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The financing of fieldlabs in the Netherlands

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Executive summary

The relevance of collaboration between public and private actors in the innovation chain has been acknowledged by all relevant actors in the Dutch innovation system. By bringing together companies, research organisations and governmental agencies, Public Private Partnerships (PPPs) provide a breeding ground for innovation. Especially when it comes to translating scientific insights into marketable products, PPPs have a crucial role to play. In recent years the emphasis on supporting Public-Private Partnerships (PPPs) in policy-making subsequently increased even further.

The primary objective of the analysis that constitutes the results of this report is to provide Dutch policy makers with information that helps them to further improve the current system of financing of fieldlabs. The result of this report however exceeds this scope. Our analysis provides relevant insight for all stakeholders involved in the financing of Public Private Partnerships (PPPs) in R&D, notably those that provide research infrastructure in the later stages of the innovation process. Our report analyses the role of fieldlabs in the innovation process, and the subsequent rationale for investment by the partners in the PPP, costs faced by fieldlabs when providing dedicated services for its stakeholders, and issues concerning the financing of a fieldlab.

Our report builds on a review of existing research and reports. A subsequent in-depth assessment of financing issues of different fieldlabs in the Netherlands was conducted, including interviews with relevant stakeholders involved. In addition, a number of interviews with policy-makers (mainly from the Dutch Ministry of Economic Affairs) were conducted.

The rational for public and private involvement in fieldlabs

The main reason why firms invest in fieldlabs is that they help them to innovate. Most importantly, from a company's perspective, fieldlabs 1) reduce the costs of innovation 2) provide access to know-how, networks and training and therewith increase the probability of success of an innovation project, 3) provide further insight on the potential impact of the innovation process on the company result. Especially in crossing the technological and commercialization valley of death fieldlabs play an important role, as during these stages costs are usually substantial and uncertainty is high.

Public actors primarily invest in fieldlabs because they aim generate economic and social benefits for society at large. Fieldlabs are seen as a way to effectively and efficiently remedy market failures, such as positive externalities and knowledge spill-overs, imperfect and asymmetric information, and coordination and network failures.

Funding needs of fieldlab

Funding needs differ between fieldlabs and change over time. In our analysis we distinguish between four different types of costs that constitute the funding needs: i)

start-up costs; ii) infrastructure costs; iii) project costs; and iv) all other / operational costs.

Start-up costs can amount to up to 1 million euro, and usually emerge in two consecutive phases. A first smaller funding round is needed to bring actors together and decide whether the idea of setting up a fieldlab will be pursued. The second wave of funding is required for the actual set-up of the fieldlab (e.g. writing proposals). The start-up phase is usually funded by public actors, mostly knowledge organisations who contribute in-kind.

Funding required to address infrastructure costs can go up to 100 million euro at the start of a fieldlab. Additional funding will be needed to keep updating the infrastructure or for a major overhaul after 5 to 10 year. Private actors are generally reluctant to directly fund infrastructure, especially in the initial phase of the fieldlab. They cover part of the required funding by contributions for specific projects (e.g. for research, initial series production, etc.). Public actors, mostly the national or regional government, subsequently play a major role in funding infrastructure.

Project costs usually accounts for roughly 80% of a fieldlab's budget, and can amount to 40 million euro annually. The total project costs increase during the first years of the fieldlab until a sort of 'steady state' is reached after 5 to 7 years. The ration between private and public funding for projects differs significantly between fieldlabs. Though experience shows that obtaining more than 50% private funding for projects is almost never possible. A wide variety of sources is used to finance projects, including cash and in-kind contributions by private parties, organisational funding of knowledge organisations (e.g. SMO), regional, national and European grants (e.g. Interreg, EFRD, TKI allowance, ad hoc grants by the Dutch government, Horizon2020 etc.), and contributions of universities (e.g. secondment of PhD students to do research in fieldlabs).

Operational costs usually amount to 10% to 20% of a fieldlabs total annual budget. Operation costs are high in the beginning, as fieldlabs have to build up a project portfolio. Later on, operational costs become a function of project costs, meaning that the amount of operational costs will increase and decrease with the number of projects a fieldlab is carrying out. The ratio between public and private funding for operational costs differs between fieldlabs and is difficult to estimate. The general impression from the interviews is that companies are reluctant to fund operational costs.

Public and private funding sources available for the financing of fieldlabs

Our analysis indicates that fieldlabs conduct specific activities that result in revenues that address the costs for setting-up and running a fieldlab. Most of these revenues originate from R&D&I related activities, conducted within the framework of dedicated projects. But fieldlabs are also involved in for example micro-production and renting out (research) infrastructure.

These activities are financed to a large extend by dedicated private contributions. Additional support by the government, in the form of institutionalised subsidies, grants and basic funding (of participating universities and RTOs) is crucial in this respect. But our analysis suggests however that fieldlabs are nevertheless often faced with a gap in their multi-annual (operating) budget. We distinguish between two different forms of budget deficit:

- A structural gap arises when the overall budget suggests a shortage in income over costs of the fieldlab over the combined years of the multi-annual budget. It implies that the fieldlab is not able to reach break-even. Note that this is in practice not surprising given the underlying forms of market failure (notably coordination failures) that prevent the emergence of fieldlabs without additional structural intervention by a government.

- An immediate gap arises when investments required to initiate (or continue) the fieldlab cannot be pre-financed, because revenues are not yet generated (or cannot be sustained under current conditions) . This is an issue especially with respect to the financing of equipment and human research capacity for projects.

Policy makers are increasingly emphasising the potential role of non-conventional modalities of financing, and the involvement of corresponding (external) actors, to address the financing gap. Suggestions include different forms of debt financing (commercial or otherwise) or equity financing.

Research indicates that debt and equity financing is suitable only to address the immediate financing gap. This implies that government intervention is required to address the structural gap between costs and income of a fieldlab. Our analysis suggests that in practice especially regional governments play an essential role in providing additional funding to this purpose. These actors are in general less driven by policy objectives aiming at supporting knowledge creation because of various underlying forms of market failure, as research results in general spills over to a supra-regional level. By providing financial support, regional policymakers hope to anchor the fieldlab in the region in order to ensure that other positive externalities of the fieldlab can be reaped in the region.

Research furthermore suggests that the actual use of private loans and for example venture capital is limited to none, because of specific considerations concerning the investment decision of the corresponding actors. For commercial banks, basis for the evaluation of a request for the provision of a loan to a fieldlab would be the assessment of the cash-flow generated. Because of the characteristics of a fieldlab, the investment decision would not be a positive one. For a venture capitalist, a fieldlab is not an interesting prospect, as it does not have the potential for rapid growth, and an exit strategy seems very complicated. This implies that also public support in some form also plays an essential role in addressing the immediate financing gap.

Key bottlenecks in public financing of fieldlabs in the Netherlands

The key bottleneck experienced by fieldlabs are: i) a shortage of funding; ii) the fragmentation of funding instruments; and iii) problems relating to funding modalities. Figure 1 provides an overview of the bottlenecks and their underlying causes at instrument level that were most frequently mentioned during the interviews within the framework of this analysis.

Conclusion

Our analysis indicates that the relevance of fieldlabs in the Dutch innovation system is acknowledged by policy makers. However, the financing of fieldlabs is currently not optimal. The reduction of direct funding since 2010 (e.g. phasing out of FES subsidies, reduction of TO2 budgets) has led to a situation where many fieldlabs, especially new ones, struggle to match private commitment. Moreover, the reduction in funding has also led to a situation in which many fieldlabs have to obtain funding from various sources. This increases transaction costs for fieldlabs and makes it more difficult to finance long-term initiatives with a programmatic approach. The Dutch government has numerous possibilities at its disposal to further improve the current system. Further research should amongst others focus on how to increase public funding in the most critical areas (e.g. start-up phase, matching private commitments, fieldlabs driven by knowledge organisations or the government, fieldlabs with many SMEs), and how to reduce the fragmentation of funding instruments.

