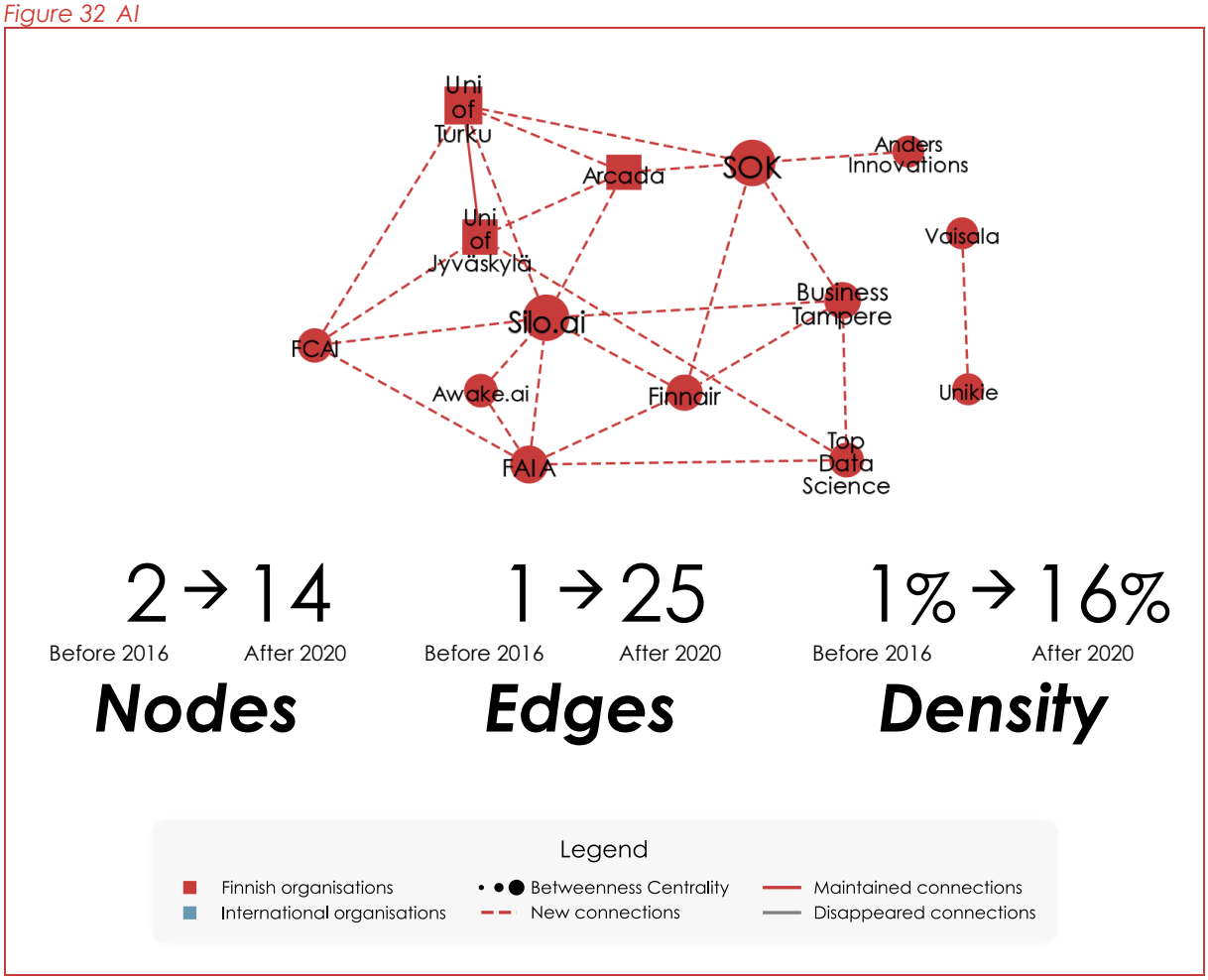
Technopolis (2022) based on data scraped from the internet archive

Figure 31 Total energy solution



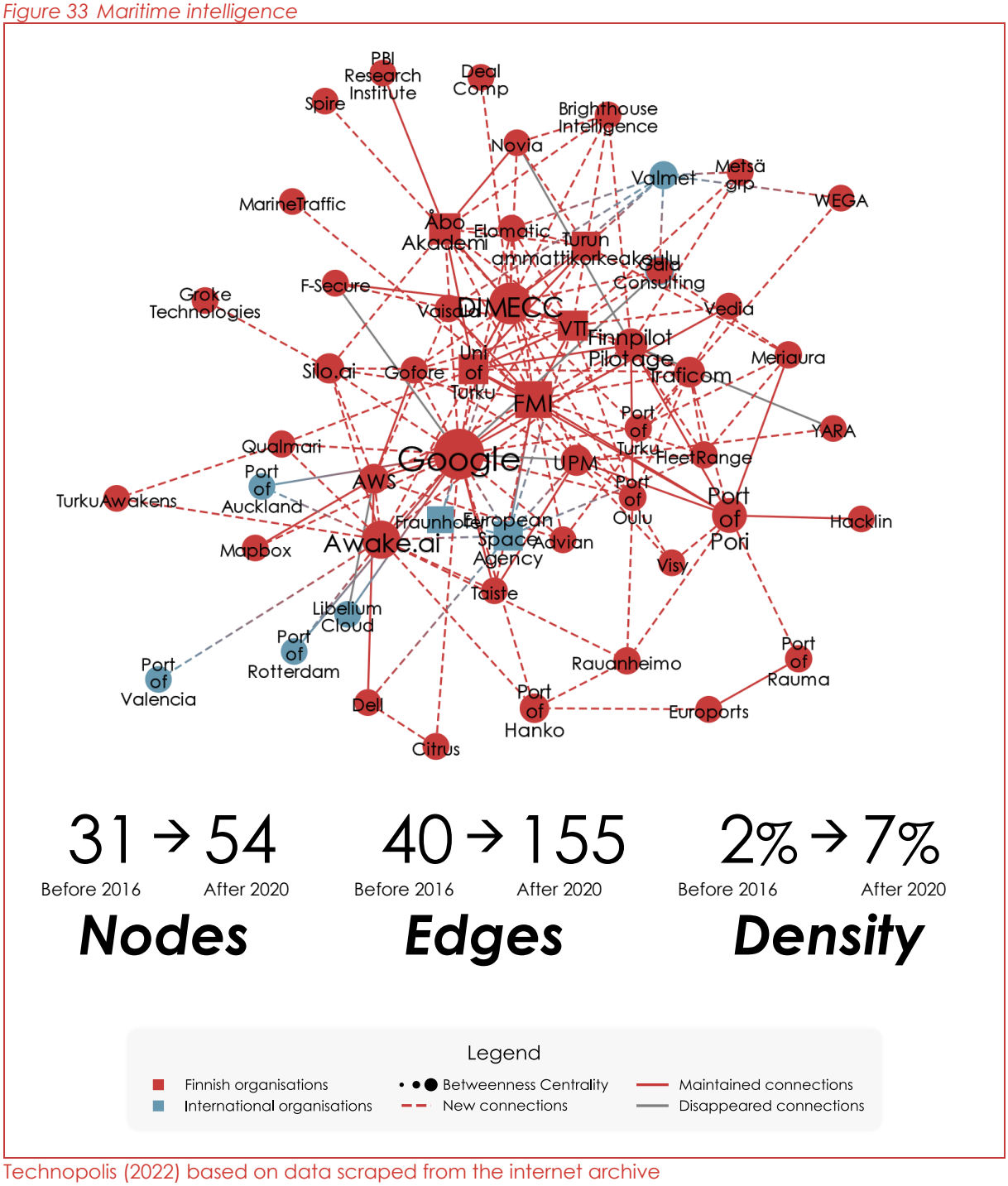
Technopolis (2022) based on data scraped from the internet archive

Figure 32 AI



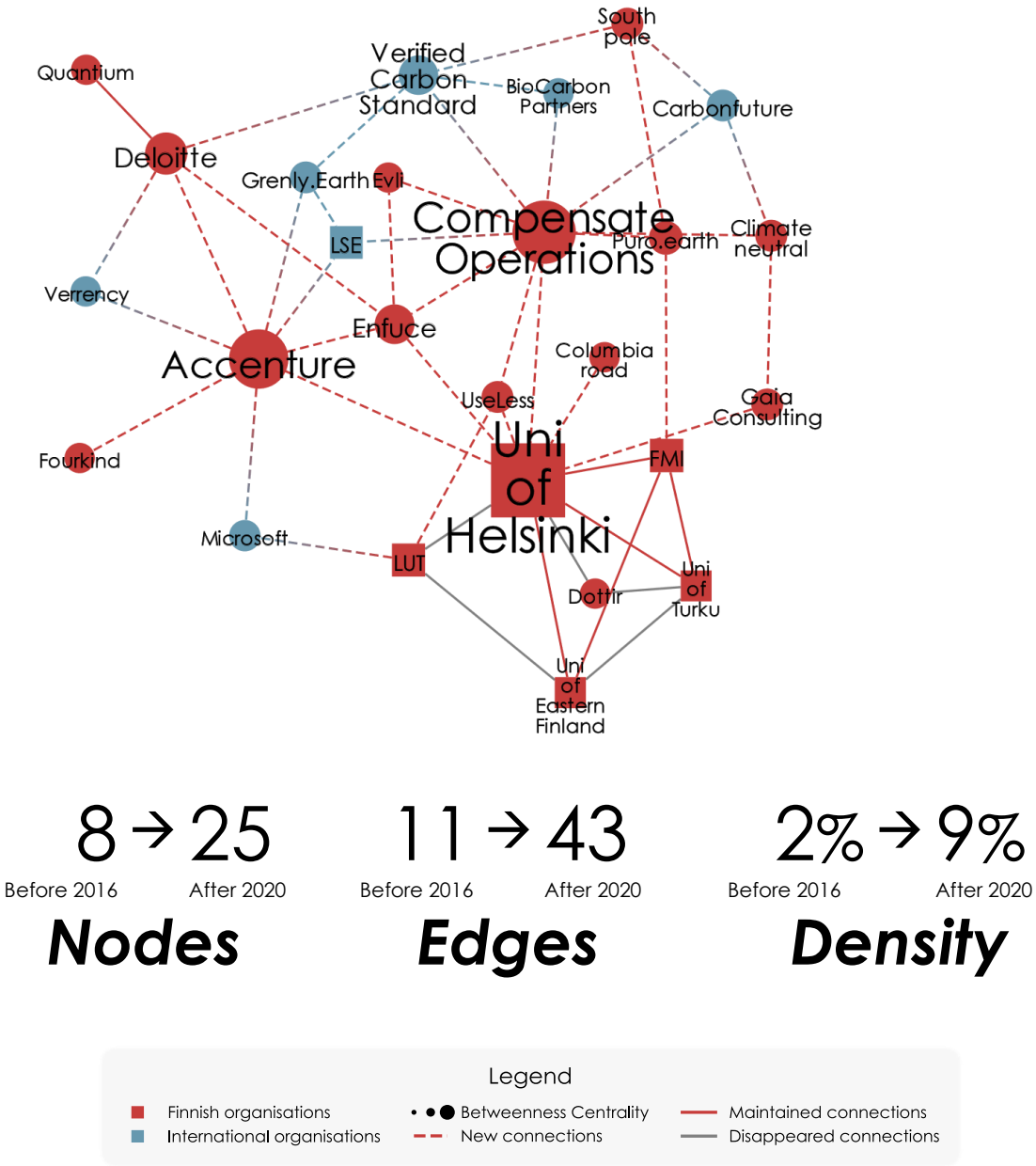
Technopolis (2022) based on data scraped from the internet archive

Figure 33 Maritime intelligence



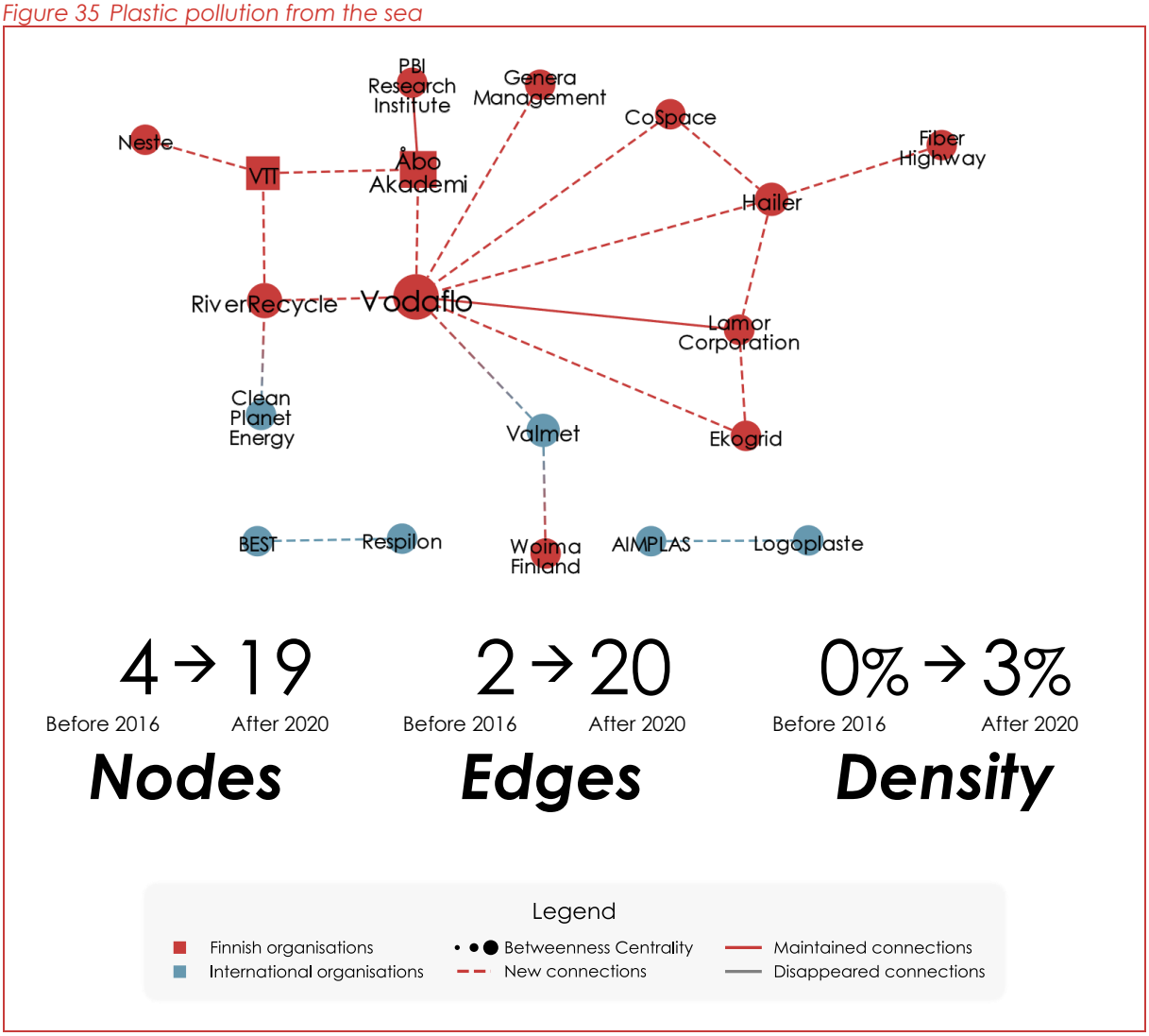
Technopolis (2022) based on data scraped from the internet archive

Figure 34 Carbon capture market



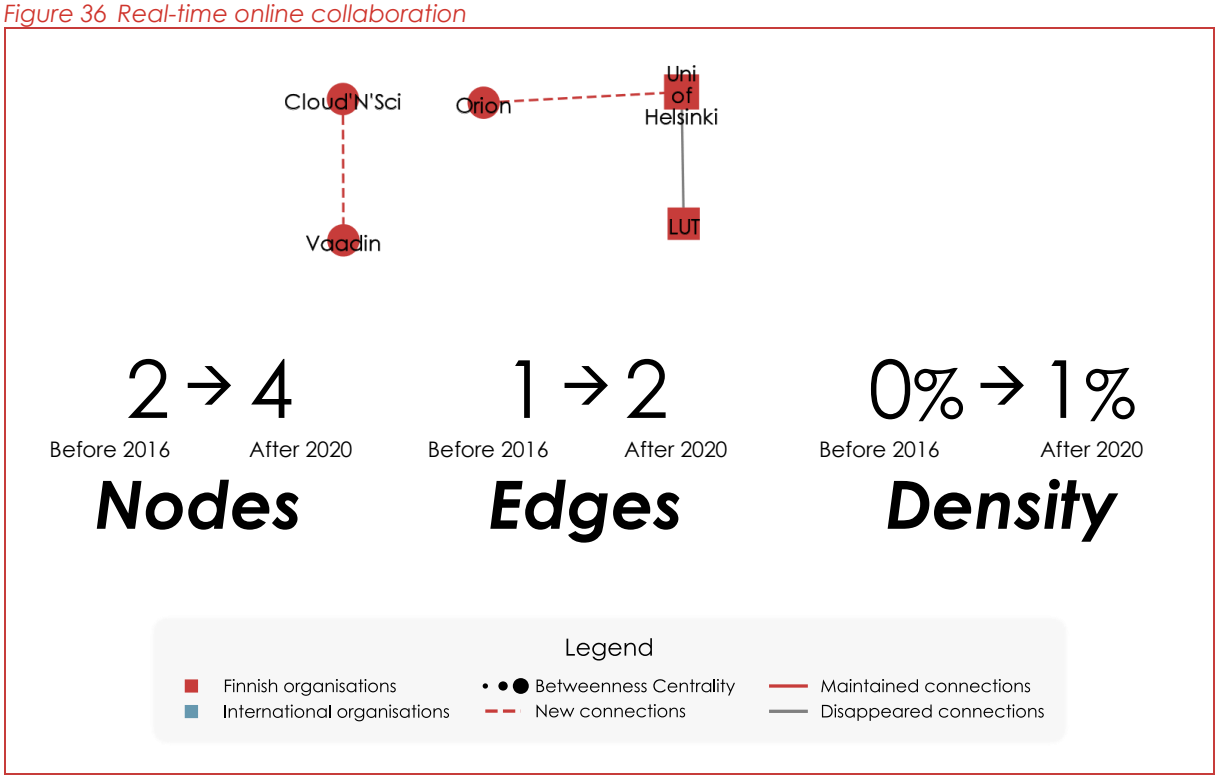
Technopolis (2022) based on data scraped from the internet archive

Figure 35 Plastic pollution from the sea



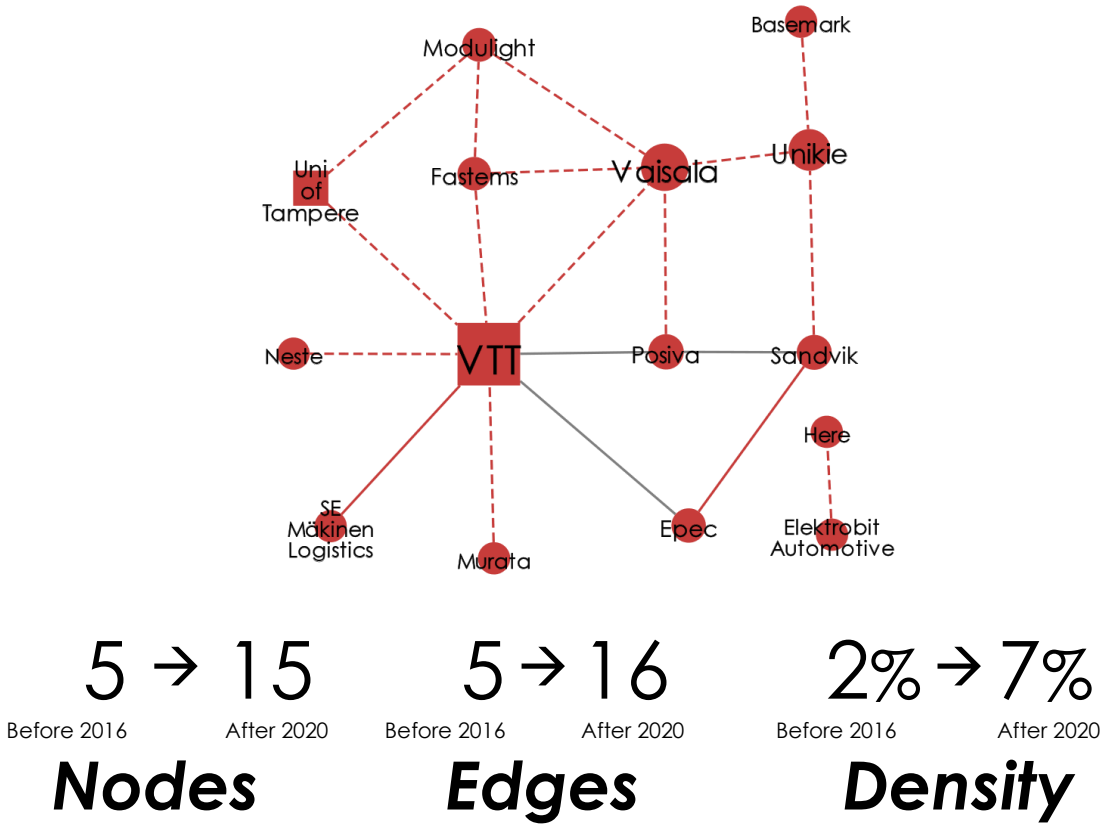
Technopolis (2022) based on data scraped from the internet archive