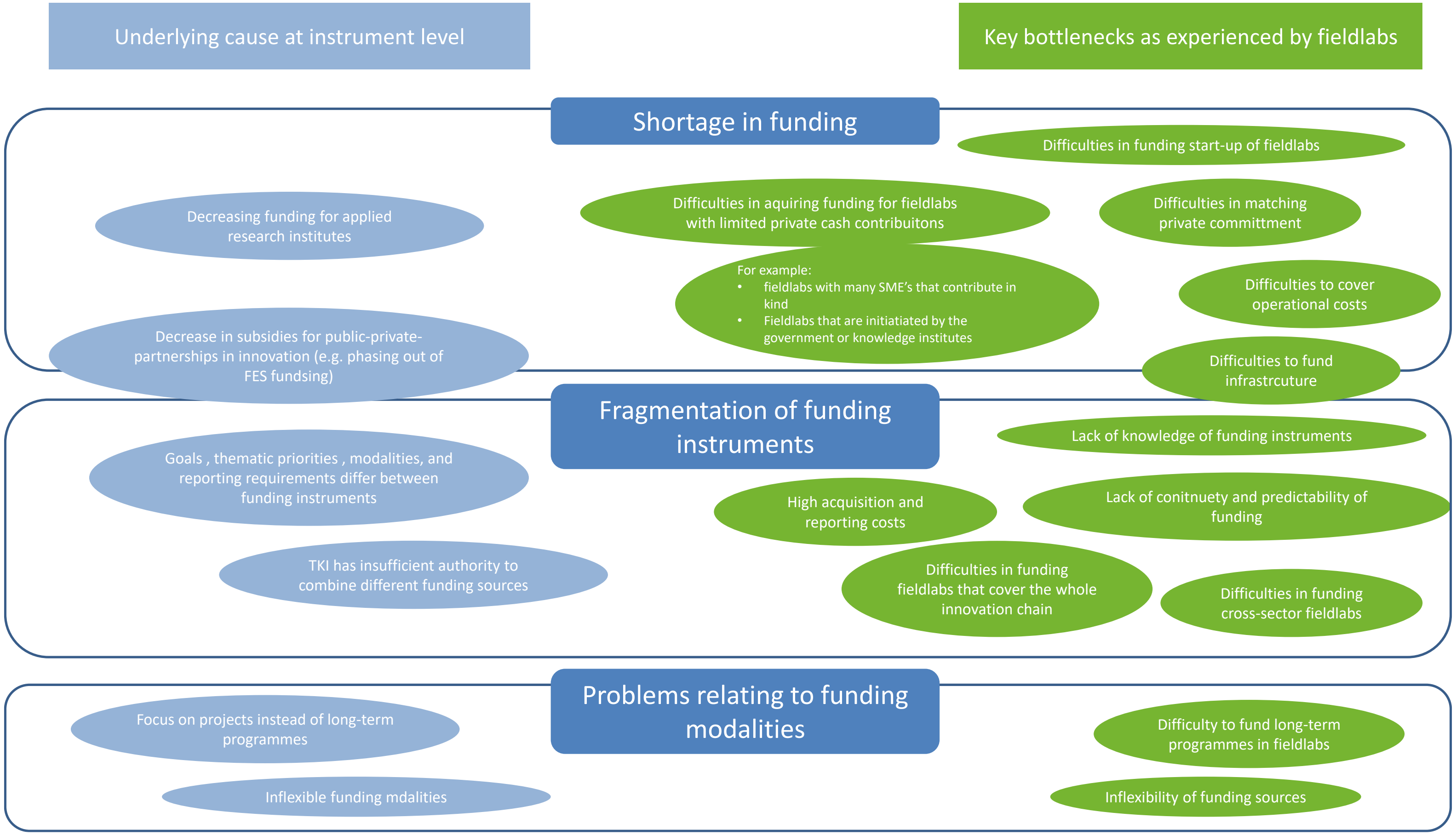

Figure 1: Key bottlenecks with respect to public support for fieldlabs, and their underlying cause at instrument level

Contents

1 Introduction

The importance of cooperation between public and private actors for innovation has long been recognised. In recent years the focus on Public-Private Partnerships (PPPs) in policy-making has increased even further. By bringing together companies, research organisations and governmental agencies, PPPs provide a breeding ground for innovation. Especially when it comes to translating scientific insights into marketable products PPPs have a crucial role to play. For example in the manufacturing sector they help companies to overcome the 'valley of death' by providing equipment and know-how for pilot production. Consequently, PPPs are generally recognised by policy-makers as being an important part of the solution to the 'European paradox' .

Currently we see numerous policy initiatives emerging to stimulate the development of PPPs, especially in the area of digitalisation and advanced manufacturing. These PPPs can be defined as so-called fieldlabs (see **Box 1**). Examples include the European 'Digital Innovation Hubs',[1] the US 'Manufacturing Innovation Institutes',[2] the German 'Mittelstand 4.0-Kompetenzzentren' (SME competence centres for advanced manufacturing),[3] and the Dutch 'Smart industry fieldlabs'.[4]

While the relevance of fieldlabs in stimulating manufacturing innovation is recognized by the Dutch government and the business community, the set-up of the fieldlabs has been sluggish. Especially the financing of the Smart Industry (SI) fieldlabs appears to be a major problem. Next to the SI fieldlabs, also existing PPPs in the Netherlands, such as the Holst Centre, experience serious difficulties in acquiring financing.

More knowledge is needed concerning possibilities for the financing of fieldlabs and related bottlenecks. Several concerns with respect to the financing of PPPs in the Netherlands have been voiced by stakeholders; but also the OECD recommends to "rebalance the policy mix by complementing the current focus on R&D tax credits with competitive, well-designed direct support instruments, e.g. for joint R&D projects with knowledge institutes […]." In order to have an idea of possible options to optimise the support to fieldlabs, policy-makers need a better view of the opportunities and bottlenecks in the current system.

The objective of this report is to provide (Dutch) policy makers with information that helps them to further improve the current system of financing fieldlabs. To this end it aims to assess possibilities for the funding of fieldlabs in the Netherlands and related bottlenecks, by addressing the following research questions:

1. What is the rational for public and private actors to invest in fieldlabs?
2. What are the funding needs of fieldlab?
3. Which public and private funding sources are suitable to finance fieldlabs?
4. What are the key bottlenecks fieldlabs experience in the Netherlands when trying to obtain funding?

[1] See http://europa.eu/rapid/press-release_SPEECH-15-4772_en.htm.
[2] See https://www.manufacturing.gov/nnmi-institutes/.
[3] See http://www.bmwi.de/DE/Presse/pressemitteilungen,did=726912.html
[4] See http://www.smartindustry.nl/fieldlabs/.

Box 1: Characteristics of a fieldlab

Fieldlabs are defined as “practical environments in which companies and knowledge institutions develop, test and implement Smart Industry solutions” in the Dutch Smart Industry action plan.[5] A key component of fieldlabs is that their offer equipment which can be used by multiple parties. The overall goal of fieldlabs is to create economic and social benefits by spurring innovation. More specific goals, which might vary between fieldlabs, are to:

- Facilitate knowledge exchange
- Provide companies with easy access to state-of-the-art equipment and expertise
- Develop and strengthen ecosystems
- Address skills needs
- Provide a platform for networking
- Facilitate business development (e.g. supporting start-ups)
- Raise awareness
- Communicate needs and provide input to policy-making

While in this report the term ‘fieldlab’ will be used, it should be noted that not only the ten Smart Industry fieldlabs are covered. Also other large-scale PPPs that are not related to the Smart Industry initiative were included in the analysis. We decided use the term ‘fieldlab’, because it is commonly used in the Dutch context. However, we are well aware of the fact that there are many other terms that refer to the initiatives we analysed; the most common ones being: ‘Public-Private Partnerships (PPPs)’, ‘shared facilities’, ‘technological infrastructures’, or ‘innovation hubs’.

The report is primarily based on an in-depth analysis of 15 fieldlabs.[6] For each fieldlab a template was completed based on publicly available information. Thereafter, interviews were carried out with stakeholders involved in the fieldlabs, such as directors or programme managers, to obtain an overview of the fieldlabs’ funding regimes and problems related to funding. In addition, a number of interviews with policy-makers (mainly from the ministry of Economic Affairs) were conducted in order to gain a better understanding of the currently available instruments.[7] Results from other projects, such as the multi KETS pilot lines project and EU-GREAT! are also used as input.[8] Furthermore, the analytical work for this

[5] See http://www.smartindustry.nl/wp-content/uploads/2014/11/Smart-Industry-actieagenda-LR.pdf.
[6] The fieldlabs under review were: Biobased Performance Materials (BPM); Biorizon; DOC; Dutch Integrated Testsite Cooperative Mobility (DITCM); Embedded Systems Innovation (ESI); Fieldlab Digitale Fabriek; Fieldlab Flexible Manufacturing Zuid; GSV Voeding en Biobased Economy; Holland Innovation Potato; Holst Centre; Impact 2; NanoNextNL; OncoXL; Qutech; Solliance.
[7] A list of all stakeholders that were interviewed and provided input within the framework of the analysis underlying is report is available in Appendix A.
[8] For the multi KETS pilot lines project see: www.mkpl.eu. Within the framework of this project, a number of interviews has been conducted and expert workshops organized, complemented by an online survey among experts from research, industry and government throughout the world (21 countries). The concept of shared facilities was often core to the discussions. Four case studies of actual industrial pilot production activities (Demonstrators - Acreo Swedish ICT AB –PEA (Norrköping, Sweden), Bio Base Europe Pilot Plant (Ghent, Belgium), Infineon IFAT (Villach, Austria), Sofradir (Veurey-Voroize, France)) allowed an in-depth insight in the problems and characteristics during pilot production. The Acreo facility and Bio Base Europe Pilot Plant are shared facilities.

report greatly benefited from the interaction with the 'PPS5050 working group', which ran in parallel to the work on this report.[9]

Concerning the scope of this report three points should be highlighted. Firstly, this report focuses on innovation in the manufacturing sector. Hence, the findings might not be applicable to processes in social innovation or service innovation. Secondly, only fieldlabs that have as a primary goal to help companies to innovate are examined. Fieldlabs that have other primary goals, such as education, are not included in the analysis. Thirdly, it should be noted that not only the ten Smart Industry fieldlabs are covered by the analysis, but also other large-scale PPPs, such as the Holst Centre or the Dutch Optics Centre. The term 'fieldlabs' as used in this report thus refers to a large number of large-scale Public-Private Partnerships (PPPs)in the Netherlands.