Figure 36 Real-time online collaboration



Technopolis (2022) based on data scraped from the internet archive

Figure 37 Autonomous transport

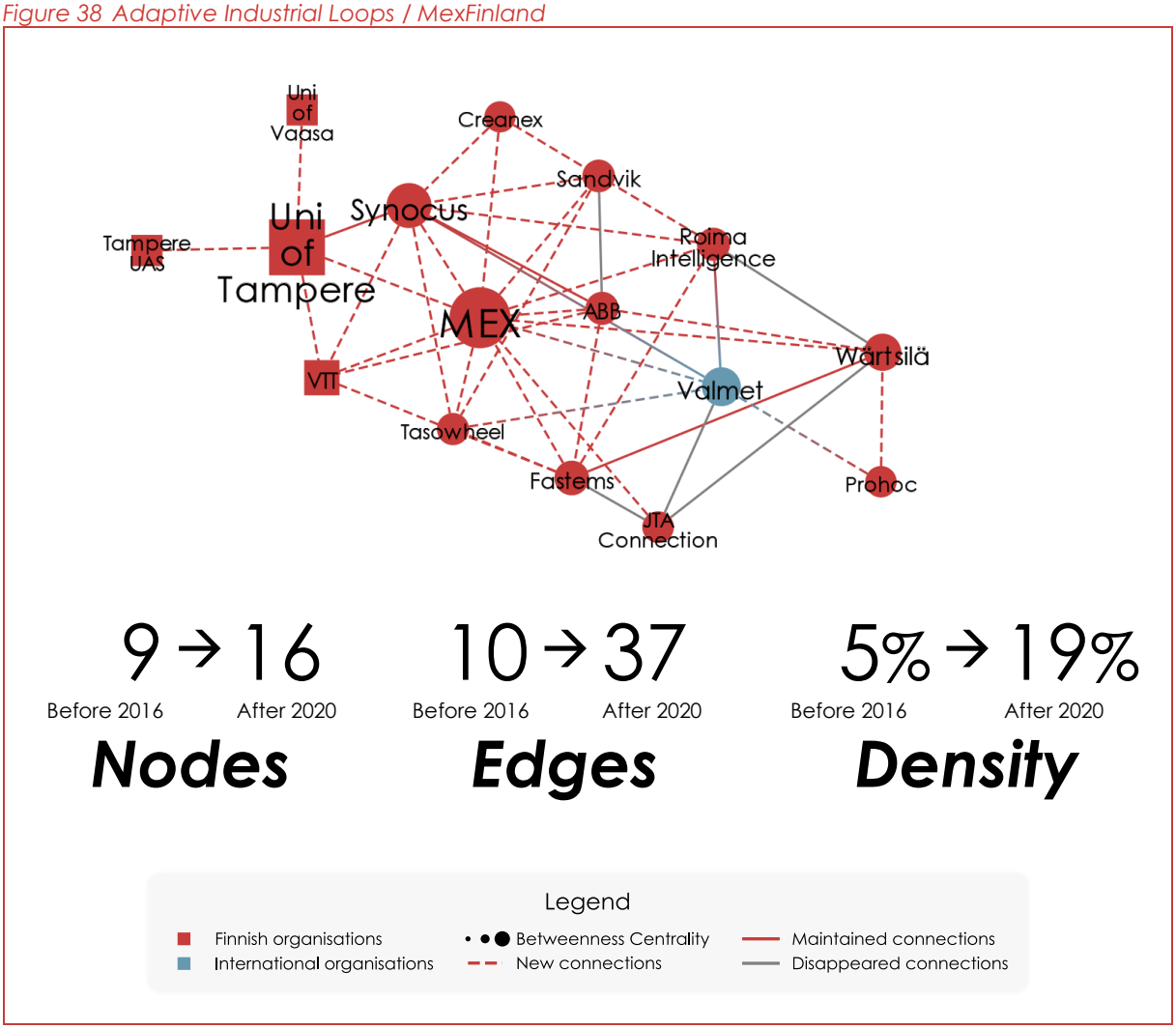


Technopolis (2022) based on data scraped from the internet archive

C.5 Growth Engine Orchestration Funding ecosystems

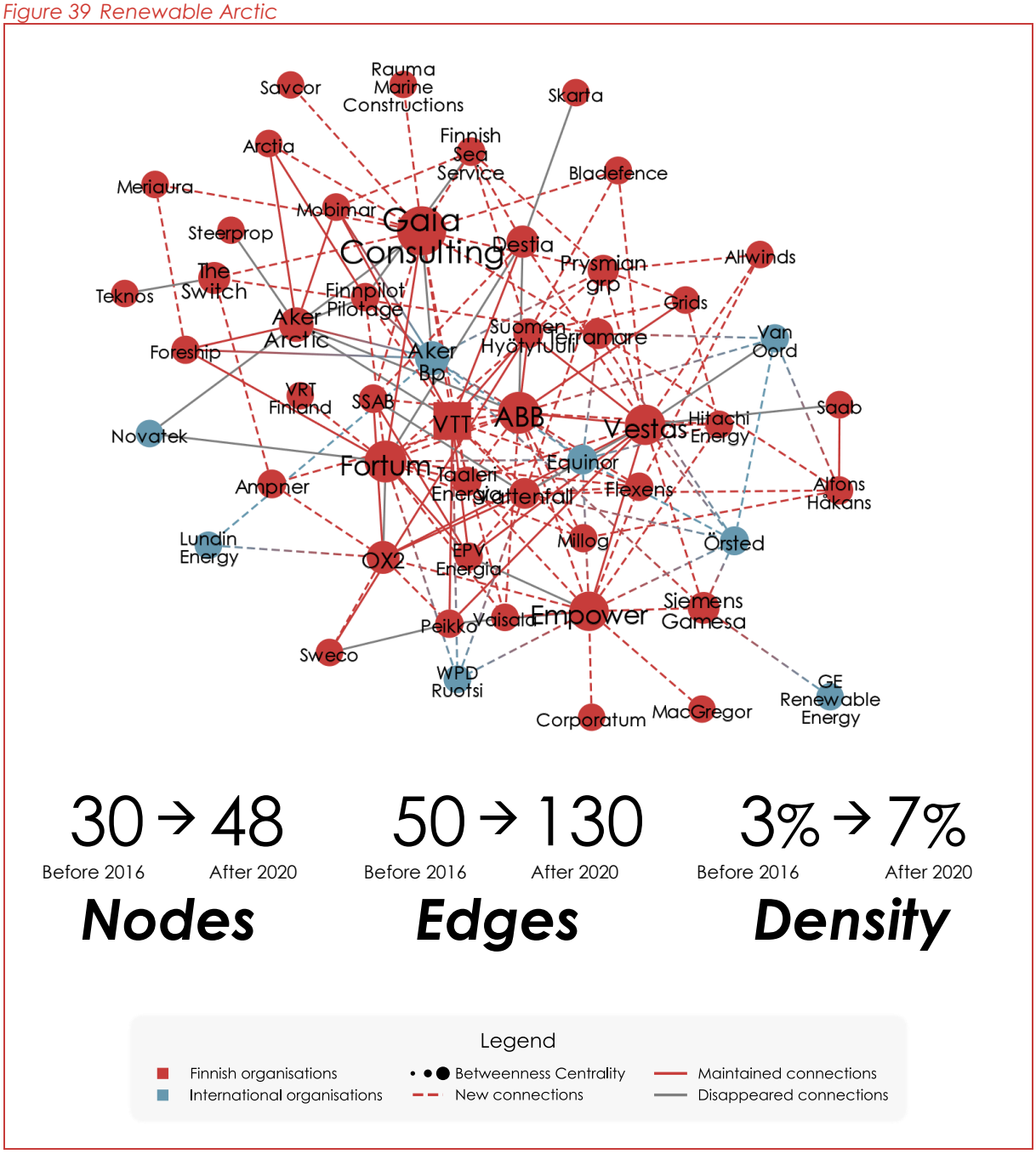
This section presents the network plots for the Growth Engine Orchestration Funding ecosystems.

Figure 38 Adaptive Industrial Loops / MexFinland



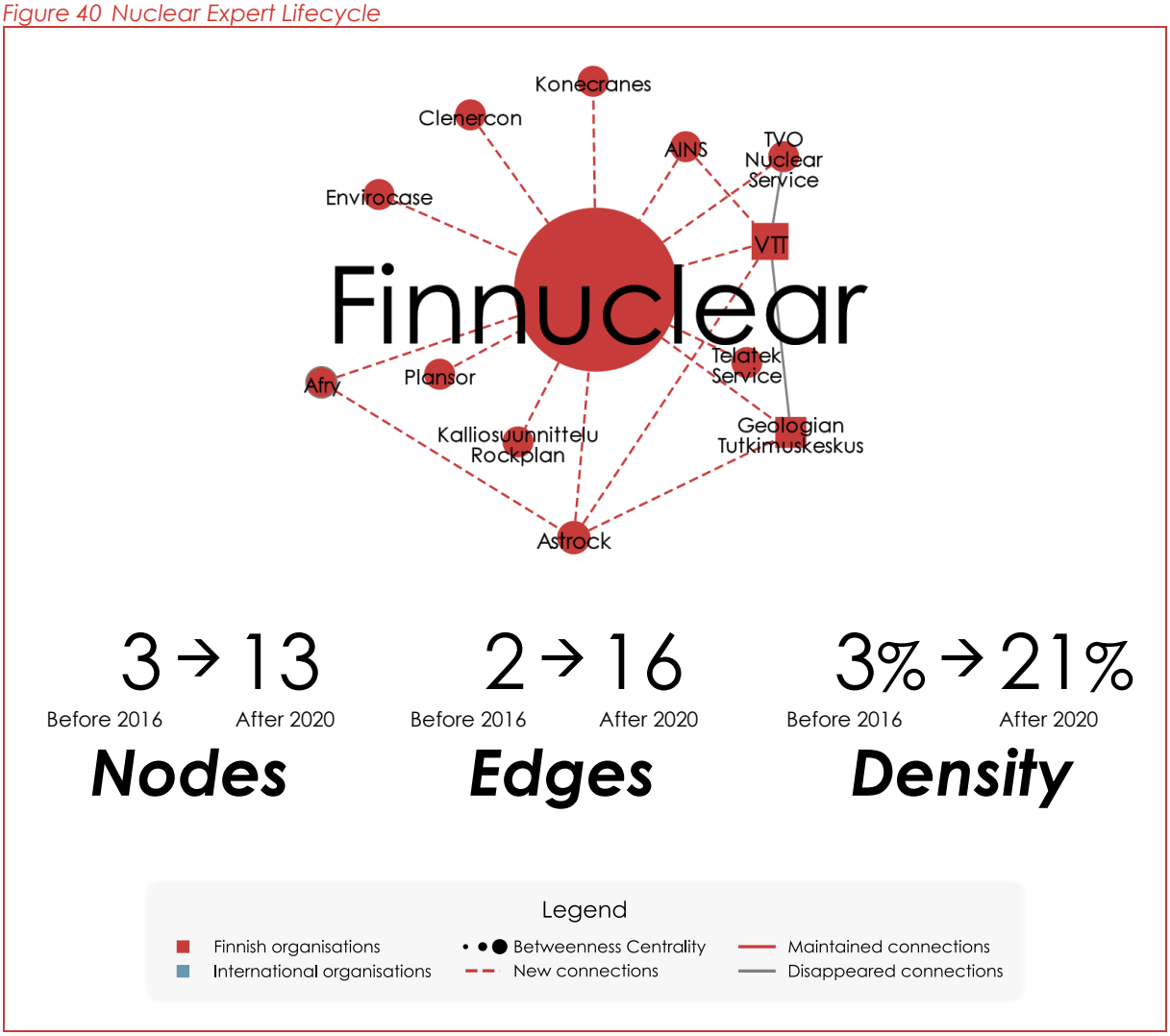
Technopolis (2022) based on data scraped from the internet archive

Figure 39 Renewable Arctic



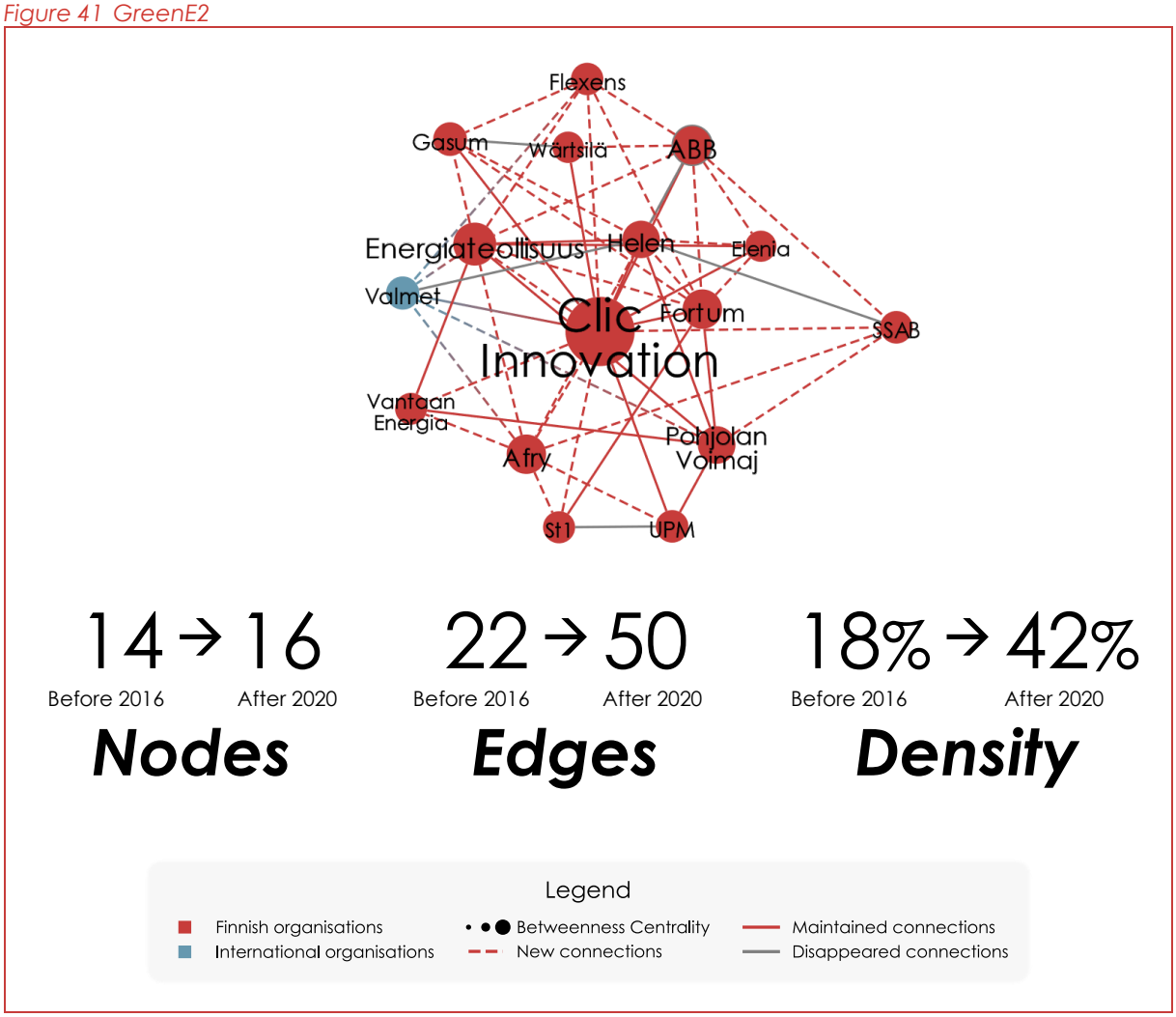
Technopolis (2022) based on data scraped from the internet archive

Figure 40 Nuclear Expert Lifecycle



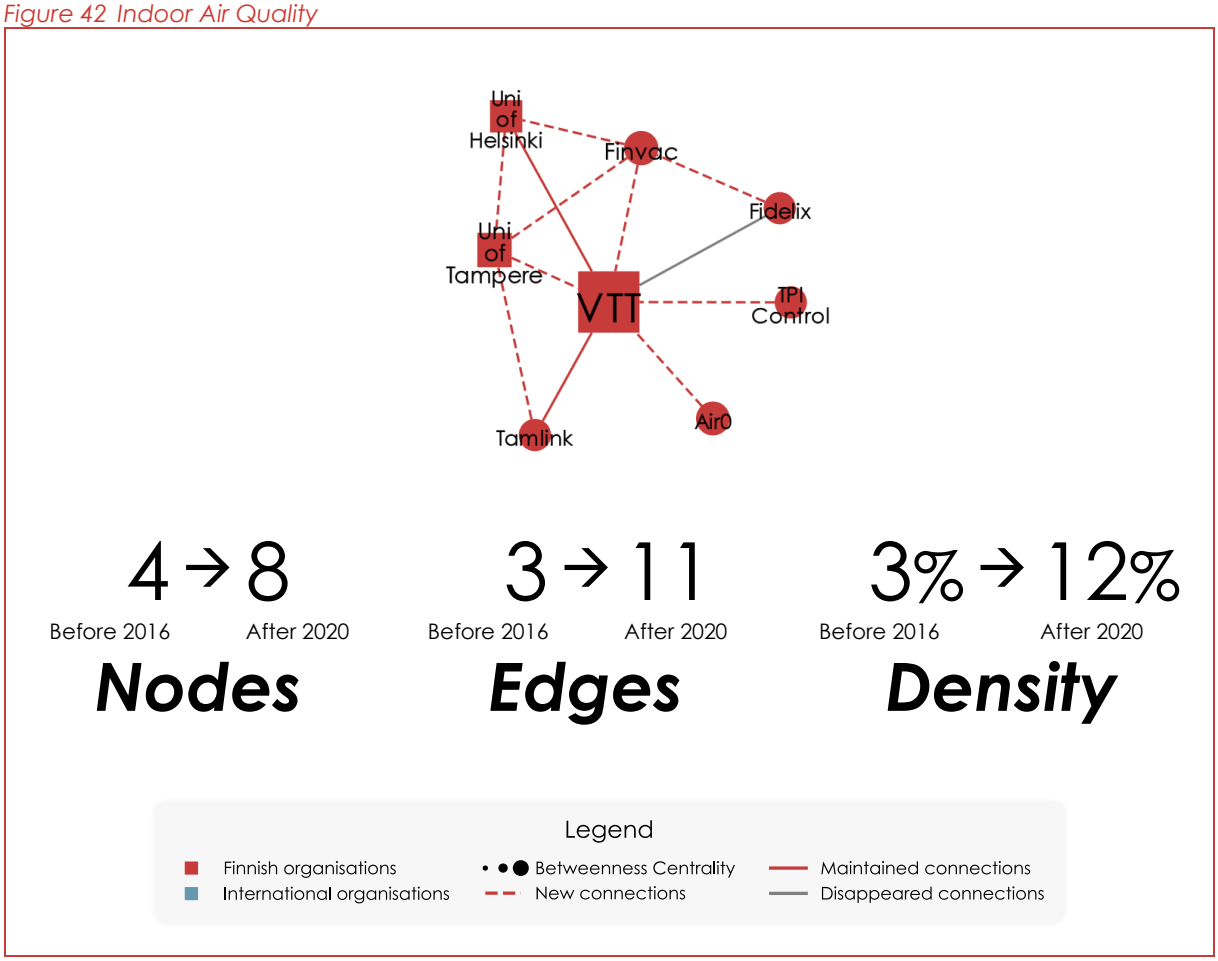
Technopolis (2022) based on data scraped from the internet archive

Figure 41 GreenE2



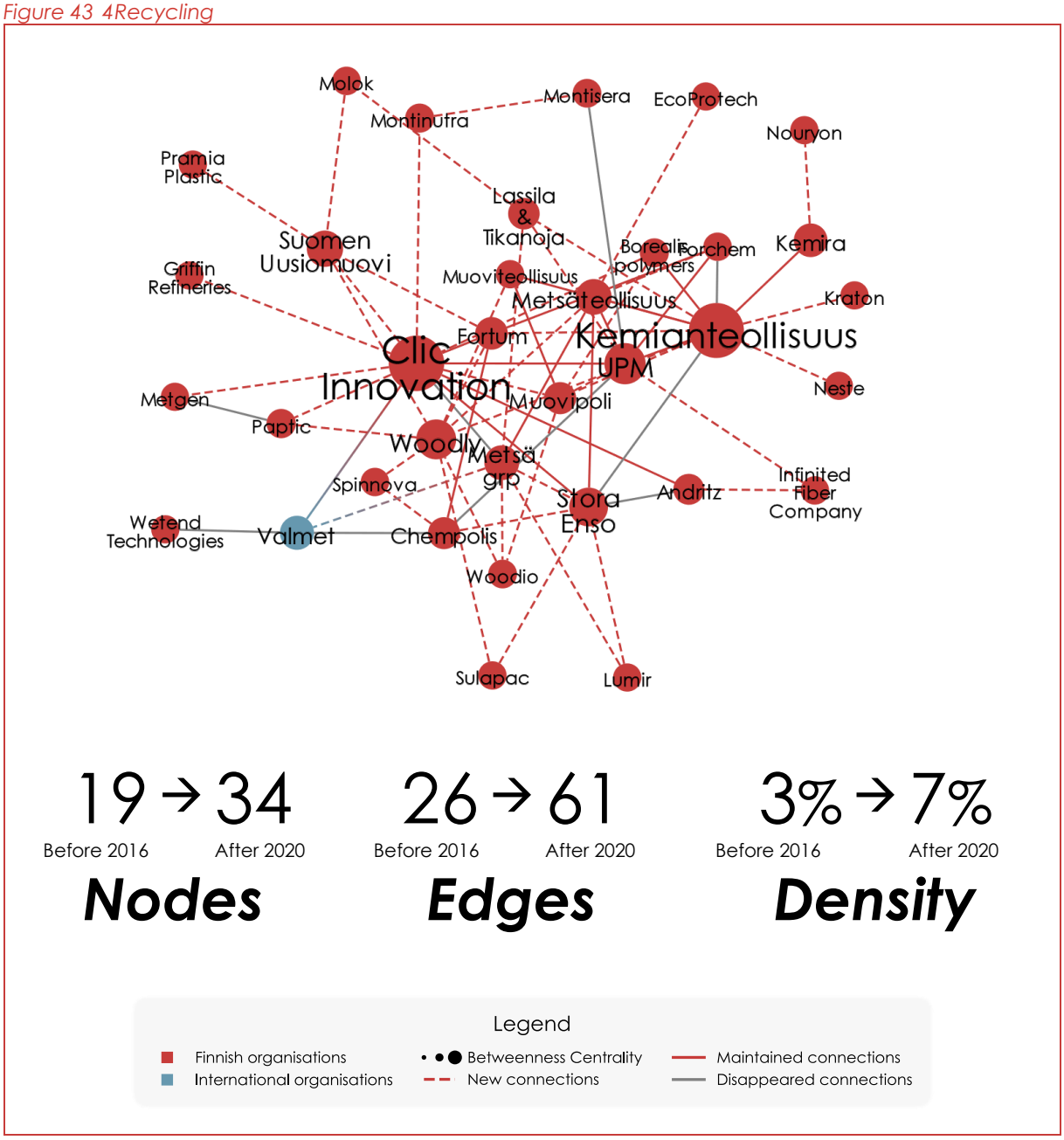
Technopolis (2022) based on data scraped from the internet archive

Figure 42 Indoor Air Quality



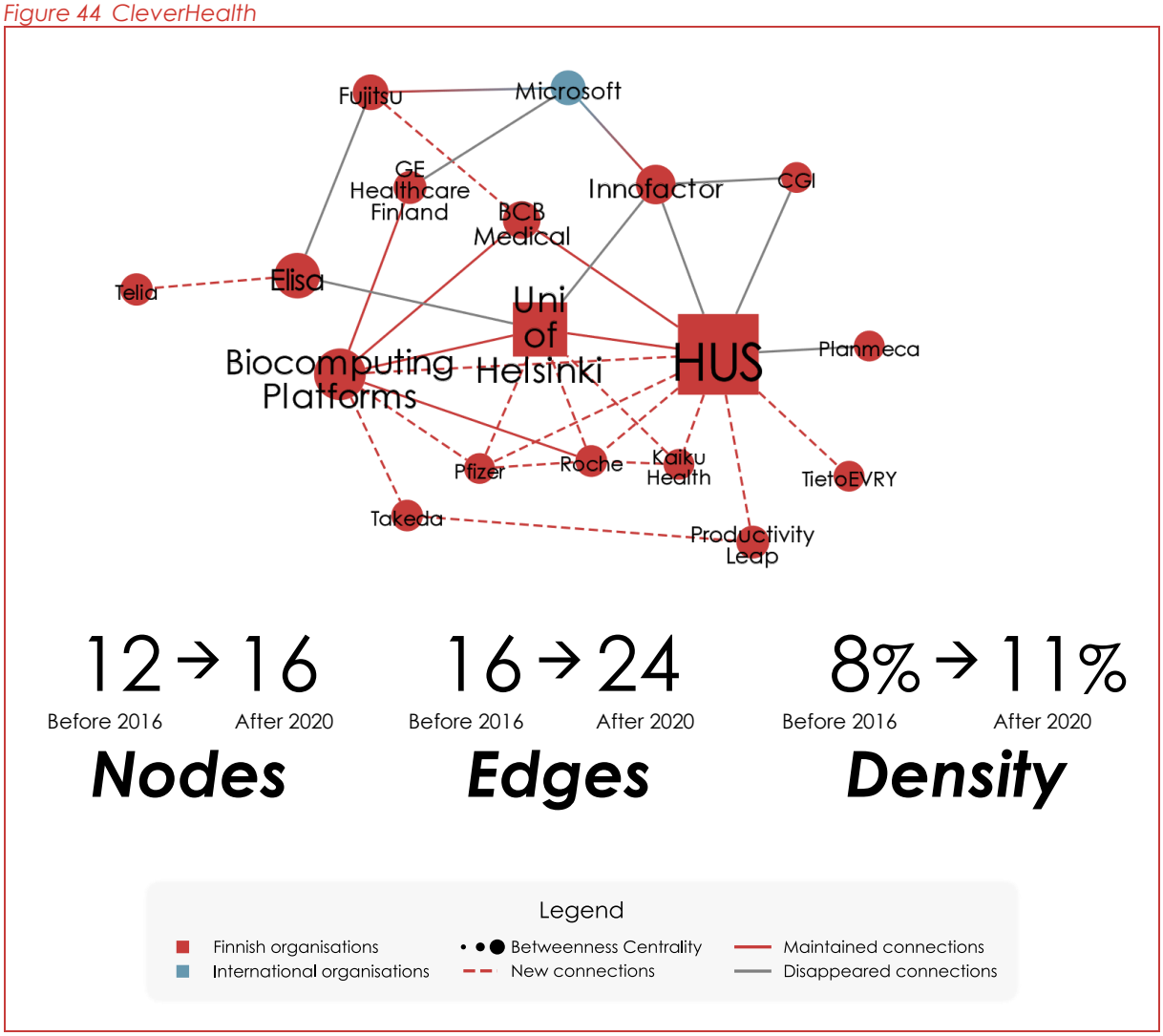
Technopolis (2022) based on data scraped from the internet archive

Figure 43 4Recycling



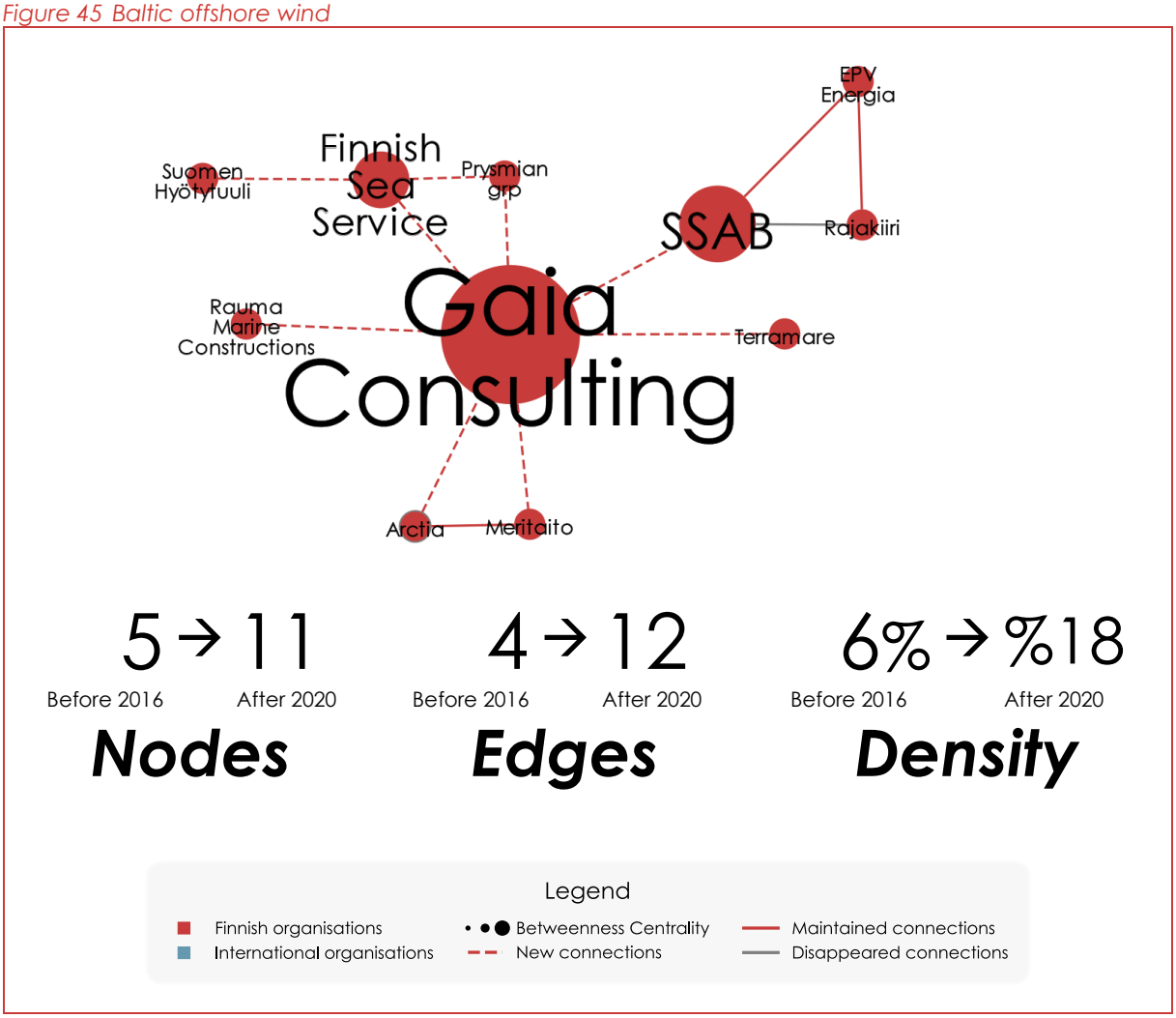
Technopolis (2022) based on data scraped from the internet archive

Figure 44 CleverHealth



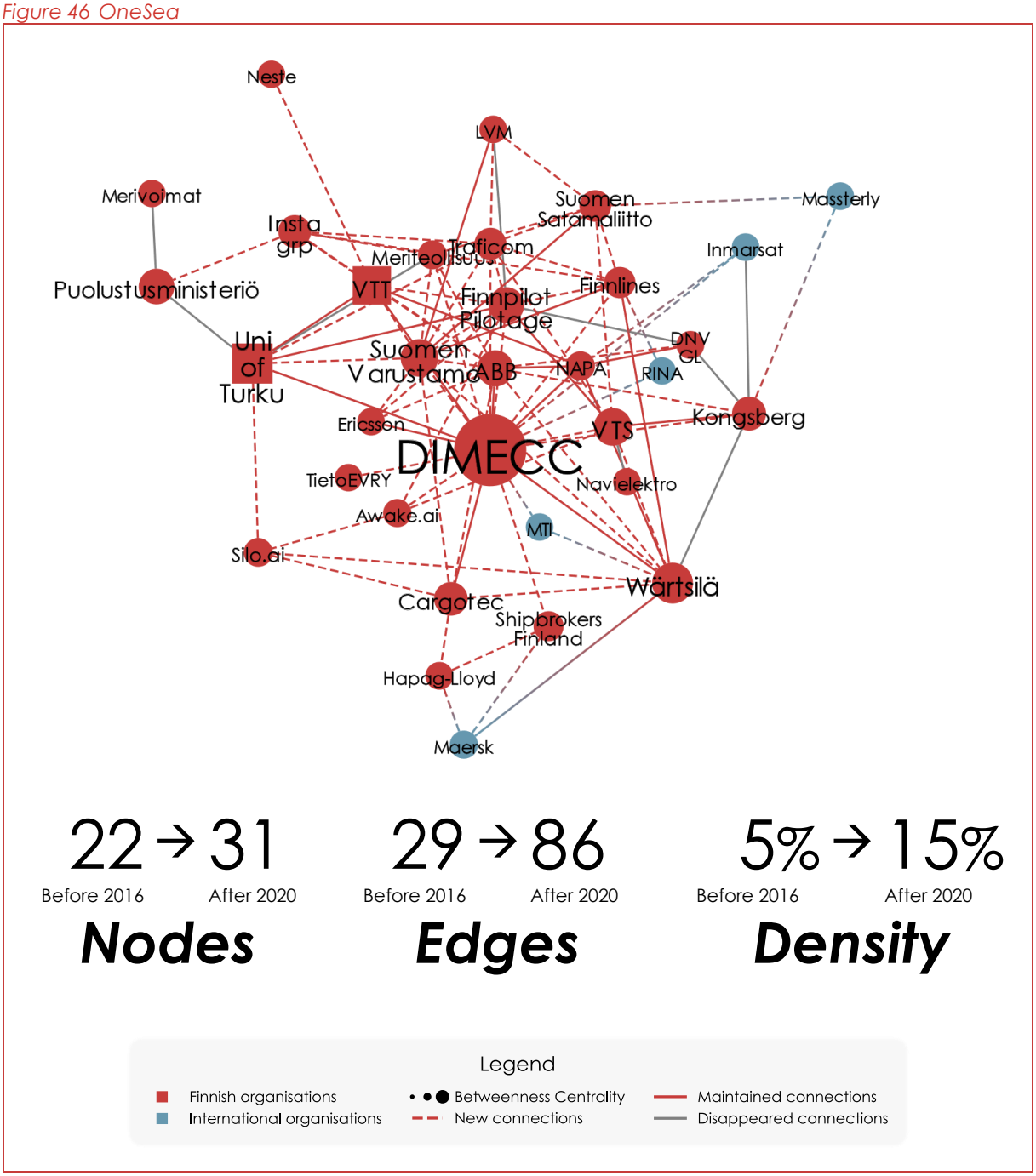
Technopolis (2022) based on data scraped from the internet archive

Figure 45 Baltic offshore wind



Technopolis (2022) based on data scraped from the internet archive

Figure 46 OneSea



Technopolis (2022) based on data scraped from the internet archive

Appendix D Case study: ExpandFibre

D.1 General information about the ecosystem

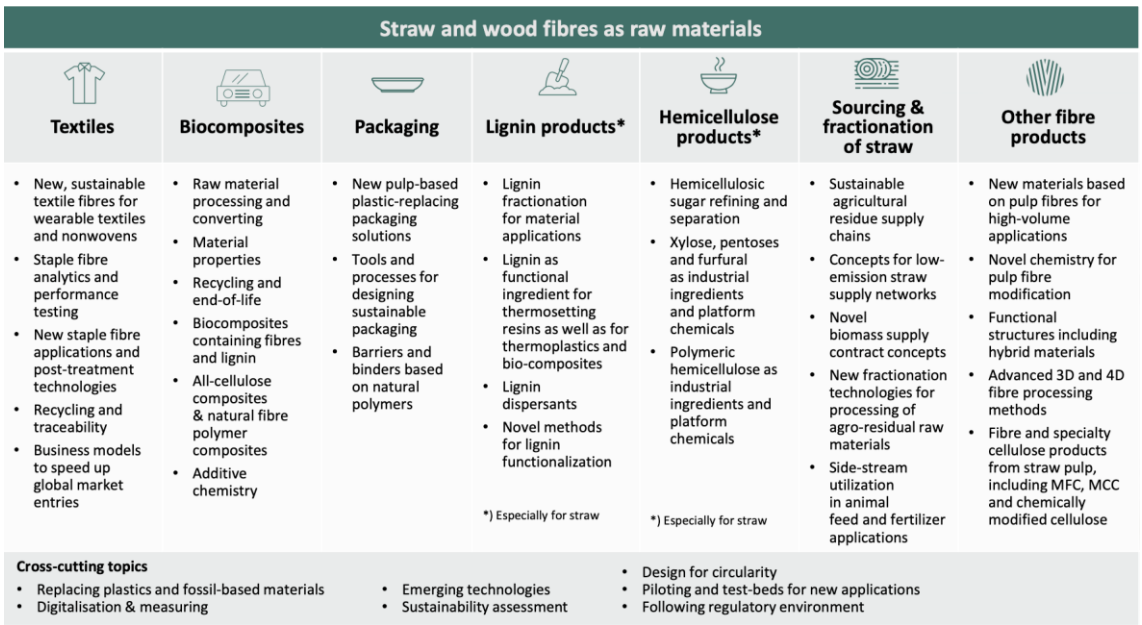
D.1.1 Official name of the ecosystem & BF support

The ExpandFibre ecosystem is founded with the Leading Company Initiative funding granted to Metsä Group and Fortum in 2020 in the first round of LCI funding. Additional funding has been allocated to ecosystem members, partners or associated organizations through e.g. Co-Innovation grants for specific R&D projects.

D.1.2 Scope and focus of the ecosystem

The overall goals of the ExpandFibre ecosystem are broadly to expand the use and sources of renewable cellulose and hemicellulose fibers to create new materials to replace existing fossil-based ones. The topics for research and development include textile fibers, biocomposites, packaging materials, as well as various lignin and hemicellulose products, such as renewable industrial chemicals.[13]

Figure 47 The seven research themes and additional cross-cutting topics of ExpandFiber



ExpandFiber, 2022

D.1.3 Background and brief history of the ecosystem

ExpandFibre was launched in 2020 after being funded in the first round of Leading Company Challenge Competition.

From the Fortum side, there is a continuum of projects under the umbrella of Bio 2X programme that have moved through the increased use of biomass for energy generation towards fractioning biomass and refining added value products from the fractions. The continuum starts

[13] ExpandFiber Roadmap, https://www.businessfinland.fi/493b06/globalassets/finnish-customers/01-funding/06-ecosystems/metsa_fortum_veturi_tiekartta.pdf

from at least from the Best SHOK-programme (2013-2016), that continued in ForBest (2017-2019) and the present ExpandFiber[14].