Chapter 2 of the report describes the characteristics of a fieldlab, and the services it offers. Chapter 3 assesses the rationale of the actors of the PPP to get involved in a fieldlab. Chapter 4 describes the costs of a fieldlab associated to delivering its services, while Chapter 5 analyses how the subsequent funding need is covered by revenues resulting from specific activities conducted. Chapter 5 assesses the gap between costs and revenues. Chapter 7 analyses the role of additional investments in order to close the budget of a fieldlab. Chapter 8 presents the conclusions main bottlenecks fieldlabs in the Netherlands experience when trying to obtain financing. Chapter 8 concludes with suggestions for further research.

For the EU-GREAT! project, see www.eu-great.com. Within the framework of this project, external financiers amongst others have been interviewed, providing debt and equity financing for PPPs with costly research infrastructure operating at high TRL-levels.

[9] The working group consists of experts from the ministry of Economic Affairs, the industry association FME, and the knowledge institute TNO. The aim of the working group is to identify options to improve the financing of PPPs in the Netherlands.

2 Characteristics of a fieldlab

Fieldlabs are defined in the Dutch Smart Industry action plan as "practical environments in which companies and knowledge institutions develop, test and implement Smart Industry solutions".[10] The overall goal of fieldlabs is to create economic and social benefits by spurring innovation and helping companies to overcome the valley of death.

A distinctive feature of fieldlabs, that differentiates them from many other PPPs for research and innovation, is that they offer infrastructure which can be used by multiple parties. Their role and functioning in the innovations system, as well as specific aspects concerning their design is defined by various factors such as: i) Stage in life-cycle (e.g. start-up, mature); ii) type of research addressed; iii) level of involvement of SMEs; iv) sector focus (e.g. one sector, several sectors); v) focus on specific stage in innovation process (e.g. research, prototyping, pilot production).[11]

Fieldlabs offer generic "services", that support firms in the crucial stages in their R&D&I process (i.e. they help cross firms what is called "the valley of death"). These services build on the specific infrastructure that constitutes (defines) a fieldlab, and which is in general characterised by the fact that it is unique, state of the art, and costly. The availability of open / shared R&D&I research capacity has an impact on the innovation behaviour of firms. In Chapter 3 we describe how the infrastructure-based services of this section affect the investment decision strategy of firms concerning conducting R&D and innovation.

These generic services are described in the following sections of this chapter. Note that we define these services such that their actual delivery results from implementation of specific activities by the fieldlab (e.g. conducting R&D&I projects resulting from dedicated co-funded joint programmes / roadmaps, initial series production / testing in labs / micro-production, or consultancy and services. These activities generate revenues such that the costs of setting-up and running a fieldlab are addressed. In Chapter 5 we describe the most common activities performed by fieldlabs.

2.1 Research and development activities (R&D) (TRL 1 to 4)

Fieldlabs carry out R&D activities on Technology Readiness Levels (TRLs) 1 to 4. In this stage of the results from fundamental research are translated into technological concepts which are tested and validated in a laboratory environment. Most of the examined fieldlabs carry out R&D. In the interviews it was emphasised by several respondents that conducting R&D is essential also to maintain the attractiveness of the fieldlab. By continuously exploring promising directions of research, the fieldlab is developing the business opportunities of the future. Through R&D the fieldlabs also ensure that their knowledge and equipment remains

[10] See http://www.smartindustry.nl/wp-content/uploads/2014/11/Smart-Industry-actieagenda-LR.pdf for a complete description of the fieldlab concept, and an overview of relevant entities.
[11] An important aspect defining the role of the actors in the PPP is the type of research addressed by the Fieldlab: "Science for Science", "Science for Society", and "Science for Competitiveness". This aspects for example also defines the actor who initiates the Fieldlab (i.e. University / RTO, Government, or Industry. This aspect also partly defines the ratio between public support and private financing.

state-of-the-art. As DITCM states in its programme for 2015 to 2019: “While we’re implementing, it’s crucial to keep pushing our knowledge further through research and development.”

2.2 Concept validation and prototyping (TRL 3 to 5)

Next to technological research, fieldlabs also carry out concept validation and prototyping. This activity supports bridging the gap between fundamental and technical research and pilot production. Scientific concepts refined during TRL 1 and 2 activities are translated into tangible prototypes which are then tested in a relevant environment to establish whether they deliver the desired functionalities. For example the Holst Centre has recently developed a prototype of an electro-chemical chip that can simultaneously detect different ions in liquids. This chip is expected to offer possibilities for application in agriculture, health care, and food and water quality monitoring.[12]

2.3 Pre-competitive series production (TRL 4 to 8)

Fieldlabs also carry out pilot production activities or enable industrial as well as academic partners to use their facilities for pilot production. Examples of pilot production can be found in many fieldlabs. For example Solliance conducts pilot production within its research programme ‘Organic PV (OPV) and Perovskites’.[13] Through piloting atmospheric printing and coating processes are being optimized, for example by using large area Sheet-to-Sheet and Roll-to-Roll processing systems. As it is often the case, dedicated piloting facilities are available. As stated on Solliance website “all imaginable testing and characterization facilities are available, giving quick feedback to the researchers and supporting short iteration loops and a sound basis for statistical analysis.” Also DITCM’s new work programme for 2015 to 2019 shows a strong focus on pilot production activities. ‘Up-scaling’ is the one of the main themes of the programme. DITCM aims at “moving away from conducting pilot projects on a small scale into a phase of wide-spread deployment”.[14] One concrete example of a project is the ‘Cooperative ITS Corridor’ – a cooperative intelligent transportation system (ITS) infrastructure running between Rotterdam and Vienna.

2.4 Incubator activities to support start-ups

As the overall objectives of fieldlabs is to have a wider economic impact, the creation of ‘new business’ in the surrounding ecosystem is essential. As a consequence, incubator activities take place in many fieldlabs. For example NanoNextNL has a dedicated valorisation programme with a budget of 4 million euros over three years (2014 to 2016).[15] Commercial projects originating from the NanoNextNL research programme can obtain financial support. Under the last call, which closed in May 2015, participants were eligible for a maximum contribution of 150,000 euro per business case; under the condition that this amount is matched with a maximum of 125,000 euro per business case in kind or in cash.[16] Moreover,

[12] See http://www2.imec.be/be_en/press/imec-news/holstcentre-ionensensor-nl.html.
[13] See http://www.solliance.eu/program/opv/.
[14] See http://www.ditcm.eu/images/Publications/DITCM_programma_2015-2019_WEB.pdf.
[15] See http://www.nanonextnl.nl/themes/valorisation-programme.html.
[16] See http://www.nanonextnl.nl/themes/valorisation-programme.html.

participants receive practical support in developing their business case. Also the Holst Centre actively supports initiatives of employees to spin off applications of mature technologies.[17] The result has been the foundation of the two spin-off companies Bloom Technologies, which offers a 'belly sensor' for pregnant women, and Red Bluejay, a foundation which assist organizations to embrace the concepts of open innovation and co-creation.[18]