D.1.4 Basic quantitative information

ExpandFibre has altogether 80 members as of May 2022 spanning the industry (57 members), universities and research organizations (11+5). Out of the enterprises approx. a quarter (14 enterprises are large enterprises, and the bulk is SMEs. A total of 68 are Finnish and 12 are foreign partners. The partners include technology, process, and systems suppliers for the forest industry, research organizations, non-conventional bio-based technology companies, as well as end users for the new materials and solutions. As such the value chain is well-represented and there are partners that both participate in development of technologies and processes, and those that utilize the technology and new materials and other products enabled by the R&D in their own products and services.

The project volume for the leading companies is approximately 50 million EUR and the ecosystem has a total of 14 R&D projects currently, majority of which make use of co-innovation and co-research project funding.

D.1.5 Analysis of the general situation of the ecosystem

According to the interviews, at this stage the bulk of the work concentrates on developing the general competences, technologies processes and materials, that pave way for specific commercial products.

D.2 Structure of the ecosystem

D.2.1 Ecosystem leading and core actors and their respective roles

The lead actors are Metsä and Fortum. The center of the ecosystem is the collaboration between Metsä and Fortum, that focuses on developing biocomposites and sustainable textile fibers, including the use recycled plastics and developing chemical refining of plant fibers. The whole ecosystem spans various collaborative projects to develop technology for e.g. biomass fractionation, refining and various new bio-based products and applications.

D.2.2 Operational environment of the ecosystem

The ecosystem operates in parallel with two other initiatives that have common partners. CLIC Innovation is a long standing ecosystem platform that has its genesis in the early SHOK programme (2006 to 2017) and through mergers between former SHOKs has molded into its present form. CLIC also operates a Growth Engine 4Recycling (see separate case). FinnCERES is a flagship funded by Academy of Finland, with a stated goal of developing novel processes for fractioning biomass and using these fractions, e.g. lingnocellulose, with energy saving, e.g. enzymatic, processes and associated technologies.[15] While the topics are similar and the same organizations belong in some instances to all three ecosystems, the main difference particularly

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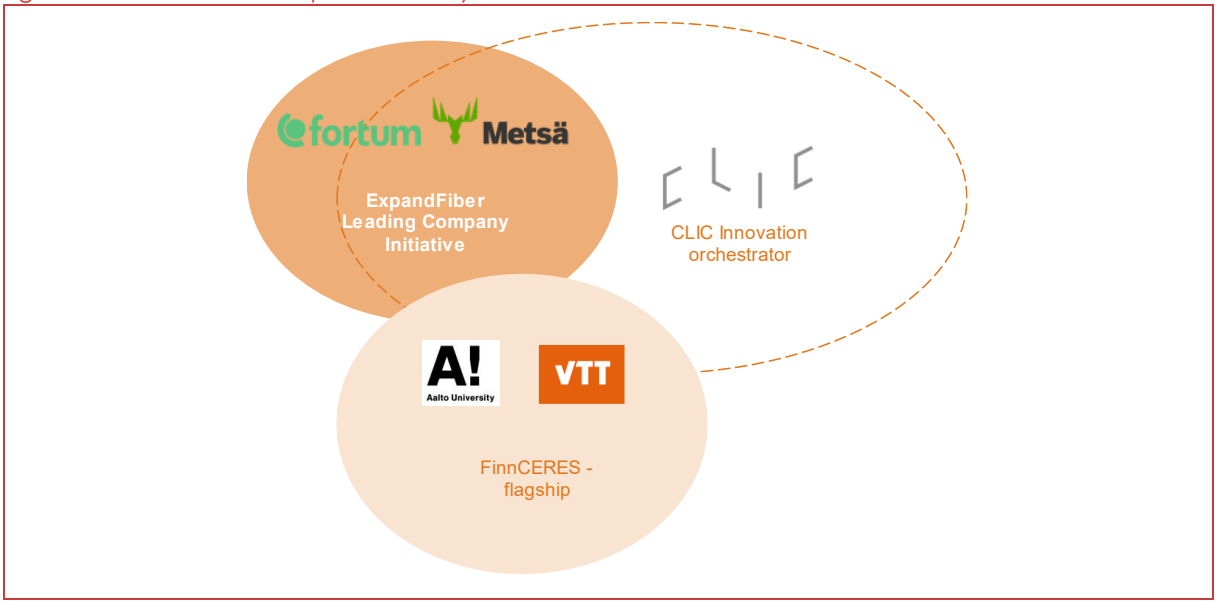
[14] Antila 2019 Saatavilla Kuinka innovaatiorahoitus auttaa Suomea siirtymään kohti puhtaampaa maailmaa? https://www.fortum.fi/tietoa-meista/blogi/forenergy/kuinka-innovaatiorahoitus-auttaa-suomea-siirtymaan-kohti-puhtaampaa-maailmaa; Bio2X – Arvokkaita lopputuotteita biomassasta, Saatavilla https://www.fortum.fi/yrityksille-ja-yhteisoille/bio2x; How material scarcity takes us towards a cleaner world, Available https://www.fortum.com/about-us/cleaner-world/how-material-scarcity-takes-us-towards-cleaner-world https://www.fortum.com/products-and-services/biobased-solutions/bio2x; https://www.businessfinland.fi/ajankohtaista/blogit/2020/expandfibre-kokoaa-biomassan-jalostajat-kestavan-tekstiiliteollisuuden-suunnannayttajiksi

[15] FinnCERES 2022: https://www.finnceres.fi/research-themes

between ExpandFiber and FinnCERES is that the R&D focuses on complementary research on biomass fractionation technologies, they operate on different technology readiness levels.

Figure 48 Illustration of the parallel ecosystems



Autohors' conception based on materials supplied by the interviewees and publicly available from the websites of ExpandFiber, CLIC Innovation and FinnCERES.

D.2.3 Ecosystem functions and collaboration models

Fortum and Metsä report that they manage and engage the ecosystem by arranging events and workshops as well as by sending regular newsletters to the ecosystem members. A key activity of the ecosystem management is to identify gaps in the R&D landscape and initiate the planning of new projects together with the Ecosystem members. To support this, the Ecosystem management will annually collect and report public data on the progress of the Ecosystem.[16] In practice, the two ecosystems managers from Fortum and Metsä Group take care of the leadership, and a consultant supports ecosystem management and practical coordination tasks, such as events.

The ecosystem has a roadmap that reflect the understanding of research gaps as defined by the partners and it is used to manage the portfolio of activity. The key partners uphold the R&D roadmap and according to the interviews as well as documentation, the main governance mechanism is focused around the roadmap/R&D agenda. The Ecosystem Steering Group consists of representatives of Fortum and Metsä Group, as well as of representatives from key partners Aalto University, CLIC Innovation and VTT Technical Research Centre of Finland.

According to the interviews, participation in the ecosystem is open and the main requirement is that the partners subscribe to the basic mission and vision. The network events and an electronic platform are fora for forming projects, and the activities between the ecosystem members are to a large degree self-organized. In practice, universities and research organizations are quite active in taking initiative in project development.

[16] Interviews, ExpandFiber 2022

D.2.4 *Analysis of the structure of the ecosystem*

The ecosystem is at the same time quite open and the governance and coordination structure is relatively loose, focusing on information steering, and relatively centralized. The open self-organizing model preserves coordinator resources, but according to the interviews in the network, leaves some members with a poor overview, which may or may not result in missed opportunities in synergy between the projects.

D.3 Value of the ecosystem

D.3.1 *Added value*

As the ecosystem focus is in R&D, the expected business value lies in the future. The expectation is that the R&D will result in disruption in a variety of consumer products and their value chains by (at least partially) replacing existing fiber sources and some variety of industrial/consumer chemicals by biomass-derived alternatives. For the core actors the expected results reinforce and/or extent the core business of biomass refining to new areas.

The core technologies are internationally scalable and partners include several MNEs that have an existing global reach in their segment. Given that the partners (outside the core partners) have a viable business case and commitment, international scale-up is a viable possibility.

D.3.2 *Strategic importance*

The topic of developing new bio-based, sustainable and/or circular solutions are of great strategic importance to the core and other actors. Also in terms of the core actors, which already have developed biomass value chains, upgrading the ability to create value from biomass and offers products for entirely new industrial and customer segments represents a strategic opportunity.

D.3.3 *Long term development of the ecosystem*

According to the interviews, it not likely that ExpandFibre will develop into a self-standing organization. Rather it aims to achieve its aims in terms of R&D and business transformation, and once the objectives are met and/or funding runs out, the partnership will find new forms and substance.

D.3.4 *Sustainable development within the ecosystem*

Sustainability and circular economy are infused into the ecosystem both generally in the main aim to develop technologies to manufacture new bio-based products, and in specific individual co-innovation projects for example by developing circular business models and associated technologies and processes for re- and upcycling textiles.

D.3.5 *Analysis of the value of the ecosystem*

The value of the ecosystem is strongly linked to the R&D performed regarding new bio-based, sustainable and/or circular solutions and the potential for circular business models and bio-based products. As such, long term value, in the sense of a lasting ecosystem, is limited as after once the objectives are met and/or funding runs out the ecosystem will likely end.

D.4 Role of Business Finland and public support

D.4.1 *Role and added value of Business Finland and its instruments*

According to the interviews, The Leading Company Challenge Competition has been an important enabler for the actors to develop an ambitious vision and develop it into an R&D

roadmap and partnership. The mentioned value added is that funding enables more ambitious projects, with larger volume and a more thorough R&D agenda.

Generally, the interviewed members view the R&D support from Business Finland favorably. The most common criticism is that the funding process is quite involved, and that the valued coaching beneficiaries receive from BF ends at the funding decision.

D.4.2 Potential for improving BF support for ecosystems

The main criticism that arises from the interviews is that BF and other public actors do not have (internally, nor between themselves) a sharp definition of what ecosystem are/should be, which results in difficulty of narrowing down how best to support them.

Another related point of criticism was that many actors have a relatively limited overview of the large picture of the ecosystems. The "ecosystem" is more typically the co-innovation project they are specifically working on. This is of course foremost a feature of the governance model of individual ecosystems but relates to BF in the sense that synergy may or may not be lost due to poor overview and cohesion. Some of the interviewees proposed more systematic collection and sharing of project descriptions and results summaries to the ecosystem members as a way to improve understanding of the direction of the ecosystem amongst the partners.

D.4.3 Analysis of the role of Business Finland and public support

The main support has been funding for the ecosystem. The impact is yet to be realized, but in terms of activities and outputs, the interviewee statements show that the volume of funding enables more ambitious R&D with a longer than usual time horizon, committing more and better resources and partners, and the expectation for the outcomes are larger than without the funding. Further strategic support and guidance is limited.

D.5 Sources

D.5.1 Written information

- Fortum, Metsä Group, 2022. EXPANDFIBRE: Accelerating the development of sustainable bioproducts, Presentation
- ExpandFiber Roadmap, https://www.businessfinland.fi/493b06/globalassets/finnish-customers/01-funding/06-ecosystems/metsa_fortum_veturi_tiekartta.pdf
- Antila 2019 Saatavilla Kuinka innovaatiorahoitus auttaa Suomea siirtymään kohti puhtaampaa maailmaa? https://www.fortum.fi/tietoa-meista/blogi/forenergy/kuinka-innovaatiorahoitus-auttaa-suomea-siirtymaan-kohti-puhtaampaa-maailmaa
- Bio2X – Arvokkaita lopputuotteita biomassasta, Saatavilla https://www.fortum.fi/yrityksille-ja-yhteisoille/bio2x
- How material scarcity takes us towards a cleaner world https://www.fortum.com/about-us/cleaner-world/how-material-scarcity-takes-us-towards-cleaner-world
- https://www.fortum.com/products-and-services/biobased-solutions/bio2x
- https://www.businessfinland.fi/ajankohtaista/blogit/2020/expandfibre-kokoaa-biomassan-jalostajat-kestavan-tekstiiliteollisuuden-suunnannayttajiksi
- FinnCERES 2022: https://www.finnceres.fi/research-themes

D.5.2 Interviews

Various anonymous interviews were performed to draft the case study.

Appendix E Case study: Unlocking Industrial 5G Beyond Connectivity

E.1 General information about the ecosystem

E.1.1 Official name of the ecosystem & BF support

The current case study discusses the ecosystem "NOKIA: Unlocking Industrial 5G beyond Connectivity". This ecosystem has been supported by Veturi/Leadership Company Initiative (LCI) instrument funded by Business Finland.

E.1.2 Scope and focus of the ecosystem

The current ecosystem focuses on industrial 5G-based technologies. 5G networks are rolling-out around the world in advanced early adopter markets, including in Finland. These networks are supporting digitalisation and improving safety, sustainability and efficiency in various industries, such as mining, energy, manufacturing, automotive, shipping or airports.[17] Thus, the purpose of the ecosystem is to support deployment of industrial 5G in the country, thereby helping to innovate products, services and find solutions in Finland that can be developed and commercialized together with the companies within the ecosystem.

The mission of all LCI ecosystems is to contribute to solving significant future challenges and have a strong impact on the national R&D&I (Research, Development and Innovation) target of 4% and the employment target of 75%, as laid down in the Government Programme. For Nokia – the LCI company – leader and driver of the ecosystem, 5G is a strategic priority, as it opens various business opportunities for the company. Thus, apart from investing EUR 20mln granted by Business Finland through the LCI financial instrument, the company and its partners will invest their own resources, reaching to approximately EUR 130mln in total. Such investment and commitment to industrial 5G development and deployment is expected to contribute to the achievement of the above-stated mission.

E.1.3 Background and brief history of the ecosystem

This ecosystem has been launched in 2020, after the funding from Business Finland was granted. Nokia submitted an application and invited some of its traditional, core partners to join the ecosystem. At the moment, around 60% of the ecosystem members represent long-term partners of Nokia. This has significantly increased dynamism of the ecosystem building and led to immediate launch of joint projects.

Since 2020, the network has been expanding, as Nokia and its partners have been discussing what other industry and research organisations could contribute to the ecosystem. They either invited or identified new members through launched open calls.

E.1.4 Basic quantitative information

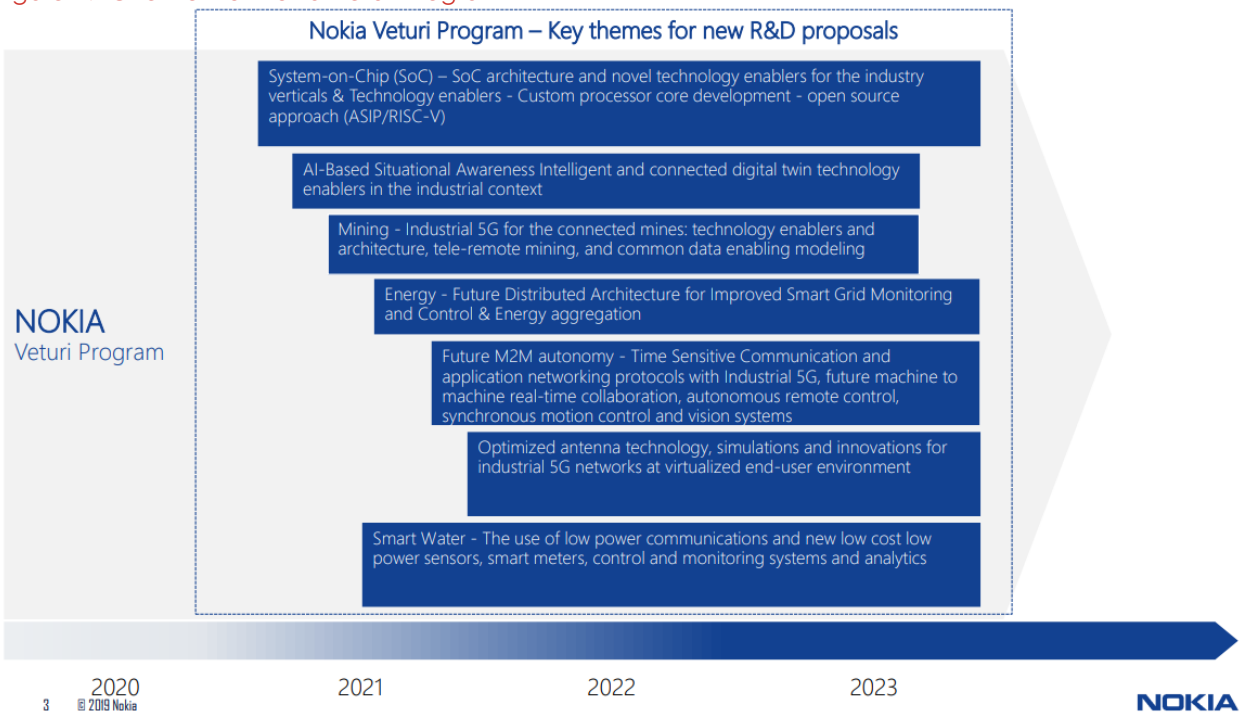
In total, the ecosystem includes over 130 members. Among the core ecosystem members are listed 10 research/university organisations, such as Aalto University, Tampere University, University of Eastern Finland, Oulu University, Helsinki University and VTT. Apart from research/university organisations, there are around 5-10 companies that are present in most projects of this ecosystem. Small and medium-sized enterprises (SMEs) are also included in the ecosystem, but they represent a relatively small share of the members. This is related to the

[17] https://www.nokia.com/blog/unlocking-industrial-5g/

limited contribution SMEs, start-ups to the ecosystem, can make due to limited resources they can commit.

In essence, the ecosystem consists of co-innovation/R&D projects performed by its members. Collectively, these projects contribute to the overall mission of the ecosystem. The figure below indicates key themes in which projects have been launched. Due to LCI funding, the ecosystem members, in total, can receive EUR 50mln from Business Finland to finance R&D projects. The maximum amount granted per project is EUR 200k with maximum EUR100k per applicant/partner.

Figure 49 Overview of Nokia Veturi Program



Nokia

E.1.5 Analysis of the general situation of the ecosystem

Despite that the ecosystem has been launched relatively recently, it could be characterized as mature, due to already existing long-term business linkages between the core ecosystem members, commitment to collaborate and invest in realisation of joint projects for achievement of mutually beneficial goals. Nokia and its partners that, in most cases, are well-established leaders in their industries could immediately start co-innovation/R&D-projects, attracting new partners to support their projects. This highlights importance of pre-existing relations, presence of important industry actors that ensure availability of resources to pursue joint ventures.

E.2 Structure of the ecosystem

E.2.1 Ecosystem leading and core actors[18] and their respective roles

This ecosystem centres at the Nokia company, specifically at Nokia's business groups that are involved in R&D activities in Finland (e.g., Mobile Networks, Nokia Software, Global Services, Nokia Technologies, Nokia Enterprise, and Nokia Bell Labs). The ecosystem has a governing board that manages the ecosystem. The board consists of Nokia representatives and a few key partners that support strategic decision-making, focusing on areas where investment is needed and new business opportunities in Finland are present. To illustrate the power of the board and especially of Nokia, it is important to note that ecosystem members cannot access the funding (EUR 50mln) from Business Finland without approval of the board. Thus, each project proposal is carefully reviewed by Nokia.

Other ecosystem members are invited to participate in consultations with Nokia/board, provide new ideas and proposals, but do not hold a strong influence on decision-making. Overall, interviewees characterized the ecosystem as collaborative, despite a strong emphasis on Nokia's critical role in governing the ecosystem. The latter is seen as justified due to Nokia's significant contribution of resources for the ecosystem building, continuous guidance for all ecosystem members and ecosystem development (including development of external relations to attract new ecosystem members, investment and other resources). In addition, most ecosystem members are integrated in the Nokia's value chain, therefore Nokia has an important role in every project that is run within the ecosystem.

For Nokia, there are two guiding principles of ecosystem management. First, it is essential to respect the rules of Business Finland, to reach critical KPIs, such as R&D, export and competitiveness. Second, the decision-making process should lead to optimal decisions that satisfy most key parties involved. Despite this, it is essential to note that Nokia does not disclose its strategy for ecosystem development and associated long-term business plans with others. The strategy has been designed without consultation with the governing board or other entities, as it would disclose overall business priorities of Nokia that are kept in secret. As such, it is not always clear for ecosystem members how individual projects are contributing to the overall mission of the ecosystem, and whether Nokia plans to maintain/invest further in relations with the ecosystem members in the long-term.

E.2.2 Operational environment of the ecosystem

Collaboration in the ecosystem occurs organically, as Nokia does not orchestrate/mediate all exchanges between members. The members actively approach each other to discuss and launch projects. The success factors behind a high level of personal initiative of members include: first, trust in the ability of Nokia to stimulate 5G deployment in Finland together with the ecosystem members; second, belief in a high business potential of 5G in Finland; third, commitment and trust between ecosystem members due to good reputation; fourth, availability of ecosystem resources that facilitate collaboration.

To stimulate relationship building across the entire ecosystem, Nokia has been organising events, open thematic sessions inviting all ecosystem members. However, due to the restrictions associated with the COVID-19 pandemics in 2019-2022 and high costs of hosting large events,

[18] Actors in sections 2.2.1/2.2.2/2.2.3 should include the appropriate private companies (SME/Large/micro), start-ups, universities and research institutes, NGOs (e.g. trade associations), banks and funding agencies, public agencies, other (please specify)

until now most events have been held online and therefore have had a limited value for relationship building and knowledge sharing.

As it was mentioned earlier, in practice, the ecosystem rests on individual projects run by consortiums of ecosystem members. Without frequent exchanges across projects, it appears that the ecosystem members are working in silos and are creating mini-clusters within the ecosystem. Despite that, all interviewees highlighted that within the projects there is strong collaboration between all consortium partners from both academia and industry. Nokia does not intervene in governing of individual projects, allowing freedom of operation that is considered most effective and efficient by a consortium.

E.2.3 Ecosystem functions and collaboration models

Among the key resources that are available to all ecosystem members is the open virtual platform that focuses on digitisation. The platform has been set up by Nokia prior to the ecosystem launch. At the moment, on the platform are registered several hundred organisations that either stimulate or undergo digitisation. Given that digitisation is strongly connected to 5G, Nokia facilitated identification of potential partners for all ecosystem members through the platform, thereby stimulating expansion of the ecosystem. The platform also provides a free of charge opportunity to share and download relevant open access resources/materials, such as journal papers, factsheets, etc. on the platform. This stimulates knowledge sharing within and beyond the current ecosystem. To ensure high quality of uploaded resources/materials, Nokia performs regular quality checks. Based on interviews, the virtual platform has been a successful instrument for creation of new partnerships that led to joint projects.

In addition, Nokia provides access to its Future-X Lab. The Lab allows industrial partners and academics to jointly test, validate and demonstrate the most promising industrial solution blueprints and applications. The Lab saves costs of partners, helps to develop better products and enhances their market engagement opportunities.

Lastly, the key contribution of Nokia towards its partners is the provision of expertise. Specifically, the staff of Nokia joins project consortiums or supports ecosystem members when they lack knowledge or capacity to execute specific tasks.

The resources of the ecosystem are gradually expanding, as new projects provide knowledge, useful resources, infrastructure. For example, through one of the projects the ecosystem members have developed infrastructure that is worth at least EUR100mln In view of interviewees, without ecosystems partners, they would be unwilling to undertake such large investment projects and would lack diverse expertise. Such projects highlight a high value of the ecosystem.

E.2.4 Analysis of the structure of the ecosystem

The current LCI ecosystem is characterized by a strong decision-making power of Nokia. This can be, to some extent, justified by Nokia's central role and significant contribution to the ecosystem, balanced by its non-intervention into governance of specific projects. Nokia, however, does not disclose its strategic, long-term plan for the ecosystem development. This represents a point of attention with regard to ensuring inclusion of interests of all partners and improving clarity of short/medium/long-term goals and steps to achieve them. At the moment the ecosystem might make an impression of suiting only the needs of Nokia, as Nokia is the only entity that has a control over and knowledge of its (long term) development.

Despite the above-listed opportunities for improvement, this ecosystem clearly illustrates how a strong market player (in this case, Nokia) is willing to share private assets/resources for the

sake of an industrial transformation in the country, at least for the short-term. The discussion of benefits of the ecosystem can be found in the next chapter.

E.3 Value of the ecosystem

E.3.1 Added value

The discussions with the interviewees revealed that there are many benefits related to the creation of this business ecosystem. First, ecosystem members access resources (both private and public) for doing R&D, such as funding, infrastructure, knowledge. This contributes to the reduction of costs for R&D, better quality of research and of products developed. Second, members form new business connections within the ecosystem that can lead to the creation of partnerships and, hence, to new business opportunities. Third, the ecosystem collectively generates knowledge and contributes to greater intelligence within a specific thematic area. Fourth, the ecosystem supports collaboration between education/academic sector and industry. As a result, it supports transformation of universities into research and innovation hubs, making project-based findings relevant for the industry and building relevant expertise within universities. In addition, some interviewees pointed out that such collaboration improves the quality of education in universities, as it is better tailored to the needs of industry. Lastly, the ecosystem becomes a marketing platform for small organisations or for organisations that want to enter a new market, and it attracts attention of media in general, contributing to greater international business opportunities.

The advantages of the ecosystem building to the leading company – Nokia – are also numerous. In essence, the entire ecosystem supports the development of Nokia's business strategy, providing solutions/products along the value chain, and establishes them as a leader in an industrial 5G area. Hence, the ecosystem decreases the risk of investment in a new area and provides resources for a joint industry venture. For many ecosystem members, Nokia will become a key client due to embeddedness in the ecosystem, therefore it is mutually beneficial for both parties.

Overall, the ecosystem highlights that doing R&D in an industrial 5G area alone would be more costly and risky, or would not be possible at this stage. The ecosystem supports development and growth of the sector, attracting new resources – physical, financial and human – to the new area, and fostering alignment of goals/objectives among industry, academic and other stakeholder organisations. If a business opportunity is identified correctly and on time, then joint efforts can greatly increase competitiveness of the Finnish economy in a new area.

E.3.2 Strategic importance

Based on interviews, the ecosystem is of strategic importance to many stakeholders in Finland, as deployment of 5G seems to be a promising business area for the technology sector and for connected industries, and it will stimulate development of next generation (6G) technologies. The current ecosystem is expected to support digitisation of the Finnish ecosystem, innovation across different industries and thereby improving competitiveness of the economy in general.

E.3.3 Long term development of the ecosystem

The long-term development of the ecosystem depends on three factors. First, willingness of Nokia and of key partners to continue driving the ecosystem. Based on the interviews, it seems that the organisations have already committed significant resources and therefore plan to pursue collaboration in the future. In addition, the management of Nokia stresses that they are open to collaboration with other LCI ecosystems and industrial partners to support the journey towards industrial 5G deployment in Finland.

The second factor that will impact long-term development of the ecosystem is the ability to transition from research to product development and commercialisation, due to complex sharing of intellectual property rights, agreement on production and distribution of profits from product sales. In general, the product development phase is expensive, and it is particularly challenging for small and medium-sized companies to invest/finance it. Some interviewees pointed out that public support is needed to support such companies.

An additional barrier for the long-term ecosystem development is a lack of long-term vision, as only Nokia has been involved in the design of a strategy for the ecosystem development. As was mentioned earlier, a lack of clarity weakens commitments of ecosystem members. Thus, an open discussion and co-creation of the long-term plan for the ecosystem is needed.

Lastly, the long-term development of the ecosystem depends on success of the current pilot phase. If existing projects seem to provide good outcomes then ecosystem members are ready to discuss scaling-up of project solutions and discuss next steps.

There are two views on sustainable development of the ecosystem. The first view is that sustainable development of the ecosystem depends on business vitality of its core industrial members, as other members play a supportive role. If these industrial members manage to accumulate sufficient funding for future R&D projects, then the ecosystem can be self-sustained.

The second view points out that there is significant willingness to collaborate and great business opportunities in 5G area, therefore ecosystem development will continue even without significant financing flows to the ecosystem. In addition, the open digital platform provided by Nokia represents an important channel that spurs future partnerships. The second view is also supported by the argument that the results of the current R&D projects will be seen only in the next 10 years, as most projects have a relatively low TRL level (2-4). Hence, 2-3 years after the end of the LCI programme this ecosystem will see the business impact of commercialisation and, if projects yielded successful results, a new wave of partnerships is expected.

E.3.4 Sustainable development within the ecosystem

Given the focus of the ecosystem on industrial 5G and digital technologies, the ecosystem is contributing towards sustainable development of the economy in Finland that is not harmful to the environment. The ecosystem does not make an explicit focus on this aspect, although it recognizes that it might contribute towards sustainable transition, as digitisation and novel technologies applied in different industries will support it.

E.3.5 Analysis of the value of the ecosystem

The ecosystem "NOKIA: Unlocking Industrial 5G beyond Connectivity" clearly shows many benefits to its members and to Nokia itself. Besides the public funding, the ecosystem members have invested significant number of private resources. The success of the current ecosystem rests on a good business rationale – in terms of the area of investment and timing, involvement of key committed partners in the supply chain, maturity of the ecosystem that enables progressing from idea creation to its testing/development, and effective and efficient facilitation of collaboration via a digital platform. An important step for the development of the ecosystem will be its transition from research to development/commercialisation activities.

E.4 Role of Business Finland and public support

E.4.1 Role and added value of Business Finland and its instruments

The role of Business Finland has been to guide organisations during the application process to receive public funding, to support development of the ecosystem by stimulating

communication and openness, organising events, sharing information and facilitating exchanges with new potential partners/investors. In essence, Business Finland provides support that addresses the needs of the ecosystem. In addition, Business Finland has been encouraging LCI ecosystems to work together to stimulate R&D&I in sectors of high potential, export, growth and employment in Finland. Nevertheless, Business Finland did not force partnerships if they were not welcomed by participants.

In view of interviewees, the contact person at Business Finland has been helpful in explaining LCI funding rules, although some organisations lack an overview of all existing funding instruments and mechanisms available in Finland and in the EU, in general. The monitoring process has been relatively relaxed, as there are no financial and legal means to ensure close monitoring. Thus, Business Finland only checked whether allocated funds have been used according to stated purposes, but omitted an in-depth analysis on effectiveness, efficiency and impact of funding.

Overall, the funding instruments provided by Business Finland have been highly appreciated by the ecosystem members, as they put the focus on R&D activities, spurred collaboration and joint undertakings, which may increase efficiencies through shared resources.

E.4.2 Potential for improving BF support for ecosystems

Despite that interviewees appreciated that Business Finland did not directly intervene in the ecosystem management, many of them prefer a stronger consultative/strategic role of Business Finland and a greater presence within the ecosystem. This could have enhanced the voice of smaller actors in the ecosystem, improved decision-making, supported ecosystems in business development and stimulated the process of design of a long-term vision for the ecosystem. In contrast, the employees at Business Finland indicated that they lack resources and skills to provide business advice.

Another area of improvement is the time to review project applications. Some interviewees pointed out that at times it took up to 12 months to receive a decision of Business Finland on whether an application has been accepted or not. Given that timing is important for realising and putting idea/product on a market and for building momentum in collaboration, ecosystem members requested to speed up this process.

Due to regulations of Business Finland, it cannot fund development and commercialisation of products. Hence, fundamentally LCIs are research ecosystems and Business Finland does not have leverages to support or encourage ecosystem members to co-create products and put them on the market. For SMEs, this represents a particular challenge, as many of them face financial challenges and might not receive funding from private sources for, what could be considered, risky investment that are not directly tied to new revenue. As a result, some interviewees argued that Business Finland should discuss with SMEs how best to support the development of innovative products. Potentially, Business Finland could link SMEs to investors or other funding agencies.

Lastly, interviewees highlighted that they would appreciate to have a stronger collaboration with the public organisations and to influence upcoming calls for proposals in Finland and in the EU. This way, they can utilize all available resources to further their plans.

E.4.3 Analysis of the role of Business Finland and public support

Business Finland ecosystem instruments have very ambitious goals, which cannot always be easily measured (e.g., future number of jobs created and export from funded R&D projects). The financial resources that Business Finland is devoting are sufficient, yet more attention should go towards ecosystem support and monitoring to further work towards success of the

ecosystem. Thus, it has a limited role and presence in the ecosystem. Nevertheless, the case of "NOKIA: Unlocking Industrial 5G beyond Connectivity" ecosystem reflects that the ecosystem success can be achieved even without continuous supervision and close monitoring if the key actors are effectively driving the ecosystem. Nevertheless, even in a successful case there is a need to ensure that the ecosystem is functioning properly and there are governance mechanisms in place that ensure best outcome for all ecosystem members in short and long-term.

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E.5.1 Written information

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E.5.2 Interviews

In total of 7 anonymous interviews utilized for the case study.

Appendix F Case study: SHIFT '25

F.1 General information about the ecosystem

F.1.1 Official name of the ecosystem & BF support

Sandvik Shift'25 consists of two domains 1) *Sandvik Shift'25 programme* and 2) *Sandvik Shift'25 ecosystem*. Shift '25 programme focuses on Sandvik's own R&D activities conducted with different partners, while Shift '25 ecosystem focuses on more research-oriented ecosystem projects. *It should be noted that the concept of 'ecosystem' covers here both the Shift'25 programme and Shift'25 ecosystem (unless excplicitly mentioned).*

Business Finland has supported Shift'25 through the Leading Company Initiative (LCI), including both financing for Sandvik's own R&D projects as well for the related ecosystem projects (co-innovation and co-creation funding).

F.1.2 Scope and focus of the ecosystem

The Shift '25 focuses on digitalizing and electrifying heavy use, harsh condition mobile machines. The Sandvik Shift`25 has four main themes: automation, digitalization, electrification and rock excavation.

In the field of automation, the focus is to develop autonomous mining vehicles, whereas the digitalisation refers to network and sensor technologies, as well as comprehensive data analytics, aiming to increase the level of situational awareness to assist in the operational management of mines. Electrification focuses on the electrification of mine vehicles, which helps to reduce emissions and, together with robotics, increase the operational precision. Drilling technology covers the usage of data-driven solutions, which improves the selection accuracy of different minerals.

F.1.3 Background and brief history of the ecosystem

The Shift' 25 was officially launched in 2021 after being successful in the second round of LCI competition in 2020.

Although the ecosystem as such did not exist before the LCI competition, many of the ecosystem members have a long history of previous R&D collaboration in Finland. Business Finland has previously supported Sandvik's and other ecosystem members' R&D projects with 'traditional' R&D funding instruments. The roots of the Sandvik's work within the focus area of the ecosystem dates back to mid-1980s.

F.1.4 Basic quantitative information

For the Sandvik's own in-house R&D activities, Sandvik has several different partners and service providers. The total volume of these activities for 2021-2025 is approximately 60 million EUR, with Business Finland support reaching 20 million EUR.

Besides Sandvik's own activities, there are currently 11 'ecosystem projects' (with co-research or co-innovation funding from Business Finland) linked with the ecosystem, with a few more in preparation. These projects include in total of 36 different organisations. The total volume of the projects is approximately +10 million EUR (BF funding volume approximately 9 million EUR). The interviewees point out that Sandvik has been very selective when it comes to including new projects in the ecosystem.

F.1.5 Analysis of the general situation of the ecosystem

Based on the case study findings, Shift ´25 ecosystem seems to be a relatively compact very industry-driven ecosystem, with a clear focus. Overall, the case highlights the need for a long-term perspective in building (and supporting) ecosystems.

F.2 Structure of the ecosystem

F.2.1 Ecosystem leading and core actors and their respective roles

The Shift '25 is led by Sandvik Group. The company is an international high-tech industrial group, focusing on selected special fields such as tools used in metalworking, equipment and tools for the mining and contracting industry, stainless materials, special metal alloys, durable metallic and ceramic materials, as well as process systems. In 2020, the group had approximately 37.000 employees and had operations in over 160 countries. The annual turnover was approximately 86 billion Swedish Krona (≈ 8,2 billion EUR).

In Finland, Sandvik operates as Sandvik Mining and Construction Oy, a subsidiary of the Swedish Sandvik AB, established in 1862. The roots of Sandvik's Finnish operations date back to 1933 when Sandvik set up a subsidiary company in Finland. In 1997 Sandvik acquired a Finnish mining industry company Tamrock. In 2021 Sandvik Mining and Construction Oy employed 2.015 people in Finland and had a turnover of 1,3 billion EUR. The interviewees highlight the strong and deep-rooted R&D and innovation culture as one of the key strengths of Sandvik's Finnish operations. For example, Sandvik has established a test mine in Tampere to provide a platform for rapid prototype testing and quality assurance verification.

Other key partners in the ecosystem include VTT and universities, especially University of Tampere, Aalto University, University of Oulu, and Lappeenranta University of Technology. Each of the universities are also managing at least one of the ecosystem projects with Business Finland funding. Sandvik is taking active part in initiating, planning and steering all the ecosystem projects.

Key companies in the ecosystem include Nokia and ecosystem project leaders such as Danfoss Editron Oy, Ponsse Oyj, Norrhydro Oy, Raute Oyj and Hybria Oy.

F.2.2 Operational environment of the ecosystem

Besides the core partners, the ecosystem consists of several companies and other organisations who are involved in the co-innovation or co-creation projects funded by Business Finland. The roles of these companies in the ecosystem and its value chains vary considerably. While some are important solution providers and integral part of the value chains, for some, Sandvik and the Shift '25 ecosystem can be quite distant as they mainly collaborate with partners in their respective projects.

Another important group of stakeholders include the companies involved in the SIX Mobile Machine Work Machines cluster (see below). These include mainly other large Finnish companies from other industries such as Ponsse, Valmet Automotive, Cargotec and Nokia. These companies are not competing within the same value chains or in the same industry, but are rather looking for solutions which can be applied and/or scaled in other contexts. The logic behind this is that the number of large autonomous machines produced annually is very small and therefore cross-sectoral collaboration is needed to achieve a critical mass of client companies.

Besides R&D investments, regulation and standardisation are also important elements for future development of the ecosystem, and are currently being discussed as part of the ecosystem roadmap.

F.2.3 *Ecosystem functions and collaboration models*

Like all the LCI ecosystems, Shift '25 also has developed a roadmap to guide the activities within the ecosystem. All projects initiated are linked to the implementation of this roadmap, which is regularly revisited and refined if needed at the Advisory Board, consisting of representatives from the key partners.

As mentioned above, Shift '25 consists of two main components: the Shift '25 *programme*, which focuses on Sandvik's in-house R&D activities, especially focusing on digitalization and electrification; and Shift '25 *ecosystem* in where the focus is on building an ecosystem with the partner organizations. The latter is mainly implemented through co-innovation and co-creation (EVET) projects, funded by Business Finland. Co-creation (EVET) projects are more research-driven and explorative, while co-innovation projects are focused on more concrete business cases.

Sandvik is active in initiating, planning and designing the projects, and has been very selective in including new projects in the ecosystem. It also pays specific attention that all involved partners are strongly committed to the ecosystem and "bring something to the table". According to the interviewees, this is something that distinguishes Shift '25 from many of the other LCI ecosystems.

Sandvik wants to ensure that the ecosystem members are on a same wavelength when it comes to the pace in moving forward. This is considered important to ensure the commitment of all actors to the ecosystem activities. Also, the importance of balancing between different TRL-level project was emphasized, as well as the need for systematically building competence for managing and orchestrating the ecosystem within the (leading) companies. According to the interviewees experience, the role of the orchestrator is important in managing the ecosystem, and it is important to ensure that the core companies are in the driving seat and that the orchestrator supports the shared roadmap of the ecosystem.

Another important feature of the ecosystem is its connection with the SIX Mobile Work Machines cluster[19], which focuses on developing new solutions for the machine industry and consists of actors from various industries (beyond mining). The cluster operates as a platform for building a shared vision and roadmap for future work machines. Parts of this roadmap is linked to the activities of Sandvik Shift'25 roadmap, and relevant Shift'25 ecosystem projects are discussed with the cluster actors. Sandvik has had an important role in setting up and supporting the cluster, and the objectives were included in Sandvik's LCI application. However, it should be noted that Sandvik is only one of the companies in the cluster and on the "same level" as other cluster members.

One concrete example of cross-sectoral collaboration is a joint co-innovation project between Sandivk, VTT and Nokia for developing next generation mining solutions with the help of industrial 5G networks.

Sandvik test mine was also highlighted as an important function of the ecosystem, and something that has helped to develop specific R&D collaboration within the ecosystem.