2.5 Education and skills development

Another activity taking place in fieldlabs is the education of current and future employees. For example a fieldlab can offer trainings (generic or tailor-made) to companies to address current and future skills needs. Moreover, students from universities and vocational training schools often do internships, or graduation or PhD projects in fieldlabs. In this way fieldlabs contribute to the education of potential future employees of a certain industry, by ensuring that their skills are relevant to the needs on the work floor. 'Industrial residents', that are employees of industrial companies which are sent to work in a fieldlab for a certain amount of time, are also trained by working in the fieldlab. The Dutch Optics Centre, which is currently being set up, sees talent development as one of its main tasks. For example the 70 PhD students which will work in DOC will be actively encourages to pursue employment in the Dutch high tech sector after finishing their PhD. DOC will also cooperate with the 'Leidse instrumentmakers School' (LiS) by offering internships and offering to use equipment for courses. NanoNextNL offers four dedicated courses for people from companies as well as the research community: IP & Valorisation Awareness (two days), Risk Analysis and Technology Assessment (two days), Entrepreneurship (three days), and Analytic storytelling (two days).[19]

2.6 Ecosystem building and networking

As outlined in the Dutch Smart Industry action plan a primary objective of fieldlabs is to develop and strengthen ecosystems. Ecosystems are often regionally organized networks of (local) companies, research institutes and universities, and are generally located at one physical location, a so-called campus. On the one side, fieldlabs contribute to the building of eco-systems by providing a framework for joint projects. On the other side, many fieldlabs organise dedicated networking or matchmaking events to connect organisations that work in the same field or can complement each other in some way. Biorizon, a fieldlab focused on functionalised biobased aromatics, organises for example an annual event for all of its stakeholders and partners.[20] Moreover, it has created on online community to facilitate the exchange of information. The community offers access to the online Biorizon Community Library with current market analyses and event reports, the Biorizon LinkedIn group, and 'member-only' events.[21]

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[17] See http://www.holstcentre.com/about-holst-centre/spin-offs/.
[18] See http://www.bloom.life/ and http://redbluejay.com/about-us/.
[19] See http://www.nanonextnl.nl/courses.html.
[20] See http://www.biorizon.eu/agenda/biorizon-event-2015-on-functionalized-biobased-aromatics.
[21] See http://www.biorizon.eu/community.

2.7 Information dissemination and awareness raising

Many fieldlabs also carry out information dissemination and awareness raising activities, such as publishing newsletters, writing articles for professional and scientific journals, giving interviews on television or for newspapers, organizing information sessions on relevant developments (e.g. on new technologies or changes in markets or public policy), liaising with other organisations (e.g. interest groups) and political decision-makers. Physical fieldlabs are tangible and therefore also have an important representation role. For example the Holst Centre has been visited by high-ranking politicians and the Dutch royal family several times.

3 The rationale for involvement in fieldlabs by the actors in a PPP

Fieldlabs have an impact on the innovation behaviour of companies, as the services offered affect their investment decision concerning RD&I. Fieldlabs also provide a basis for effective / efficient modality of public support, addressing specific forms of market failure.

This section explains the rationale for public and private involvement in (the financing of) fieldlabs.[22]

3.1 Why do private actors conduct R&DI within the framework of a fieldlabs?

Analysis indicates that firms are reluctant to invest during the innovation process in the stage from R&D to prototype / proof of concept, and especially from pilot / demonstration to commercialization / maturation (see Figure 2). Assessment of the underlying rationale for a negative investment decision suggests that firms in that case assume (estimate) that the uncertainty concerning the outcome of the innovation process is such that the required investment to cover the costs of the (remaining stages of the) innovation process cannot be recovered. They phrase this in that case as: "the economic risk is too high."[23]

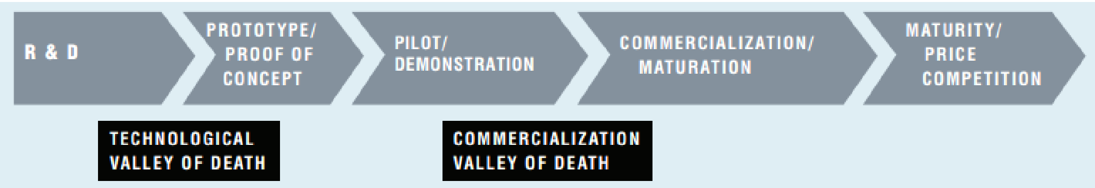

Figure 2: Technological and Commercialization "Valley of Death" (Source: http://thebreakthrough.org/blog/Valleys_of_Death.pdf)

Micro-economic theory suggests that the above investment decision is based on the perception of the following three factors that define the (remaining stages of the) innovation process: i) impact on the profit in case of successful completion; ii) the associated probability of success; and iii) the required investments.[24]

Fieldlabs now address the abovementioned factors in different ways, such that firms might alter a negative investment decision, and decide on conducting the (remaining of the) innovation process:

[22] For a theoretical background on the rationale for public and private involvement in PPPs such as a fieldlab, see De Heide, M.J.L., and M. Butter (2016). *Deliverable 5.3 Report assessment match/mismatch and issues with combined funding*. EU H2020 project EU-GREAT.
[23] Based on the results of the mKETs pilot line project, and interviews within the framework of this analysis.
[24] See De Heide, M.J.L. (2011). *R&D, Innovation and the Policy Mix*. Thela Services.

Fieldlabs reduce the required investments in the (remaining stages of the) innovation process

Fieldlabs help companies to innovate by reducing costs along the innovation process. Costs for innovation, especially in the industrial sector, can be substantial. Especially during pilot production and demonstration, costs increase sharply. An increase by factor five, compared with R&D, is nothing out of the ordinary. Fieldlabs provide research infrastructure that plays a role in the innovation process, such as machines, laboratories, testbeds, computers, software, office space and much more. By sharing research infrastructure within the framework of such a fieldlab, the associated investment and maintenance costs for the individual partners are lower compared to the situation where they would purchase infrastructure individually.

Fieldlabs also provide a platform for collaborative / cooperative research, such that also other project related innovation costs can be shared by the participating partners.

Fieldlabs provide access to know-how, networks and training and therewith that increase the probability of success of an innovation project

If an innovation project is carried out in (or in cooperation with) a fieldlab the probability of success increases. A wide body of literature suggests that innovation projects are more successful when several parties are involved, be it other companies, clients, or research institutes.[25]

Fieldlabs provide an excellent opportunity for companies to interact with other actors. For example research institutes or universities are often partners in fieldlabs and can provide companies with access to know-how (e.g. concerning state-of-the-art technologies) they do not have available in-house. This increases the chance that a project will be successful from a technical viewpoint. In addition, fieldlabs increase the probability that a project will be successful from a market perspective, as they offer the possibility to engage potential customers.

Moreover, for example through networking events and joint projects they create an environment in which companies can exchange expectations concerning market opportunities. The importance of the availability of know-how in fieldlabs was also stressed by the mKETs pilot lines survey, which found that access to specific know-how is the most important reason for companies to use fieldlabs (circa 65% of the responds indicated that access to know-how is the major reason to use fieldlabs).

Fieldlabs also increase the chances of success by training current and potential future employees. Moreover, consultancy services, such as legal or marketing advise, increase especially the chances of SMEs to successfully bring a product to the market, as they often lack specialised knowledge. Incubator activities, for example linking start-ups to investors or well-established companies, also increases the chances of new companies to successfully pursue pilot production.

[25] See Fageberg et al. (2005). *The Oxford Handbook of Innovation*. Oxford University Press, Chapter 3.

Fieldlabs reduce uncertainty about the potential impact of the innovation process in case of successful completion

Fieldlabs also contribute to reducing uncertainty concerning market opportunities and technical feasibility. Especially when horizontal actors from the value chain are involved in a fieldlab, or even potential clients and lead users, potential information about market opportunities is available.

3.2 Rationale for public support

There are several specific forms of market failure that contribute to gap between foreseen costs of the innovation process, and the expected change in company results (i.e. profit in case the innovation process is completed successfully) as perceived by firms. These forms of market failure provide a rationale (legitimisation) of public intervention aimed at supporting fieldlabs. This support could be directly addressing the fieldlabs, but also delivered by RTOs or other public research actors (e.g. universities).

Table 1 indicates how fieldlabs address different types of market failure that are associated with conducting R&D&I, as defined in the EU State Aid rules on R&D and Innovation.[26]

Table 1: Types of market failures, and how they are addressed by Fieldlabs[27]

Market failure as defined in the EU state aid rules	How fieldlabs address the market failure
Positive externalities and knowledge spill-overs "R&D&I often generate benefits for society in the form of positive spill-over effects, for example knowledge spillovers or enhanced opportunities for other economic actors to develop complementary products and services. However, if left to the market, a number of projects might have an unattractive rate of return from a private perspective, although they would be beneficial for society, because profit seeking undertakings cannot sufficiently appropriate the benefits of their actions when deciding about the amount of R&D&I they should carry out."	• Fieldlabs encourage knowledge spill-over through joint projects, networking and training • Fieldlabs work on innovations which are benefitial to society at large, but cannot be sufficiently appropriated by individual firms • Fieldlabs work on innovations that are ahead of the market
Imperfect and asymmetric information "R&D&I activities are characterised by a high degree of uncertainty. Under certain circumstances, due to imperfect and asymmetric information, private investors may be reluctant to finance valuable projects and highly-qualified personnel may be unaware of recruitment possibilities in innovative undertakings. As a result, the allocation of human and financial resources may not be adequate and projects which may be valuable for society or the economy may not be carried out."	• Fieldlabs help companies to assess and reduce uncertainties • Fieldlabs create awareness

[26] See "Framework for state aid for research and development and innovation C(2014) 3282".
[27] See http://ec.europa.eu/competition/state_aid/modernisation/rdi_framework_en.pdf.

Market failure as defined in the EU state aid rules	How fieldlabs address the market failure
Coordination and network failures “The ability of undertakings to coordinate with each other or to interact in order to deliver R&D&I may be impaired for various reasons, including difficulties in coordinating among a large number of collaboration partners where some of them have diverging interests, problems in designing contracts, and difficulties in coordinating collaboration due for example to sensitive information being shared.”	• Fieldlabs bring actors together and facilitate cooperation

4 The financing needs of fieldlabs

The delivery of the services as outlined in Chapter 3 by means of different activities lead to a ‘demand for financing’ of fieldlabs. This chapter zooms in on the financing needs of fieldlabs, resulting from costs associated with setting-up and running a fieldlab.

Based on the assessment of existing fieldlabs, we cluster the costs for setting up and running fieldlabs in according to four different types: (i) Start-up costs; (ii) Infrastructure costs; (iii) Project costs; (iv) All other costs / operational costs. It should be noted that although the interviewees acknowledge the classification as suggested in this report, they in practice (i.e. in the every-day management of a fieldlab) do not adopt a form of clustering of costs.

4.1 Start-up costs

Start-up costs arise in the first stages of the set-up of the fieldlab. The start-up phase is considered to be finished as soon as the first projects are being conducted. Subsequent costs result from:

- Consortium building (e.g. meetings between possible partners)
- Market analysis (e.g. meetings with potential clients, costs for professional market surveys)
- Developing a business plan or proposal for funding (e.g. writing a proposal to apply for subsidies)
- Developing the work programme and strategic research agenda of the fieldlabs

The analysis indicates that financing needed at this stage to cover these costs usually ranges between 250.000 euro and one million euro. The interviews indicate that financing in the start-up phase can roughly be divided into two stages. During the first ‘exploration’ phase a number of parties explore together the possibility to set up a fieldlab. This phase is characterised by informal talks, some background research and sometimes stakeholder workshops. Resources devoted to this phase usually range between 30.000 to 50.000 euro. At the end of the exploration phase a ‘go’ or ‘no-go’ decision is taken on whether the idea of setting up a fieldlab is pursued or not. The second phase is characterised by the effort to develop a business plan/programme of work for the fieldlab and obtain funding for the envisaged activities. To obtain public funding fieldlabs usually have to submit extensive proposals. Also negotiations with private parties on financial commitment (e.g. annual participation fees) take place during this phase. The costs for this second phase of the start-up process can differ widely, from 200.000 euro to up to 1 million euro.

4.2 Infrastructure costs

Infrastructure costs arise with the purchasing of physical infrastructure, such as buildings or equipment. Amounts of up to 100 million euro were observed in some of the cases analysed. The characteristics of the infrastructure define the role and relevance of the fieldlab within its specific innovation chain.

The availability of costly infrastructure provides the rationale for the existence of fieldlabs. Individual firms are in general not willing to cover the total investments required to purchase the equipment provided by the fieldlab, as the resulting benefits of their use are often not sufficient to cover the costs. By allowing the shared use of infrastructure, thereby limiting the individual costs for the firm, the decision concerning whether or not to get involved in innovation can be altered.

4.3 Project costs

Implementation of projects results in costs concerning for example salaries of research staff working on a specific project, costs for purchasing specific and dedicated equipment used for single project, costs for organizing a project-specific event, costs for project management, etc. Project costs usually account for roughly 80% of a fieldlab’s annual budget. In the case of NanoNextNL for example, the total budget allocated to projects equals about 40 million euro annually. The total budget for conducting projects usually increases during the first years of a fieldlab, until a relatively steady state is reached after approximately five years.

4.4 Other / operational costs

Running a fieldlab also results in additional operational costs. They emerge from the day-to-day operation of a fieldlab (e.g. salaries for staff not working on a project-base such as business developers and management staff, rent for buildings, maintenance of infrastructure, operation of website, organisation of regular networking events). They incur on a regular basis and are not related to specific projects.

Operational costs usually amount to 10% to 20% of a fieldlabs total annual budget. A large part of operational costs are related to acquisition and monitoring of projects. Many fieldlabs rely on multiple funding sources and hence have to deal with several different application and reporting cycles, each imposing different requirements.

Operation costs are high in the beginning, as fieldlabs have to build up a project portfolio. Later on, once the fieldlab has established its reputation and network, operational costs become a function of project costs (i.e. operational costs will increase and decrease with the number of projects a fieldlab is conducting).

5 Activities and corresponding revenues

The previous chapters describe the different services offered by fieldlabs, and the associated costs when setting up and running such an entity as to deliver them. This chapter assesses how revenues are created by providing activities that deliver these services, and identifies other sources of income that result from implementing these activities. This chapter builds on the work conducted within the framework of the EU-GREAT! project.[28]

Table 2: Activities as a source for generating income, by actor in the PPP (Source: EU-GREAT!).

Activities and other sources of income	Actors involved		
	Business	**Universities / RTOs**	**Government ((supra)nat. / reg. / local)**
Co-funded R&D&I programmes / roadmaps with corresponding projects	participation fees (also in-kind)	(in-kind) contribution	funding
Specific co-funded collaborative R&D&I projects	project costs (also in-kind)	(in-kind) contribution	funding
Contract research	project costs		
Initial series production / testing in labs / micro-production	project costs		
Infrastructure use	project costs		
Consultancy and services (workshops, training and education, scouting and intelligence, incubator services, etc.)	consultancy fee		
Public procurement of R&D&I			project costs
IPR	licence fees		
Participations	revenues		

Our analysis confirms that most of the revenues generated by a fieldlab originate from R&D&I related activities, conducted within the framework of dedicated projects. Many of these projects result from co-funded shared work-programmes or roadmaps that have been set-up by the fieldlabs in collaboration with the actors of the PPP (e.g. industry, and universities / RTOs) . These programmes generally

[28] See De Heide, M.J.L., and M. Butter (2016). *Deliverable 5.3 Report assessment match/mismatch and issues with combined funding*. EU H2020 project EU-GREAT.

focus on the development of pre-competitive technologies, usually (but not exclusively) ranging from TRL 1 to 5. The Holst Centre for example has adopted a programme based approach as a basis for the set-up of projects, as well as NanonNextNL (which has 28 dedicated programmes).

These programmes are (pre-)financed by the participating actors in the fieldlab for multiple years. The contribution by the industrial partners can be considered as a membership or participation fee. Public support as well as the contribution by the participating RTOs and universities can be considered as a form of basic funding for the fieldlab. TNO is for example funding the Holst Centre through annual contributions, which amounted to 3 million in 2014 and 4 million euro in 2015. The contributions can also be in-kind (e.g. in the form of equipment, or with research personnel).

Box 2: R&D&I programme within DITCM

One research programme line of DITCM (a fieldlab on "mobility and accessibility") for the period 2015 to 2019 is 'Human Factors (HF)'. Under this programme line new knowledge and technology will be developed with the following goals:

- Developing adaptive systems that adapt to individual drivers
- Creating an intelligent and intuitive Human Machine Interface (HMI)
- Constructing behavioral models that can estimate the effects of cooperative driving on various variables such as traffic, safety, the environment, and comfort
- Implementing a behavioral data database that stores all behavioral data collected through DITCM's projects in a standardized and user-friendly manner

Source: DITCM Programme 2015-2019, www.ditcm.eu

Note that (some of the) fieldlabs conduct also publically co-funded single / dedicated shared R&D&I projects that do not result from shared work-programmes. Contributions to the project are subsequently on an ad-hoc / project basis.

Ownership of the results of publically co-funded shared R&D&I projects is non-exclusive, meaning that outputs (e.g. IP / new technologies) can be used by all parties partnering in the project / programme). Note that this has an impact on the decision of firms concerning participating in such a project, as the expected impact of the project result on profit could subsequently be less.[29] For the ultimate investment decision, the firm will weigh this against the fact that project costs are also lower.