F.2.4 *Analysis of the structure of the ecosystem*

While the Shift '25 basic structure is quite traditionally organized around BF-funded R&D projects, it has several interesting and distinctive features – such as Sandvik's active and selective role in managing the project portfolio, linking the ecosystem with the SIX Mobile Work

[19] https://www.six.fi/mobile-work-machines

Machines cluster, and Sandvik's test mine – which can be further explored for learning lessons in building industry driven R&D ecosystems.

F.3 Value of the ecosystem

F.3.1 Added value

According to the interviews, the main added value of the Shift '25 (beyond Business Finland funding which is discussed below) is in providing a longer-term roadmap and vision for the R&D activities among the Shift'25 stakeholders. While it was seen that most of the projects in the ecosystem would probably have been conducted regardless of the ecosystem (as individual projects) in some capacity, the ecosystem helps to clarify the framework and provides a clearer structure and direction for these activities. This way it has helped to *accelerate* the implementation of the activities. The value of the ecosystem (and related LCI funding) in increasing the legitimacy for the thematic area was also highlighted. However, the added value for SMEs and other partners outside the ecosystem core, was considered less evident, apart from the fact that being part of the ecosystem may help them get funding for their own R&D projects.

When it comes to broader added value for the Finnish economy, it should be noted that the projects conducted as part of the ecosystem – in accordance with the LCI instrument – focus on early-stage research and development projects (TRL levels 1-4) and have only recently started. Therefore, it will take many years until the results and benefits will materialise (e.g. in terms of new products and turnover). In fact, many of the interviewees highlighted that while so far the experiences are very positive, the added value of the ecosystem still remains to be seen.

F.3.2 Strategic importance

Mining industry is currently in a state of comprehensive transition, as emission reduction goals as well as safety improvements have led to the increased use of electrification and digitalisation functionalities. The goal of the ecosystem is to respond to the ongoing transition by creating solutions that improve productivity, safety and sustainability of the mining industry.

F.3.3 Long term development of the ecosystem

The collaboration between the key actors in the ecosystem precede the Shift '25 and it is also likely that the collaboration will continue in some form also after the current LCI funding period. However, the future of the LCI funding is likely to significantly affect *how* the collaboration will conducted in the future, and interviewees emphasized the need to already start planning the future of the instrument.

F.3.4 Sustainable development within the ecosystem

Sustainability is directly linked to the mission and objectives of the ecosystem: the aim of the ecosystem is to build more sustainable solutions in the mining industry. The need to reduce emissions and increase the safety of the mining industry are important drivers in increasing global demand for such solutions.

F.3.5 Analysis of the value of the ecosystem

While the long-term impact of the ecosystem activities remains to be seen, there is already some indications that the ecosystem has helped to provide direction for R&D activities and leverage R&D investments for a shared roadmap.

F.4 Role of Business Finland and public support

F.4.1 Role and added value of Business Finland and its instruments

Business Finland has supported Shift'25 through the LCI funding instrument. This consists of €20 million EUR funding commitment for the leading company (Sandvik) as well as a commitment of €50 million EUR for supporting companies within the ecosystem (with co-innovation and co-creation funding). Overall, the role of Business Finland in supporting the ecosystem was considered significant, and there is good and active collaboration between the ecosystem and Business Finland.

Regarding the LCI funding, several key strengths and clear value added were highlighted. The long-term (5-year) focus and sufficient volume of the funding were highlighted as strengths of the instrument. This, according to the interviews, provides a real opportunity for developing breakthrough products, build competence and knowledge, and achieve a real change within the field – especially when compared to funding scattered for smaller individual projects. The funding also helps to steer R&D activities towards a shared 'mission', and presents a step away from the fragmented project-based R&D funding 'cycle'.

From the perspective of the leading company, the funding is very attractive as it can be used to cover company's own R&D activities, and does not need to be used only for subcontracting. This type of funding for larger companies has not existed for many years for larger companies. According to the interviews, this can bridge the gap in competitive advantage with other countries (who have been providing similar type of funding), and is an important aspect when companies consider their investment decisions.

F.4.2 Potential for improving BF support for ecosystems

Overall, the interviewees considered the LCI instrument to be very important addition with high impact potential. However, also several factors for improvement were highlighted.

First, the KPIs regarding long-term impacts such as exports or number of jobs created, were considered somewhat irrelevant or problematic since many of the projects are very early-stage projects (e.g. TRL 1-4), and it is impossible to assess their impacts against these criteria. Instead of these (project level) KPIs, it was suggested that KPIs could focus on the broader picture and implementation of the ecosystem roadmap actions and milestones.

Second, the instrument was not considered as very attractive or relevant for SMEs. The KPIs were considered particularly problematic for SMEs, since it is difficult or even impossible for them to commit, for example, to certain levels of export growth. In addition, it was highlighted that the projects are very research-oriented and can be difficult for SMEs to participate in. Thus, there should be more emphasis and support for the ecosystems to better integrate SMEs. In fact, according to one interviewee, the main motivations for SMEs to join the ecosystem is the "fear of missing out" as most of their main clients are involved. One important attractor for SMEs would be the opportunity to get concrete reference cases and client relations for their products as part of the ecosystem. This is currently not possible due to funding terms. There was also some criticism for Business Finland for falling for "hype" and "corporate jargon", which may distance some of the companies, especially SMEs, and result in increased use of professional 'application consultants' in the process.

Third, although the instrument is considered as an important step for long-term funding, the individual ecosystem projects are still relatively short and lack continuity, which may lead (back) to the short-term project cycle and difficulties in linking the projects within the ecosystem roadmap. This applies especially for the more research-oriented co-creation (EVET) projects.

Fourth, some interviewees called for more emphasis on the 'orchestration work' beyond the actual R&D projects, for example on knowledge-sharing, competence building, utilization of EU-funding, dissemination of results etc. It was seen that the extent of work needed is not yet fully understood in supporting ecosystems. Currently these types of activities can be included in the work plan, but the instrument itself is not ideal for this purpose, and the activities largely depend on the leading company.

Finally, the interviewees emphasized the need for continuity in supporting ecosystems. This requires that Business Finland should already start planning, what happens after the current LCI instrument, and to draw lessons for building the next generation of instruments. Instead of just increasing the number of LCI ecosystems, the focus should be on supporting the most effective ecosystems

F.4.3 Analysis of the role of Business Finland and public support

The role of Business Finland in supporting the ecosystem is similar to the other LCI-supported ecosystems and is mainly related to the R&D funding for the leading company and for the ecosystem projects. The volume of Business Finland's funding is significant and comparable to the large Business Finland (prev. Tekes) technology programmes. All in all, the case highlights that the LCI instrument has clear and important strengths but also room for improvement.

Besides funding, the role of Business Finland in supporting the ecosystem has been quite limited, and the ecosystem has been designed 'bottom-up' largely without Business Finland support or steering. Findings suggest that in this case, this type of 'loose' approach has worked well, but it also raises a question, if more active support for designing and managing ecosystems is needed in other cases.

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F.5.1 Written information

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F.5.2 Interviews

In total of 5 anonymous interviews utilised for the case study.

Appendix G Case study: Flexible Renewable Energy

G.1 General information about the ecosystem

G.1.1 Official name of the ecosystem & BF support

Flexens Oy Ab is an ecosystem that focuses on solving challenges related to use and integration of renewable energy in existing and new systems. Flexens envelops the whole energy system including generation, electricity and district heating networks, mobility and real-estate management. Flexens Oy Ab received Growth Engine capital loan in 2019 and additional orcestration grant in 2021.

G.1.2 Scope and focus of the ecosystem

The mission of Flexens is to create, develop and implement scalable, integrated and affordable self-sustained energy systems based on a 100 % renewable energy mix.[20] The scope is in working with RTOs, and various energy system stakeholders to work towards renewable energy systems.

G.1.3 Background and brief history of the ecosystem

The background of the ecosystem goes back to early 2000s in the form of a series of research projects on renewables and more tangibly to mid-2010s when Åland regional stakeholders and outside parties such as then CLEEN, presently CLIC Innovation, recognized the potential to develop Åland as a platform for carbon neutral energy ecosystem. CLEEN and Ålands Teknologicentrum (ÅTC) facilitated the first feasibility study with a consortium of RTOs for developing especially offshore wind in 2015.[21]

Flexens was founded as public-private partnership between CLIC Innovation and Åland regional stakeholders and incorporated in 2018 to develop the Smart Energy Åland concept that "offers multiparty solutions to the challenge of affordable renewables integration initially based on a full society scale demo"[22]

G.1.4 Basic quantitative information

The main stakeholders in Flexens are CLIC Innovation, Ålands Landskapsregering and regional energy companies. The core network includes 26 enterprises, ranging from renewables start-ups to established energy and process technology enterprises. The wider network is altogether more than 50 enterprises, RTOs and public bodies in Åland, Finland and EU.

G.1.5 Analysis of the general situation of the ecosystem

Flenxens is based on a long-standing collaboration of the key partners and committed stakeholders, with a portfolio of projects built over more than a decade.

G.2 Structure of the ecosystem

G.2.1 Ecosystem leading and core actors and their respective roles

Flexens is co-owned by CLIC Innovation, Ålands Landskapsregering and a consortium of energy and mobility enterprises from Åland. Flexens manages the Smart Energy Åland project

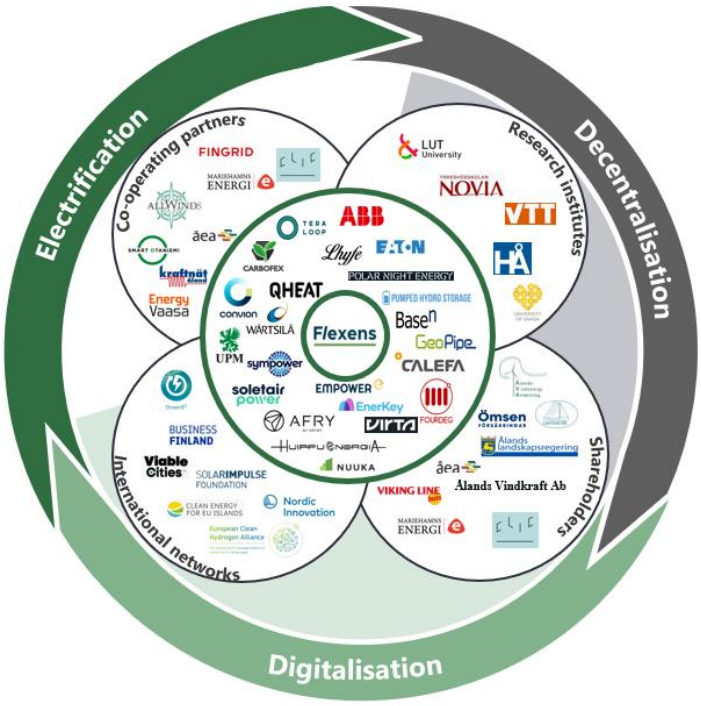
[20] Flexens, Background. Available: https://flexens.com/background/

[21] Åland Smart Energy Platform, 2015.

[22] Flexens, 2019. Introduction to Smart Energy Åland

and consortium that is the base and demonstration project for developing and delivering a renewable energy system. The SEÅ project pilots several technologies that come together as a smart energy system and is governed by the same actors.[23] The following figure illustrates the roles of various actors.

Figure 50 The structure of Fexens ecosystem (as of March 2021)



Source: Flexens/BF

G.2.2 *Operational environment of the ecosystem*

As discussed, the ecosystem envelops a multitude of technology suppliers, energy enterprises as well as public authorities and RTOs. The SEÅ project is a development and demonstration platform for a portfolio of technologies that integrate various enterprises, RTOs as well as the core partners.

G.2.3 *Ecosystem functions and collaboration models*

The key function of Flexens is to act as a project developer and project/systems integrator, as multiple technologies are developed and integrated in the tangible energy systems. The larger portfolio includes the development of a layer of digitalization and open market-based coordination mechanisms, that enable flexible "smart" energy system with adequate demand response. The core of the platform is the SEÅ project and Flexens facilitates and develops new adjoining projects with a variety of partners both nationally and in e.g. ERA Nets and Horizon 2020 programmes. The project development focuses on narrower and commercially viable smart energy projects to further develop commercial and technical references.

[23] C.f. e.g. Smart Energy Åland, Energiekosystemet, Available: https://smartenergy.ax/energiekosystemet/

G.2.4 *Analysis of the structure of the ecosystem*

The nexus of the ecosystem appears to be the SEÅ project platform, that brings together the various partners and ecosystem members that participate in solving the overall challenge and the multitude of technological and socio-economic aspects of building a society scale renewable energy system.

G.3 Value of the ecosystem

G.3.1 *Added value*

Flexens and its project portfolio, including SEÅ, are potentially a high value adding public-private partnership. The proposition is that Åland develops climate leadership and better energy security, and attracts investments and tax income in the process. The partnering enterprises get to develop and demonstrate various energy and digital innovation in a society scale real demonstration and get important references. And public fenders have an investment target that is creating scalable technology, products and services. The long-term value is that Åland gains a sustainable energy system and investments, and the partners gain a reference delivery of scalable products and services.

G.3.2 *Strategic importance*

The ecosystem is extremely well aligned with public policy agenda at the regional, national and EU levels. The direction of the ecosystem activity indicates it creates added value to the various stakeholders. What differentiates Flexens from various other ecosystems and platforms is the setup as a PPP, where the partners are the main beneficiaries, and the focus from the onset to deliver industrial or societal scale demonstration or complex socio-technical system transformation, that adds value for users and suppliers of technology, products and services.

G.3.3 *Long term development of the ecosystem*

The focus on a portfolio of tangible projects and a roadmap for scaling the products and services developed in the ecosystem indicates that the trajectory is towards self-sustaining business.

G.3.4 *Sustainable development within the ecosystem*

In many ways developing a smart scalable energy system is at the core of sustainability agenda. Even more so, Flexens is engaged for example an RDI project that aims enabling fair local sustainability transitions.[24]

G.3.5 *Analysis of the value of the ecosystem*

Flexens has a high potential to create added value for its stakeholder directly and indirectly through the development of smart energy systems, and various associated scalable business models, products and services.

G.4 Role of Business Finland and public support

G.4.1 *Role and added value of Business Finland and its instruments*

BF funding has been instrumental in the formation of Flexens over a long history of preceding RDI and other funding. The capital loan has enabled Flexens to develop an operating model

[24] See e.g. LocalRES, www.localres.eu

that includes project development, systems integrations, seed investment and spin-off development.

G.4.2 *Potential for improving BF support for ecosystems*

Flexens and the associated Smart Energy Åland is well set up to for mutually beneficial RDI and demonstration of technology, products and services. What sets Flexens apart from many other initiatives, is the commitment from Ålands Landskapsregering and other local partners to set up a platform for piloting and demonstration of technology, products and services.

G.4.3 *Analysis of the role of Business Finland and public support*

BF role has been instrumental in enabling Flexens through various phases of funding to the constituent organizations and preceding projects.

G.5 Sources

G.5.1 *Written information*

- Business Finland, 2019. https://www.businessfinland.fi/ajankohtaista/caset/2019/kasvumoottori-flexens-rakentaa-kokonaan-uusiutuvalla-energialla-toimivia-alueita
- Flexens, 2019. Introduction to Smart Energy Åland
- Smart Energy Åland, Energiekosystemet, Available: https://smartenergy.ax/energiekosystemet/
- Flexens, Background. Available: https://flexens.com/background/

G.5.2 *Interviews*

In total of 2 anonymous interviews utilized for the case study.

Appendix H Case study: Open Creative

H.1 General information about the ecosystem

H.1.1 Official name of the ecosystem & BF support

Official name of the ecosystem is Open Creative. It is led by a Finnish start-up Family in Music Oy.

Business Finland has supported the ecosystem with Growth Engine funding (capital loan). In parallel, Business Finland is supporting the establishment of Open Creative House (OCH) with innovation cluster funding, channelled through Finland's Sustainable Growth Programme (RRF[25]).

H.1.2 Scope and focus of the ecosystem

The ecosystem focuses on the creative industry. The primary priority vertical of the ecosystem is the music industry, but a longer-term plan is to expand to other creative industry verticals (such as audio-visual industries and expert services).

The mission of the ecosystem is to develop world's leading digital and data-based creative industry platform (managed by Family in Music), bringing together a broad range of creative industry actors, and create significant new international business opportunities. At the same time, the ecosystem aims to strengthen the networks and knowhow within the Finnish creative industry ecosystem with the OCH initiative (see below).

H.1.3 Background and brief history of the ecosystem

The first discussions for establishing the Open Creative ecosystem were held in 2019 between Jiffel Music Oy (the parent company of Family in Music) and Business Finland. At the end of 2020, FIM's application – supported by several actors within the industry – was among the winners of the GE competition and Family in Music was granted BF capital loan as the first creative industry company.

One of the preconditions for the funding decisions was that FIM will launch an orchestration project (Open Creative House) to support the broader Finnish creative industry ecosystem. The rationale for the precondition was to ensure that the impacts of Business Finland's funding would support the broader ecosystem, not just the platform company.

Initial plan was that the orchestration project (OCH) would be set up under FIM, but later it became clear that due to the EU funding terms, a new company – with maximum of 25 % owned by FIM – would be needed to manage the orchestration project. For this purpose, Open Creative Oy was set up by Jiffel Music Oy in the end of 2021. The new company applied for the orchestration project (innovation cluster funding) in early 2022. After long negotiations, the application was accepted in June 2022, with the precondition that 75 % of the ownership of Open Creative Oy would need to be transferred to other members of the ecosystem. This

[25] „Funding for the Sustainable Growth Programme for Finland will come from the one-off EU recovery package 'Next Generation EU' (NGEU). The NGEU is divided into seven instruments, of which the Recovery and Resilience Facility (RRF) is the largest. Member States must present a national Recovery and Resilience Plan (RRP) in order to receive RRF funding. Finland's Recovery and Resilience Plan will form part of the Sustainable Growth Programme for Finland." https://vm.fi/en/sustainable-growth-programme-for-finland

criteria was met in autumn, and Business Finland accepted the project in full in October 2022. The opening event for OCH was organized on 16th November 2022[26].

H.1.4 Basic quantitative information

The ecosystem covers a broad range of different stakeholders. In total of 32 organisations submitted their Letter of Intent to support the application. Of these, 18 were companies, 4 research organisations and 10 non-governmental organisations and creative industry associations. However, since the OCH initiative has only recently launched, the role of these stakeholders in the ecosystem has been limited by the time of writing.

H.1.5 Analysis of the general situation of the ecosystem

Due to the complexity of the instrumentation (two different, but interlinked funding instruments), and prolonged funding negotiations, the ecosystem activities (OCH) have been delayed, and the situation of the ecosystem has been uncertain until recently. Now that the contract negotiations have finally been completed, the future of the ecosystem is much more positive.

H.2 Structure of the ecosystem

H.2.1 Ecosystem leading and core actors and their respective roles

The key actor of the ecosystem is Family in Music Oy (FIM), the company behind the Family in Music platform. FIM is a Finnish start-up company established in 2019 as the subsidiary of Jiffel Music Oy. In 2021 FIM employed 8 people and had the turnover of around one million Euros.

The Family in Music platform is currently in beta phase with approximately 5.500 users, of which 95% outside Finland. The main market focus is currently the UK.

Open Creative Oy operates as the company running the Open Creative House (OCH). The company was initially established as a subsidiary of Jiffel Music Oy, but in order to accommodate the Business Finland funding terms (see above), 75 % of the ownership was transferred to other members of the ecosystem in 2022.

H.2.2 Operational environment of the ecosystem

Besides the core 'platform company', the ecosystem has a broad range of different stakeholders (many of them providing their Letter of Intents to support the application for the Growth Engine funding). These include for example several IP and industry associations, representing a broad range of artists, producers, etc. The main 'end user' and clients of the ecosystem consists of independent artists and content creators, especially song writers. Other stakeholders include service providers such as IP lawyers and design and marketing agencies as well as research organisations.

The broader context of the creative industry is characterized by the importance of copyright issues and relevant IP regulation. The 'IP management' industry has been growing rapidly in recent years and has attracted considerable VC investments as well as investments from global actors like Spotify and Apple Music (e.g. In Focus[27] by Spotify).

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[26] https://www.sttinfo.fi/tiedote/espoon-keilaniemeen-uusi-luovien-alojen-keskittyma-open-creative-house-juhlistaa-avajaisia-1611-avoimilla-ovilla-ja-huippuvierailla?publisherId=69819697&releaseId=69955977

[27] InFocus by Spotify, https://infocus.byspotify.com/

H.2.3 Ecosystem functions and collaboration models

At the core of the ecosystem is the Family in Music digital platform for sharing content and data and managing IP rights. The most valuable assets of the platform are related to the IP management and blockchain technologies.

The platform offers "the right tools, people and knowledge for you to grow and thrive in the music industry". This includes for example knowhow from music industry professionals, actionable guides for artists, distribution services, networking, management of royalty payment and advances. The platform has been labelled as the "LinkedIn for the music industry".

For broader collaboration within the Finnish ecosystem, the key function is the Open Creative House concept (OCH). The purpose of OCH, located in Keilaniemi (Espoo), is to operate as a local hub to bring together various creative industry stakeholders such as companies, IP rights associations, and the individual artists. Due to the situation described above, the activities of the OCH have been rather limited until November 2022 when the OCH was officially opened. The opening event attracted a broad range of creative industry stakeholders[28].

H.2.4 Analysis of the structure of the ecosystem

The structure of the ecosystem, centred around one start-up company and its digital platform, is typical for all Growth Engines with capital loan. Also, similar to other Growth Engine ecosystems, the ecosystem functions and collaboration practices with other stakeholders are relatively 'light'. From this perspective, the Open Creative House concept provides an additional and interesting layer to the ecosystem, but its role cannot yet be assessed at the time of writing.

Compared to other ecosystems supported by Business Finland, the Open Creative ecosystem has some specific characteristics such as the role of individual artists and large number of (very) small companies, as well as the crucial importance of copyright issues.

H.3 Value of the ecosystem

H.3.1 Added value

For the platform company, the value of the ecosystem is related to the potential growth and revenue generated through the digital platform.

For the 'extended ecosystem', namely the independent artists and creators such as songwriters, the platform provides better access to various tools and services for supporting their business development. These kinds of services are otherwise not easily accessible especially for independent artists. At best, the platform can help to reduce transaction costs and provide a 'market place' for a previously disintegrated market, and improve opportunities also at the 'bottom' of the value chain (in this case the independent song-writers and other artists).

For the broader (Finnish) ecosystem, the added value of the ecosystem is mainly related to the Open Creative House concept, which brings together different stakeholders and helps support the development of the Finnish creative industry in general. The plans to establish the Open Creative House was also the main motivation for their support to the ecosystem and since the

[28] STT Info: Espoon Keilaniemeen uusi luovien alojen keskittymä – Open Creative House juhlistaa avajaisia 16.11. avoimilla ovilla ja huippuvierailla, 11.11.2022. https://www.sttinfo.fi/tiedote/espoon-keilaniemeen-uusi-luovien-alojen-keskittyma-open-creative-house-juhlistaa-avajaisia-1611-avoimilla-ovilla-ja-huippuvierailla?publisherId=69819697&releaseId=69955977

establishment of OCH was delayed until November 2022, the added value for the stakeholders has remained very limited at the time of writing. This has caused some uncertainty about the situation of the ecosystem among stakeholders.

H.3.2 Strategic importance

The strategic importance of the ecosystem is related to the scattered nature of the creative industry and the lack of structures to be able to compete in international value chains. Ideally, the platform could bring together different actors and create an internationally competitive ecosystem, while also strengthening the knowhow and networking within the industry as well as supporting the livelihood and businesses of the increasingly growing group of independent artists and content creators.

On the policy level, the ecosystem has links to the Creative industry roadmap[29] as well as to the ongoing work for the new IP strategy.[30]

H.3.3 Long term development of the ecosystem

Currently the platform is in beta phase with new features are being developed and business models are being validated. The future of the ecosystem is largely dependent on the success or failure of the platform to achieve a critical mass of users and a viable sustainable business model. This requires significant resources and efforts for user acquisition and retention.

As for the Open Creative House, the activities have only recently been started and its long-term future cannot yet be assessed.

H.3.4 Sustainable development within the ecosystem

Sustainability and ESG issues were not particularly highlighted as part of the case study. However, it should be noted that the mission of Family in Music is the be "Writer First" and to "empower especially the rapidly growing number of new songwriters", which can be seen to be aligned with the social sustainability goals.

H.3.5 Analysis of the value of the ecosystem

The potential added value of the ecosystem is quite typical to 'B2C-platform ecosystems' in the sense that it entails high risks but also high rewards. As in all platform ecosystems, the question of balancing the added value for the platform vis-à-vis the users is essential.

H.4 Role of Business Finland and public support

H.4.1 Role and added value of Business Finland and its instruments

The ecosystem was one of the four winners of the Growth Engine competition in 2020, receiving a capital loan funding (total funding subject to the accomplishment of selected milestones). In parallel, Business Finland is supporting the establishment of Open Creative House (OCH) with innovation cluster funding, subject to the criteria described above. Launching the Open Creative House was also one of the preconditions for the capital loan funding (see section 1.3).

The added value of the capital loan funding for the platform company is significant as it improves the financial reserves of the company and enables further investments for the

[29] TEM: Luovan talouden tiekartta. https://tem.fi/luovan-talouden-tiekartta

[30] Valtioneuvosto: Aineettomien oikeuksien strateegia (IPR-strategia). https://valtioneuvosto.fi/hanke?tunnus=TEM066:00/2021

development of the platform. Especially in the creative industry, the access to financing is often an important bottleneck for growth.

For other stakeholders, the added value of capital loan is dependent on the Open Creative House concept, supported by Business Finland through the innovation cluster funding.

H.4.2 Potential for improving BF support for ecosystems

First, while the combination of two very different instruments (capital loan and innovation cluster funding) makes a lot of sense on paper, it has proved to be challenging as has created a complex structure with interlinked criteria and funding terms. This has resulted in prolonged negotiations and uncertainty. In addition, the objectives of the two instruments can be very different or even conflicting: while capital loan is aimed for supporting the development of a digital platform, the innovation cluster funding is aimed for orchestrating a broader ecosystem. Combining these two objectives can be difficult, especially for a start-up focusing on the development of the product and finding the most relevant business model. Communicating these different objectives to stakeholders can also be challenging, since they are not involved with the development of the platform (capital loan) and are mostly interested in the broader ecosystem benefits (innovation cluster funding).

Second, while on the outset, the capital loan can be very helpful in opening doors and improving access for private financing, there is room for improving the coherence with private (equity) financing as there is a risk that a large 'injection' of capital loan at too early stage of the company development may distract some of potential early-stage investors. There have also been some different interpretations and misunderstandings on how the capital loan should be addressed in accounting. While this is mostly a 'technical' issue, it can be very important when negotiating for additional financing with potential VC investors or commercial banks.

Regarding the innovation cluster funding, the instrument is still very new and there is not that much experience yet. On paper, it can be used to support the achievement of broader goals of Growth Engines. However, as discussed a above, the funding terms are seen as relatively complex and integrating the instruments in practice can be problematic. On the positive side, the instrument can be used for funding multiple (consecutive) projects, which can enable more long-term development.

H.4.3 Analysis of the role of Business Finland and public support

The case study highlights many opportunities for improving Business Finland's support, especially when it comes to the capital loan funding and the innovation cluster funding. It should be noted that both instruments are relatively new and there has been no previous experience of similar cases. For the future, it is important that the framework and conditions for the instruments are very clear and avoid too complex structures. Furthermore, the case highlights the need to improve the coherence of capital loan instrument with private funding. Finally, since the capital loan instrument is relatively 'heavy' tool with high risks, it is essential to pay attention to any potential market distractions and ensure that sufficient thematic and market expertise is available when assessing the applications.

H.5 Sources

H.5.1 Written information

- Family in Music, https://familyinmusic.com/

- Business Finland: Open Creative -ekosysteemi. https://www.businessfinland.fi/4af8c2/globalassets/finnish-customers/news/news/2020/family-in-music---open-creative---kasvumoottori_2020.pdf
- STT Info: Espoon Keilaniemeen uusi luovien alojen keskittymä – Open Creative House juhlistaa avajaisia 16.11. avoimilla ovilla ja huippuvierailla, Accessed 11.11.2022. https://www.sttinfo.fi/tiedote/espoon-keilaniemeen-uusi-luovien-alojen-keskittyma-open-creative-house-juhlistaa-avajaisia-1611-avoimilla-ovilla-ja-huippuvierailla?publisherId=69819697&releaseId=69955977
- STT Info: Musiikki-startup Family in Music voitti Business Finlandin kasvumoottorikilpailutuksen. Accessesed 2.11.2022. https://www.sttinfo.fi/tiedote/musiikki-startup-family-in-music-voitti-business-finlandin-kasvumoottorikilpailutuksen?publisherId=62628948&releaseId=69897003
- Open Creative House. www.opencraetivehouse.com

H.5.2 Interviews

In total of 2 anonymous interviews utilized for the case study.

Appendix I Case study: 4Recycling

I.1 General information about the ecosystem

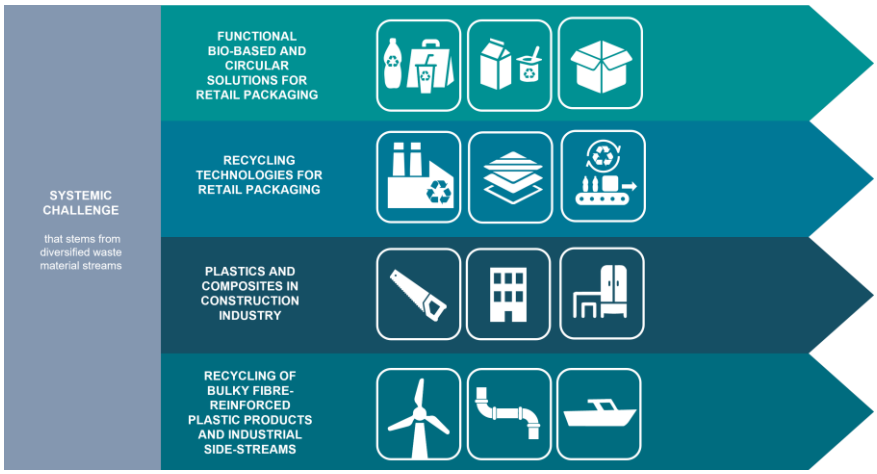
I.1.1 Official name of the ecosystem & BF support

4Recycling is an open innovation ecosystem that aims to solve the systemic challenge presented by the prevalent use of plastics by developing new solutions for enhanced recycling of plastics and bio-based substitute materials. 4Recycling is orchestrated by CLIC Innovation Oy and funded by Business Finland with the Growth Engine Orchestration Funding.

I.1.2 Scope and focus of the ecosystem

The overall mission of 4Recycling is to solve the "plastics challenge", which entails developing bio-based alternative and substitute materials for e.g. packaging, and developing technologies and processes for plastics recycling and/or circular business models. 4Recycling has 4 foci, that each have their own R&D roadmap, as illustrated in the following figure.

Figure 51 The focus areas for 4Recycling



4Recycling

I.1.3 Background and brief history of the ecosystem

CLIC Innovation is non-profit organisation for facilitating R&D projects and collaborations. The stakeholders of CLIC include enterprises from various chemical and process industries and their technology partners, who aim to develop new sustainable processes, materials and business models.

4Recycling is a innovation ecosystem aimed specifically at orchestrating development of circular economy of plastics in many consumer goods and industrial applications. 4Recycling was funded with the Growth Engine orchestration funding at the end of 2019 and started operations in the following year. The partners named in the funding phase were, besides CLIC Innovation, Andritz, BMH Technology, Borealis, Fortum Waste Solutions, Fortum, Kemira, Lassila & Tikanoja, Metsä Fibre, Metsä Board, Metsäliitto Osuuskunta, Neste, Stora Enso, UPM-

Kymmene, Valmet sekä Kemianteollisuus ry, Muoviteollisuus ry ja Metsäteollisuus ry, altogether 17 partners.[31]

I.1.4 Basic quantitative information

4Recycling has facilitated altogether 8 R&D (Horizon 2020, Bio-based Industries Joint Undertaking, and BF co-innovation) projects with additional partners related to the project. First tier partners engaged in the projects are approximately 50 altogether, but the reach of the projects is according to project information in the hundreds.

The key partners also represented in the steering group are mostly large enterprises and/or a part of an MNE. Looking into the projects, the involvement of research organizations is prolific and also start-ups/SMEs are represented.

I.1.5 Analysis of the general situation of the ecosystem

The ecosystem is relatively recently started (roughly 2 years in operation), but has a relatively wide portfolio of projects. What sets it apart from the other studied ecosystems, is that 4Recycling has ambitions for setting a mission-oriented (the plastic challenge) roadmap, and that it is networked and engages with EU programmes, which potentially enables better international reach for the partners and other projects' outcomes.

I.2 Structure of the ecosystem

I.2.1 Ecosystem leading and core actors[32] and their respective roles

The named key partners represent chemical, process, and forest industry enterprises, recycling industries, process and equipment manufacturers and consumables suppliers, and industry associations for the plastics and polymers, chemical technology and forest industry, as well as research organisations.[33]

CLIC Innovation is in charge of orchestrating and facilitation of the ecosystem. The ecosystem also has a steering board, comprising representation from the aforementioned core industrial actors. The governance model is characterized by "open innovation", and the main instruments are the R&D roadmaps and market shaping plan for the four focus areas.

I.2.2 Operational environment of the ecosystem

As discussed in the ExpandFiber case, there is an intersection between 4Recycling and EpandFiber, as well as the FinnCERES Flagship, as these ecosystems share several stakeholders, including the key actors. All three ecosystems are adjacent to the Finnish forest industry MNEs and more or less directly feed into the forest industries nascent pivot to bio-based enterprises and developing higher-value product streams in the process. As discussed in the case of ExpandFibre, FinnCERES flagship programme focuses on basic research in the field of advanced bio-based materials, while ExpandFibre is more product focused. 4Recycling

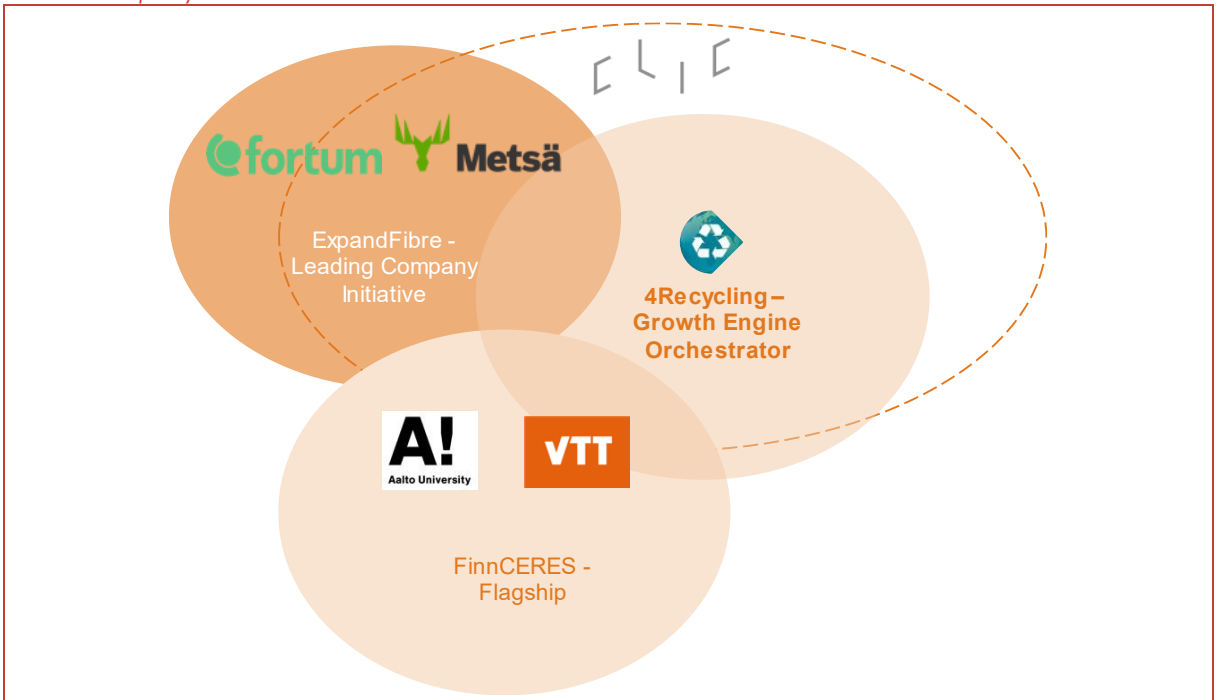
[31] https://www.businessfinland.fi/ajankohtaista/uutiset/2019/muovien-kierratyksen-ja-biopohjaisten-materiaalien-kehittamiseen-verkosto-rakenteilla

[32] Actors in sections 2.2.1/2.2.2/2.2.3 should include the appropriate private companies (SME/Large/micro), start-ups, universities and research institutes, NGOs (e.g. trade associations), banks and funding agencies, public agencies, other (please specify)

[33] CLIC Innovation 2022 4Recycling – Who are Involved? https://clicinnovation.fi/ecosystems/4recycling/ecosystem/who-are-involved/

focuses in solving the system challenge and prepares applied research projects both for developing recycling and bio-based alternatives for plastics.

Figure 52 Illustration of the parallel ecosystems (as presented in the ExpandFibre case elsewhere in the report)



Authors' conception based on materials supplied by the interviewees and publicly available from the websites of ExpandFibre, CLIC Innovation and FinnCERES.

I.2.3 *Ecosystem functions and collaboration models*

The coordination of the ecosystem is handled by CLIC Innovation. The concrete activities include interviews, vision workshops and other collaborative strategy strategy and roadmapping, building ecosystem principles, market shaping planning, and project building. The tangible outcome are the roadmaps and market shaping action plans for each of the focal areas, and launching of R&D projects based on the roadmaps. Additionally 4Recycling organizes co-creation events for its members, including for example an annual results seminar.

According to 4Recycling, the operative idea is to act as a nexus of collaboration and information exchange to develop networking and mutual interests between the wider network of actors. R&D projects are funded both from national and EU funding programmes. CLIC/4Recycling may or may not be a partner in these projects. Additionally, CLIC offer paid services and coaching for ecosystem building and management.

I.2.4 *Analysis of the structure of the ecosystem*

4Recyling describe themselves as an open innovation ecosystem, and the management or coordination of the ecosystem focuses on creating joint strategic plans for development, information sharing and co-creation between the partners and concrete project preparations to execute the strategic plans. As such the ecosystem is to an extent self-organizing outside the core actors.

I.3 Value of the ecosystem

I.3.1 Added value

The added value of 4Recycling is to offer an impartial and open platform for various enterprises, research organizations and other actors to engage in developing foresight and identifying mutual interests, that can turn into R&D projects. Additionally 4Recycling and the ecosystem partners engage in European partnerships and projects that have the potential to improve market access and international networking.

As discussed 4Recycling is partially in the same field and shares some members with, at least at the group level, as ExpandFiber and FinnCERES, and all three work with partly the same aspects and technologies to utilize biomass and particularly cellulose, lignin and their various fractions to new products. In this mix, 4Recycling brands itself as the ecosystem that focuses in the mission of 'solving the systemic plastics challenge', through hosting an open platform for R&D co-operation, identifying technology gaps and opportunities, and developing projects in needed applied research both for development of recycling and bio-based alternatives for plastics.

I.3.2 Strategic importance

The ecosystem is well aligned with public policy agenda and also the amount of parallel ecosystem activity signals that 4Recycling is well positioned. The data does not enable strong conclusions how committed particular enterprises are or how strategically important the ectivities are.

I.3.3 Long term development of the ecosystem

The functioning and development of 4recycling is almost entirely up to continued public funding (directly and/or indirectly), as the the operation model is based on open collaboration and project building. As such the ecosystem has its place in the larger ecosystem by addressing bottom-up R&D needs.

I.3.4 Sustainable development within the ecosystem

4Recycling is explicitly focused on sustainability, in the sense that the main aims are to develop recycling of plastics and bio-based substitute materials for packaging and relevant industrial applications.