All fieldlabs that have been examined for this report have received direct public support, for instance in the form of a TKI-allowance, or funding from the EU's Horizon2020 programme. Table 3 provides an overview of the most common direct funding instruments for fieldlabs in the Netherlands (non-exhaustive).

[29] See De Heide, M.J.L. (2011). *R&D, Innovation and the Policy Mix*. Thela Services.

Table 3: Available funding sources: Grants and basic funding

EU-level	National level	Regional level
• European Regional Development Fund (ERDF) • Horizon2020 • INTERREG • EUREKA • Joint Technology Initiatives (e.g. ECSEL) • Eurostars • SME instrument	• TKI allowance • MKB-innovatiestimulering Regio en Topsectoren (MIT) • Ad-hoc grants from the national government (e.g. ministries) • Ad-hoc financial support via TO2 institutes, (TNO, ECN, MARIN, Deltares, NLR, WUR), NOW, STW, Universities	• Innovatief Actieprogramma Groningen • Subsidieprogramma Innovatief en Duurzaam MKB Groningen (IDG) • SRE-Stimuleringsfonds (Metropoolregio Eindhoven) • Subsidie haalbaarheidsstudies innovatief MKB (Brabant) • Ad-hoc grants from regional governments

Besides co-funded shared R&D&I projects, fieldlabs also carry out contract research on behalf of industrial partners. These projects often focus on higher TRL levels (5 to 9). In contrast to shared R&D projects, the intellectual property (IP) generated in what is often called B2B (Business to Business) projects is usually exclusive, meaning that companies obtain the right to use the results or even obtain total ownership of the IP.[30] B2B projects are for example a key business model of the Dutch Optics Centre.

Some B2B projects go beyond research. Fieldlabs offer for example commercial services, such as lab services, testing and validation services (e.g. DITCM offers the testing and validation of cars with cooperative driving features), and micro-production (e.g. production of small series of very complex mirrors for telescopes at DOC). Several of the fieldlabs analysed, such as Holst, DOC and Solliance, rent out equipment to firms, such that these can use it to advance their own technology..

Some fieldlabs are exploring also other sources of income, such as consultancy and services (workshops, training and education, scouting and intelligence, incubator services), public procurement,[31] licensing out IPR, or pay-offs generated by participations in spin-offs or start-ups originating from for example R&D&I projects conducted. Table 2 summarizes the most common activities as well as the source of revenue generated by implementing them.

[30] Exclusiveness mostly extends to one application area and a certain geographical area, e.g. Europe.
[31] Public procurement of R&D&I is a specific type of contract research, involving the purchase of goods and services by or on behalf of a public authority, such as a ministry or government agency. Public procurement is in most western countries regulated (e.g. public tenders must be issued if the value of the contract exceeds a certain threshold) as to prevent infringement of the State Aid rules (i.e. to prevent abuse such as local protectionism).

6 Costs versus revenues

In this chapter we assess how the costs over time (as described in Chapter 4), are addressed by income of the fieldlab, resulting from the delivery of services for the stakeholders involved in the PPP (as described in Chapter 5). These elements form the basis for the multi-annual budget of a fieldlab addressing its activities (i.e. like an operating budget). We emphasize the role of private contribution to the financing of the fieldlab in our analysis, as this is considered an important indicator of the relevance and success of the PPP. This chapter builds on the work conducted within the framework of the EU-GREAT! project.[32]

6.1 Start-up

Our analysis indicates that the costs resulting from the start-up phase of a fieldlab are covered, with a few exceptions, by public organisations such as RTOs (e.g. TNO, DLO) or universities. Companies are reluctant to invest at this stage because of the uncertainty with respect to whether the fieldlab will generate enough benefits to offset initial investments. Especially in case the fieldlab addresses what is defined as “Science for Science” or “Science for Society”, the actors involved in PPP assume that universities or RTOs will finance the initial stage.

The interviews provide some examples in which firms contribute cash (e.g. such as in the case of DITCM where each of the twelve partners provided 10.000 euro, or in the case of Biorizon where two companies provided 20.000 euro each to carry out a market analysis). However, overall private investment during the start-up phase is hardly ever sufficient to cover all costs.

Universities and RTOs consider the investments required to cover the costs that emerge during the start-up phase as a form of expenditure associated to the acquisition of new income. They anticipate on revenues from for example future contract research or other consultancy services to be conducted once the fieldlab is running to cover these required investments.

These acquisition costs at the start-up phase cannot be covered by any regular / existing public funding scheme or institutionalised instrument. The required investments are discounted into the overall cost price of the organisation, and are prefunded as part of the regular budget of the involved organisations (e.g. SMO budget of TNO). As basic funding for knowledge organisations in the Netherlands is currently decreasing in favour of more demand-driven funding, financial leeway to finance the start-up of new fieldlabs from existing budgets is decreasing.

In several cases it was highlighted that the up-front availability of a large amount of public funding served as crucial enabler to start the fieldlab (e.g. Biobased Performance Materials (BPM), Holst Centre). The commitment of the national or regional government to fund a fieldlab incentivises private parties to step in as well. As one interviewee put it: “Money attracts money” (“geld trekt geld”).

[32] See De Heide, M.J.L., and M. Butter (2016), *Deliverable 5.3 Report assessment match/mismatch and issues with combined funding*, EU H2020 project EU-GREAT.

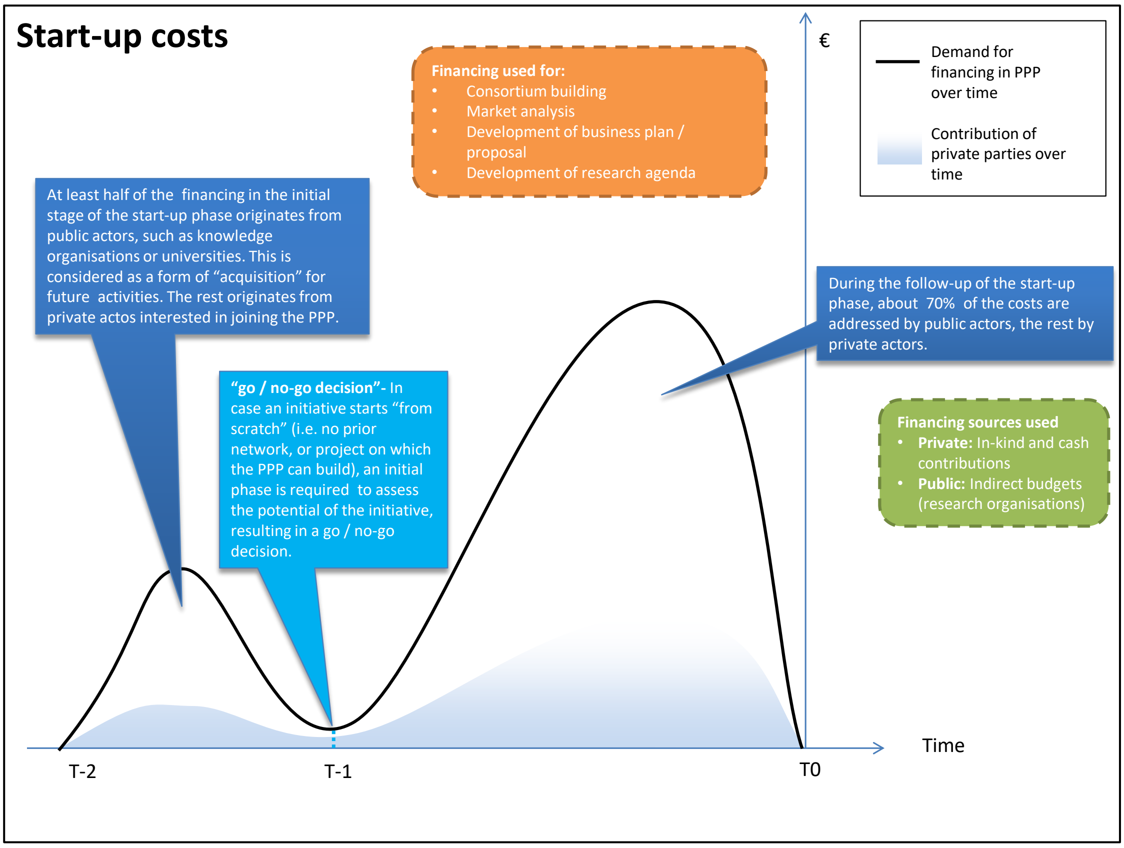

Figure 3: Costs associated with the start-up of fieldlabs.

6.2 Infrastructure

As mentioned in previous sections, the investments required to cover the costs for infrastructure are in general relatively high. Equipment subsequently represents a considerable item in their multi-annual budget. Fieldlabs have adopted different modalities of financing / support as to limit the subsequent costs, such as: (re)using already existing infrastructure (e.g. NanoNextNL); outsourcing infrastructure to a separate (commercial) entity (DITCM); and building on equipment owned by and located at partners (ESI). Some fieldlabs stated that their infrastructure is updated by integrating projects results in the fieldlab (e.g. DITCM).

Fieldlabs try to cover the (remaining) costs for acquisition and updating of the essential but costly infrastructure by means of the revenues created by fieldlab, such as participation fees and contributions to collaborative research projects, and co-funding. Note that the firms in our analysis prefer in-kind contributions to the required equipment as a form of participation fee over cash contributions to the fieldlab.

Our analysis suggests that there are two important issues that limit the use of revenues as a basis to cover the required investments:

- Equipment is an essential element (condition) for fieldlabs to actually generate revenues. In practice there is an immediate financing gap in the multi-annual (operating) budget at the very start of the fieldlab initiative that is difficult to address. Firms are not willing to get financially involved at that stage if the fieldlab does not yet have a certain reputation (i.e. with respect to the quality of the output / results). There is furthermore also no specific / dedicated public instrument that addresses the pre-financing of equipment during the build-up of a fieldlab.

- Revenues in general seem not sufficient to cover the purchase of equipment. In many of the analysed fieldlabs there is subsequently a structural gap in the multi-annual (operating) budget of the fieldlab.

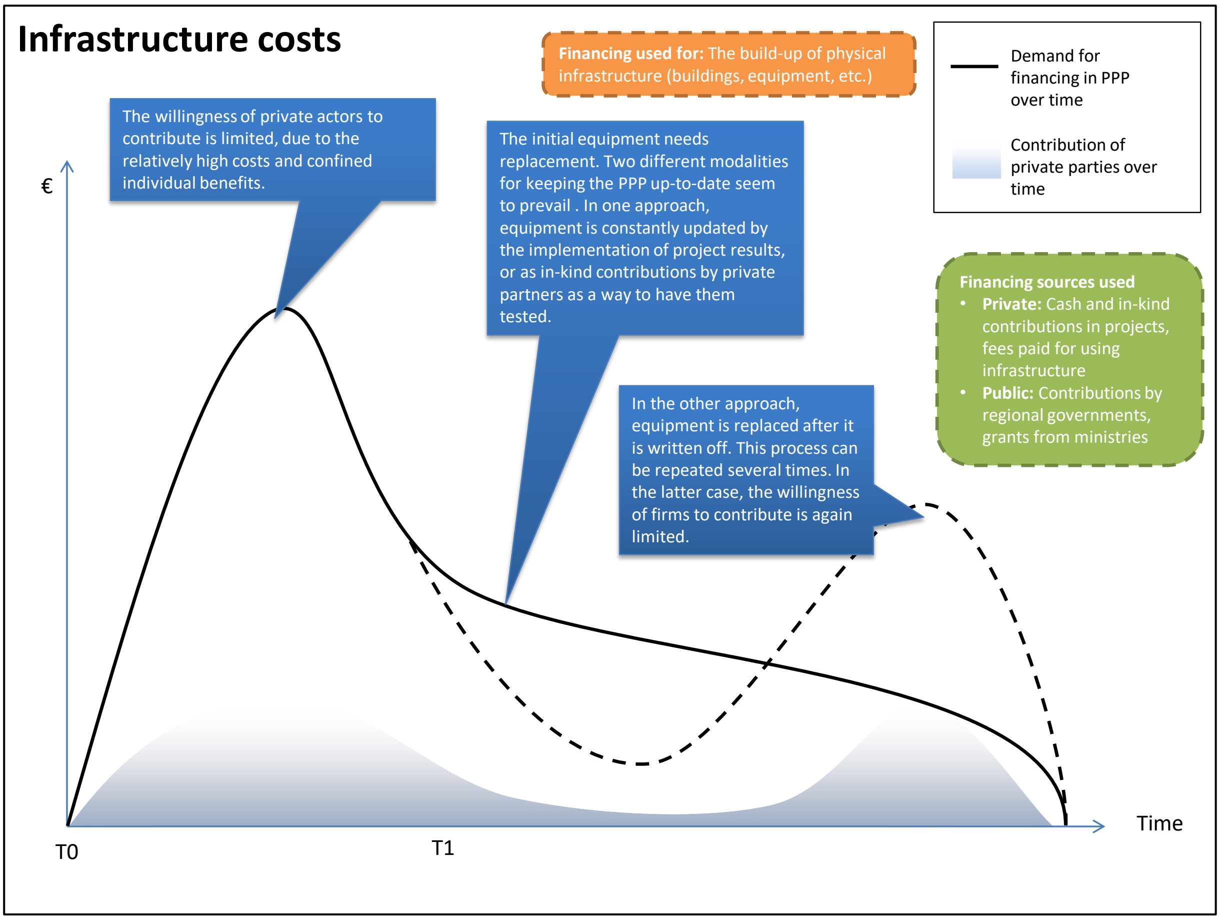

Figure 4: Costs associated with the purchase and replacement of infrastructure.

6.3 Projects

Our analysis suggests confirms that, almost all activities offered by fieldlabs as a way to generate revenues are implemented in the form of projects. There is a wide variety of sources used to directly cover the costs resulting from conducting these projects within the framework of fieldlabs (see Table 2). The corresponding modalities of financing include amongst others: cash and in-kind contributions by private parties; organisational funding of knowledge organisations (e.g. SMO), regional, national and European funding (e.g. Interreg Europe, EFRD, TKI allowance, Horizon2020 etc.), and contributions of universities (e.g. secondment of PhD students to do research in fieldlabs).

The analysis of the case studies also indicates that funding for collaborative research projects by private parties does not start immediately once a fieldlab is set up. For example the Holst Centre started off with circa 15% private funding in its first year. This had developed to circa 45% after 8 years. While the exact ratio differs between fieldlabs, the interviews have shown that obtaining more than 50% private funding for projects is almost never possible. This suggests an potential immediate financing gap in the first years after the start-up of the fieldlab.

The level of private and public funding seems to depend on a variety factors:

- *Stage in lifecycle:* Fieldlabs that have just started generally find it challenging to obtain private funding, as they first have to "prove themselves". Once they can illustrate their added value by referring to concrete projects they carried out in the past, companies are less reluctant to contribute to projects.

- *Position in the innovation chain:* Fieldlabs that focus on lower TRLs generally receive less private funding than fieldlabs that address higher TRLs. Investing in high-TRL projects is more attractive for companies as the projects' results are already closer to the market. Projects focusing on technological research are less interesting for companies, as their results cannot as easily be transferred into a marketable product or service.

- *Sector structure:* A major challenge for financing projects is that companies generally favour in-kind over cash contributions. In contrast, fieldlabs tend to favour cash contributions. In sectors with a high share of SMEs, or in sectors in which companies tend to have less cash freely available, obtaining cash contributions for projects can be very difficult.

- *Goal of the fieldlab:* The willingness of firms to invest in R&D&I project that run in a fieldlab is defined (amongst others) by the potential impact on profit (see previous chapter). We therefore argue that the willingness of firms to get involved in R&D&I projects is higher for what is defined as "Science for Competitiveness" in comparison to "Science for Science" and "Science for Society".

As indicated, public funding for collaborative research projects (resulting from dedicated programmes, as well as specific co-funded collaborative R&D&I projects (see Chapter 5)) is essential. Especially low-TRL activities, such as R&D, concept validation and prototyping, are often publicly funded. Governments have traditionally been more reluctant to fund activities on higher TRL levels, such as pilot production. However, there is a recent trend in European and national policies to allow for public funding of pilot production activities as well.

It is important to note that public funding for fieldlabs is especially crucial because it can be used to invest in frontier research, which companies are generally not willing to finance, as the spill-over effects are rather high, the risks involved are difficult to assess, and the immediate benefits are limited. However, it is this frontier research that defines the success of a fieldlab. The invention and development of radical new technologies differentiates a fieldlab from many corporate R&D initiatives and therewith creates its key added value for businesses and society at large. If public funding for frontier research is not reliable or not given at all a fieldlab will likely lose its added value.