I.3.5 Analysis of the value of the ecosystem

4Recycling creates value by identifying knowledge gaps, barriers to market, and opportunities for value creation to complement the existing activities in plastics recycling and bio-based materials development. 4Recycling offers an open RDI collaboration platform and identifies market development needs. 4Recycling/CLIC also facilitates project inception, prepares collaborative projects and seeks funding for the consortia.

I.4 Role of Business Finland and public support

I.4.1 Role and added value of Business Finland and its instruments

BF instruments have been instrumental in formation of CLIC Innovation and 4Recyling. BF orchestration funding enables 4Recycling to function as an independent open platform.

I.4.2 Potential for improving BF support for ecosystems

According to the stakeholders, Business Finland best supports ecosystems by providing long-term funding and sustained support and collaboration. In a wider view, what was highlighted

in the interviews, BF could serve the ecosystems better by publishing more tangible information on the funded projects and their deliverables/outcomes, and supporting interaction and sharing of best practices and information between beneficiaries and ecosystem.

I.4.3 Analysis of the role of Business Finland and public support

Business Finland funding for ecosystem orchestration is instrumental for setting up open platforms for ecosystem orchestration. Based on the interviews also outside 4Recycling, developing a self-sustaining business model for ecosystem platforms based on e.g. membership fees is difficult without it being tied to (other) value-added services, such as consultancy.

I.5 Sources

I.5.1 Written information

- 4Recycling Website, Ecosystem, and Projects sub-sites. Available: https://clicinnovation.fi/ecosystems/4recycling/
- Business Finland, 2019. https://www.businessfinland.fi/ajankohtaista/uutiset/2019/muovien-kierratyksen-ja-biopohjaisten-materiaalien-kehittamiseen-verkosto-rakenteilla
- Written materials and presentations suuplied by the interviewees and presented at 4Recycling Annual seminar 2022

I.5.2 Interviews

In total of 3 anonymous interviews utilised for the case study.

Appendix J Case study: Team Renewable Arctic Finland

J.1 General information about the ecosystem

J.1.1 Official name of the ecosystem & BF support

This case study concerns the *Team Renewable Arctic Finland* ecosystem. The ecosystem has been supported through the Growth Engine Orchestration Funding instrument in 2021-2022. It was created based on previous ecosystem activities, specifically *Team Arctic Finland* and the *Baltic Offshore Wind* ecosystems. The latter was also funded through the Growth Engine Orchestration Funding instrument, in 2018-2020.

J.1.2 Scope and focus of the ecosystem

The mission of the Team Renewable Arctic Finland ecosystem revolves strongly around the shift towards carbon neutrality and low carbon solutions. The ecosystem aims to bring together key stakeholders (investors, businesses, technology and service providers and governmental institutions) in order to create "*competitive offshore domain expertise with a scalable and global export potential*".

The ecosystem has three main focus areas:

1. Renewable energy expertise
2. Low emission marine solutions
3. Sustainable infrastructure solutions

While the overall focus areas are broad, offshore wind power is overall quite centrally placed. This is also where much of the future potential of the ecosystem is linked to. Example of this is the designated area for offshore wind power as outlined in the Maritime Spatial Plan[34] and the recently (8 July 2022) granted permits for offshore wind power production[35].

J.1.3 Background and brief history of the ecosystem

While the Team Renewable Arctic Finland ecosystem officially only started in 2020, its origins go back much further. The Team Renewable Arctic Finland ecosystem is in essence a merger of Team Arctic Finland and the Baltic Offshore Wind ecosystems, see Figure 53.

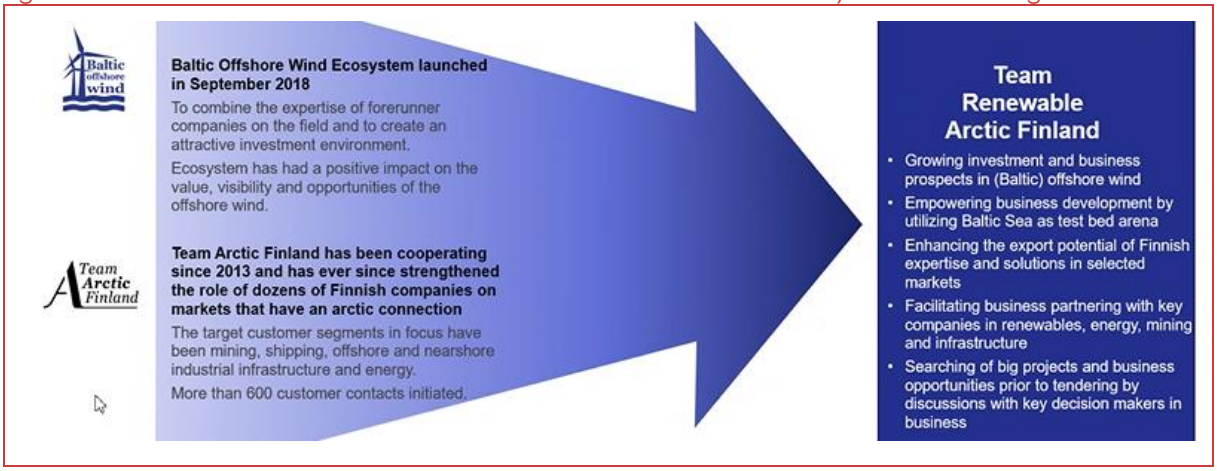
Team Arctic Finland is an initiative that dates back to 2013 and was aimed at a wider range of arctic and marine related markets, including mining, shipping and nearshore infrastructure as well as offshore activities and energy. Overall, the focus was on business development, through attracting investors, uniting resources, opening up markets and engage in cooperation at national level.

The Baltic Offshore Wind ecosystem started in 2018. This ecosystem was funded through the orchestration funding instrument of Business Finland. The focus on this ecosystem was quite strongly on offshore wind energy production. The ecosystem was primarily aimed at the opportunities in the Baltic Sea, but also emphasised the scalability of business towards global export.

[34] https://www.merialuesuunnittelu.fi/en/

[35] https://valtioneuvosto.fi/en/-//1410837/finland-to-significantly-ramp-up-offshore-wind-power-production#:~:text=The%20Korsn%C3%A4s%20offshore%20wind%20farm%20project%20is%20a%20key%20renewable,area%20in%20Finland%27s%20territorial%20waters.

Figure 53 Overview of the creation fo Team Renewable Arctic Finland by Gaia Consulting



Gaia Consulting

J.1.4 Basic quantitative information

Over the years, and part of the two predecessors, the members have changed. In the current setup of the ecosystem there are 21 members next to the orchestrator, Gaia consulting. Many of them are companies, one being a research organisation.

Based on Gaia estimates, the ecosystem R&D activities amount to 80.000 Eur. In addition, the ecosystem received 500.000 Euro for implementation of the IceWind research project.

As stated, a large part of the ecosystem is tied to the potential of the opportunities for offshore wind energy production. Gaia consulting reports from the Maritime Spatial Plan that there will be a potential for 15,7 GW for offshore wind energy production. For reference, the total electricity production capacity in Finland is around 18 GW, showing the size of the business potential.[36]

In terms of R&D, few figures are available. Only that the aim of the ecosystem is to create up to €25 million worth in R&D through collaborative projects.

J.1.5 Analysis of the general situation of the ecosystem

Taking into account the predecessors, the ecosystem has quite a long history in comparison with many of the other ecosystems that Business Finland supports. At the same time, it is clear that the setup and objectives of these predecessors are not the same as in the Team Renewable Arctic Finland. This is also experienced by members of the current ecosystem, as they recognize that the ecosystem is somewhat split between the topic of offshore wind energy production and other maritime focus areas. They also recognize the strong link to future potential of offshore wind energy production, while currently there is limited ongoing business to build upon.

J.2 Structure of the ecosystem

J.2.1 Ecosystem leading and core actors and their respective roles

As the orchestrator of the ecosystem, Gaia Consulting has a central and leading role. Gaia Consulting initiates activities, brings actors together and provides supportive services to the ecosystem members. GAIA knows the fields of expertise of the ecosystem members as many

[36] https://www.irena.org/IRENADocuments/Statistical_Profiles/Europe/Finland_Europe_RE_SP.pdf

of the members have been participating in the predecessor ecosystems. They approach and consult the members they need in order to organize activities, while avoiding any potential for conflict of interest.

The main members consist of about 20 companies and VTT as research organisation. During the course of the runtime there was one merger within the ecosystem and one member was dropped from the ecosystem due to business restructuring within the company. Overall, the size of the ecosystem is manageable from the central orchestrator, but there they also make use of working groups in order to facilitate collaboration on specific themes. In principle, all members take part in these working groups. Nevertheless, interviewees indicate that about half of the members can be labelled as (very) active.

Within the ecosystem we see members whose expertise is linked to the three main focus areas of the ecosystem, we see members with expertise in energy and marine infrastructure, with expertise in energy production (mainly wind energy) and with expertise in (arctic) marine activities, including ships. Roughly speaking, the ecosystem is a 50/50 combination of members from the two predecessors.

Figure 54 Overview of ecosystem members

Technopolis, based on materials from GAIA and Business Finland

J.2.2 *Operational environment of the ecosystem*

The operational environment of the Team Renewable Arctic Finland ecosystem is characterized by its history and by the central role of the orchestrator GAIA. Its origins in the two predecessor ecosystems is currently still visible in the operations of the ecosystem. While there are shared meetings, the combination of offshore wind energy and marine business is not operationally put into practise. Ecosystem members join the meetings with the perspectives, expectations and objectives in mind from the predecessors. As such, it has been challenging

to establish a common and shared strategy for the ecosystem. GAIA, whose competences lie more in the area of consulting, marketing and networking, might also not be best positioned to guide the ecosystem towards such a shared strategy, as ecosystem members express that a business leader might be needed to take a next step.

In recent years the ecosystem welcomed newcomer Nokia to the ecosystem. Nokia has an interesting profile as it is not a typical marine or wind energy actor. In recent years, they have however started investing in smart grids, private networks solutions (mobile and fixed) and their application in large industries in Finland[37], which may be the main link towards the infrastructure side of the ecosystem.

VTT is the main research organisation member in the ecosystem. As they perform research in the wide spectrum of the ecosystem, they play a relatively central role in connecting the different worlds of marine business and the upcoming field of offshore wind energy.

Next to these members the ecosystem has connections with energy associates and other relevant actors in the wider context of the ecosystem. The Finnish Wind Energy association is a clear example of such an actor, there has been intensive collaboration, exchange of information and exploration of synergies to make sure activities strengthen each other. Next to that there are various links towards governmental and state-owned organisations, regarding policy, nature, grids, chambers of commerce abroad, etc. Given the importance of policy and regulation in the field of offshore wind energy and marine activities, members emphasise that the links and dialogue with policy makers could/should be increased further.

J.2.3 Ecosystem functions and collaboration models

Overall, the ecosystem does not have many shared resources. On the strategic side, the scoping of the activities of the ecosystem in terms of the main focus areas which is outlined in a Memorandum of Understanding for the ecosystem members. However, there is no shared common strategy, agenda or roadmap for the ecosystem that outlines the future steps of the ecosystem. As a result, there is also no documented shared common guideline for (upcoming) R&D activities or joint commercialization, except an IPR template for joint R&D projects. Most activities originate from the orchestrator and/or are developed in collaboration between the orchestrator and single (or a small number of) ecosystem members.

One of the core shared resources in the ecosystem is the development of a virtual offshore wind project. This project act as a platform for ecosystem members to perform demo activities together with VTT, to outline the potential for electricity prices and to test the water of collaboration between the partners. As the offshore wind market is not yet mature (not a lot of active business) the virtual offshore wind project provides a much-needed avenue to take specific collaborative steps.

In terms of collaboration models many of the interviewees for this case study refer to the ecosystem as a project. In the ecosystem, they have shared meetings and they explore potential collaborations, partly in the context of the virtual offshore wind project. Meanwhile Gaia, as orchestrator, provides services to the members, for instance by building new (international) connections, branding the ecosystem internationally, analysing the business potential and opportunities, supporting R&D and pushing from networking within the ecosystem.

[37] https://www.nokia.com/about-us/news/releases/2019/12/03/nokia-to-transform-finlands-nationwide-smart-grid-for-better-support-of-renewable-energy/

J.2.4 *Analysis of the structure of the ecosystem*

Overall, the position of the orchestrator Gaia is very central and focused on the need of the (individual) members. They might not be best positioned to drive the development of a shared business strategy that builds a bridge across the wide range of expertise within the ecosystem. A core challenge for the ecosystem is that the marine business is more mature that the upcoming business offshore wind energy. Next to that, the different focus in the predecessor ecosystems makes that members join the table with different ideas, expectations and objectives.

J.3 Value of the ecosystem

J.3.1 *Added value*

The core added value of the ecosystem is the network building within and outside the ecosystem. The interviewees indicate that while many actors knew each other in advance, the ecosystem meetings deepen the relationships and the understanding of each others' strengths and needs. Even when the two thematic groups, marine and offshore wind energy, remain a bit at distance, it is still stressed that these relations are also deepened and valuable. Outside the ecosystems the added value is the ability to make connections with actors in other countries, creating links to embassies in other countries and the overall representation of the ecosystem as a whole in the international context. Taking the step towards a new market, new partners, etc. is made easier by taking on the challenge together. Many of these aspects are driven by the central orchestrator, Gaia.

The networking is largely supported by the availability of market information and information on doing business in these markets as well as the global business environment. On a practical level, setting up customer contact information and the facilitation of customer contact are a key element in the added value of the ecosystem. This shows a clear export focus within the ecosystem, although this part is more heavily concentrated on the marine side of the ecosystem, as maturity is high enough to allow for these activities. On the offshore wind energy side of the ecosystem the focus is more on exploring the potential and taking (theoretical) steps towards collaboration. The market is simply not mature enough to go further at this stage. Emphasis is on building reputation, develop ideas and increasing the network of collaboration partners for future activities.

Due to different nature of the activities, the uncertainties about the future and a lack of strategy to create synergies between the marine side and the offshore wind energy side of the ecosystem, not all interviewees were convinced about the added value of a combined ecosystem.

In recent years the ecosystem has shifted its focus more towards R&D, where this was hardly the case in the past. Gaia, as orchestrator, does not have a strong R&D profile, and therefore cannot drive the ecosystem with regards to the content side of R&D and innovation (setting a direction, kick-starting ideas, etc.). While R&D is a core focus of the financial instruments of Business Finland, members indicate that this is not very well known within the ecosystem. While in the past the activities were mainly aimed at service provision for maritime companies, now more projects are starting up in which upstream R&D is in scope.

Regarding R&D, the maturity of the offshore wind energy sector is also a limiting factor for realising (R&D) projects in practice. Linked to this, companies are also not always willing to share knowledge. The potential of the market can create high stakes and competition around potential opportunities in which innovation can play a large role. The virtual offshore wind project has been a good step to test collaboration and to gain insights into the added value of working together.

J.3.2 *Strategic importance*

The strategic importance overall is not questioned. The offshore wind energy and marine markets provide sufficient potential for public investments. Given that commitment towards offshore wind energy is starting to show, it makes sense to keep supporting this new sector/industry. It is however clear that this market will require time to mature. Similarly, it remains unclear what the relevance of combining marine and wind energy activities together really is.

Overall, the ecosystem seems to miss a core uniting business idea and strategy to rally around. Interviewees indicate that the ecosystem should be solution for such a shared objective/challenge. The need for R&D should be linked to what is needed to realize the collective goals, which is linked strongly to (future) customer needs which remain uncertain in an immature market.

J.3.3 *Long term development of the ecosystem*

In its current form, the ecosystem is built around the exploration of collaboration, mainly export and representation-oriented services of Gaia. These services are appreciated, companies contribute financially towards these services, and overall, they seem to have an effect with regards to establishing international networks and support the conditions for export. Many of these services could however also be provided without public support, although likely in smaller scale. The long term added value of the ecosystem, creating those sustainable business relationship by strengthening each other beyond a service relationship, seems to depend on a missing uniting business idea and strategy. At the same time, addressing the challenges of offshore wind energy (especially in a harsh climate of the Nordic waters) shows a lot of potential for ecosystem development. Similarly, the various developments in marine related markets (such as mining, shipping, nearshore industrial infrastructure, and energy) all have to face key challenges in the transitions towards renewable energy and digitalisation.

J.3.4 *Sustainable development within the ecosystem*

While business and R&D results might not (yet) be high at this stage, the focus of the ecosystem is quite strongly linked to Sustainable development (ESG). The topic of offshore wind energy is at the heart of this, as it is aimed at renewable energy production. The marine activities have a broader profile, but also include the topic of energy and sustainability.

J.3.5 *Analysis of the value of the ecosystem*

The current value is largely linked to building (international) relations and exploring the potential for future activities. The upcoming business of offshore wind energy is not yet mature and is dependent on many external factors (such as policy and regulation). This field will require long-term developments which can benefit from ecosystem activities – addressing shared challenges. Meanwhile, the potential of the offshore wind energy market is a clear driver for meeting long-term growth goals set out by the ecosystem funding instruments provided by Business Finland. The marine market is more strongly based around current business of ecosystem members. The challenges in this sector can also benefit from a collective approach with regards to transitions towards renewable energy and digitalisation. The reasoning to combine both remains somewhat unclear, also to ecosystem members, even if value connections are still made. A core uniting business idea and strategy seems to be a missing element within the ecosystem.

J.4 Role of Business Finland and public support

J.4.1 Role and added value of Business Finland and its instruments

The funding provided for the orchestration activities is highly appreciated in order to kick off the activities of the ecosystem. It was however not easy to acquire the funding (took a long time), and the funding lacks the dynamics to respond towards the developments of the ecosystem. The instrument does not respond well to (potential) growth of the ecosystem, complicating practical aspects such as cost reporting. At the same time, to take the next step, the instrument does not provide the push that interviewees think could be needed to reap the benefits.

The monitoring and strategic support of the ecosystem were not well executed by Business Finland for this ecosystem. Business Finland was often not present to support the ecosystem and during meetings many different people showed up that often did not have the full background of earlier developments. Partly this was a capacity issue, impacted by the COVID pandemic. At the same time, there is limited content knowledge and expertise available of this specific topic, making it challenging to provide founded strategic support. Insights into the activities and results of the ecosystem are limited due to a lack of monitoring and dialogue. Strategic support, providing guidance, could make a large difference within this particular ecosystem, aspects mentioned were identifying a leading (R&D) company, supporting the development of a shared strategy and identifying and addressing key bottlenecks and opportunities that require dialogue with relevant (international) policy makers (at a higher level than just the ecosystem). Note that offshore wind and marine activities are often linked to international politics and agreements.

J.4.2 Potential for improving BF support for ecosystems

A key point of improvement is to have more presence of Business Finland in the ecosystem, to really be a voice at the table. At first in a supportive monitoring role and, when opportune, in a strategic supporting role. Investments in new sectors/industries are seen as a very positive thing. Often such investments require a strategic approach in which the government is at the table to identify and address key bottlenecks and opportunities that come up, when pushing for new business, new innovations, etc. Overall, the business challenge of an upcoming market such as offshore wind energy benefits from orchestration but could use more support to take the steps necessary. Availability of capital plays a large role; market developments take a long time and capital can play a role in bridging gaps. Coupling such available capital with the above-mentioned strategic support can create a situation in which the private and public sector collectively works towards set goals. The objectives that are important to Business Finland should also be outlined clearly, widely known within the ecosystem and should be in line with the maturity of the business area.

J.4.3 Analysis of the role of Business Finland and public support

Overall, it is clear that there is room for improving the presence of Business Finland in the ecosystems. Business areas that are in the long term process of development can benefit greatly from the financial support, but also from a more strategic counterpart from the government to collectively set objectives that can be reached in collaboration between the public and private sector.

J.5 Sources

J.5.1 Written information

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- https://www.irena.org/IRENADocuments/Statistical_Profiles/Europe/Finland_Europe_RE_SP.pdf
- https://www.nokia.com/about-us/news/releases/2019/12/03/nokia-to-transform-finlands-nationwide-smart-grid-for-better-support-of-renewable-energy/

J.5.2 Interviews

In total of 6 anonymous interviews utilized for the case study.

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