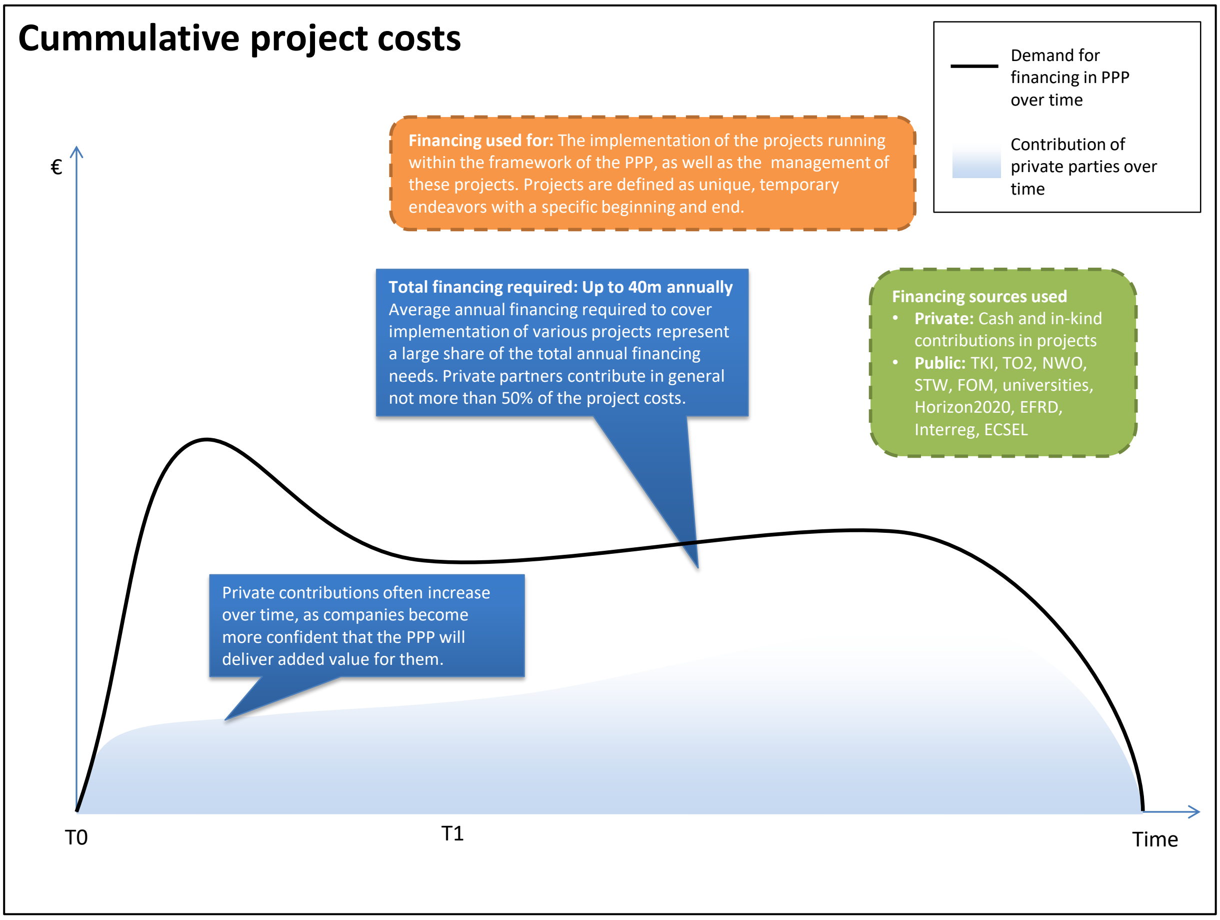

Figure 5: Project costs

6.4 Other / operational costs

The interviews indicate that the ratio between public and private financing for operational costs differs between fieldlabs and cannot be generalised. They suggest that companies are reluctant to fund operational costs, as their interest in operational activities (e.g. management, networking events, information dissemination) is not immediate. This suggests a potential structural financing gap for the fieldlab.

Fieldlabs have developed different models to cover operational costs. One practice is to cross-charge operational costs to projects, meaning that the over-head costs are part of the hourly rates of research staff working in the fieldlab. Another practice is to finance operation costs through annual participation fees that partners that are involved in the fieldlab have to pay. In many fieldlabs both of the practices are used. In case of the fieldlab Flexible Manufacturing Zuid, Brainport Industries (an organisation funded by regional high-tech suppliers) is for example responsible for project management and commits circa 50.000 euro for this purpose. These kind of contributions are usually made on a regular basis, for example annually, and not designated towards a certain project. Funding for operational costs can also come from public funding sources. Many public funding sources allow that a certain percentage of the funding (e.g. 5% or 10%) can be used to cover over-head costs.

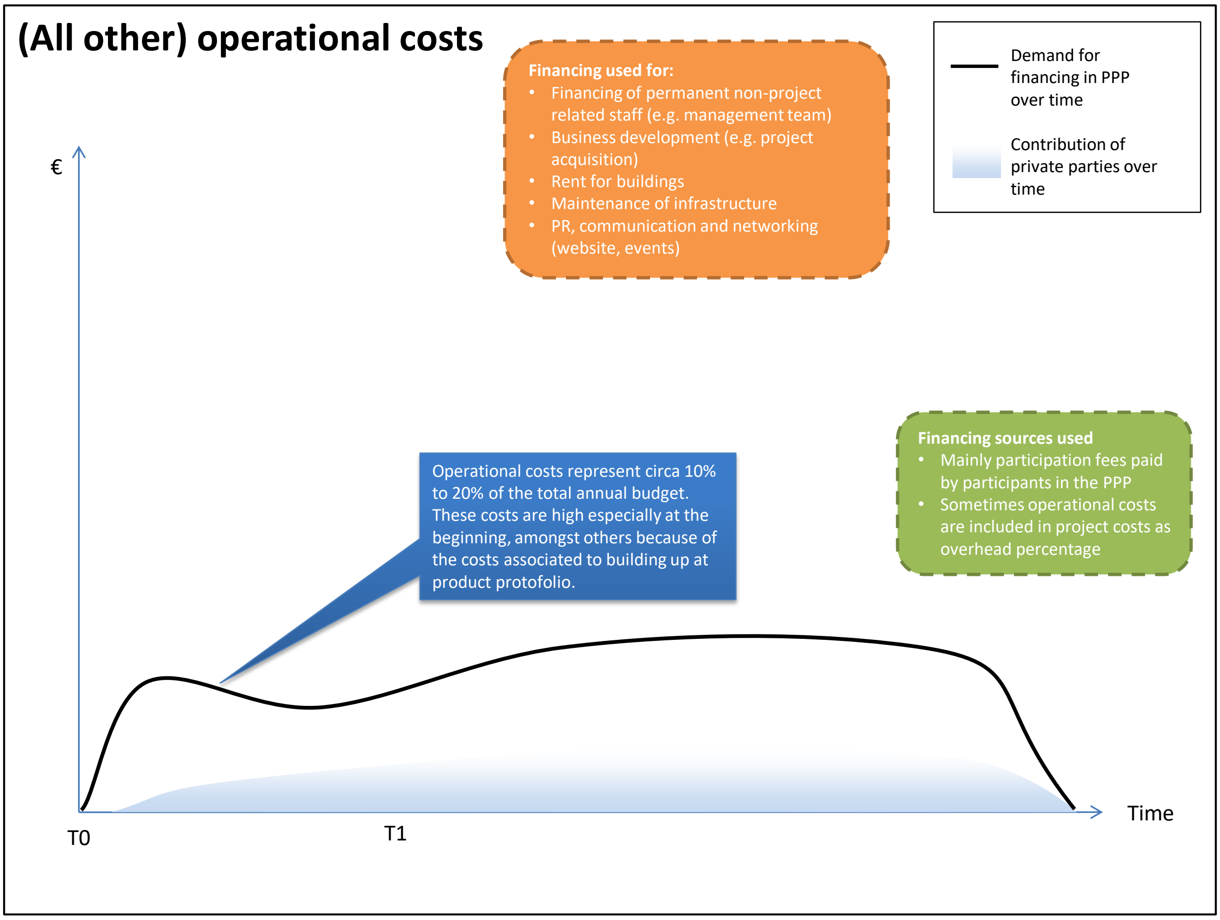

Figure 6: Other / operational costs

7 Investments

Our analysis in Chapter 6 suggests that fieldlabs are very often faced with a gap in their multi-annual (operating) budget. As indicated, we distinguish between two different forms of budget deficit:

- A structural gap arises when the overall budget suggests a shortage in income over costs of the fieldlab over the combined years of the multi-annual budget. It implies that the fieldlab is not able to reach break-even. Note that this is in practice not surprising given the underlying forms of market failure (notably coordination failures , see Appendix A) that prevent the emergence of fieldlabs without structural intervention (i.e. support) by a government.

- An immediate gap arises when investments required to initiate (or continue) the fieldlab cannot be pre-financed, because revenues are not yet generated. This is an issue, as already illustrated, especially with respect to the financing of equipment and human research capacity for projects.

In this section we will describe the potential investments that can address the gap between costs and revenues. The sections on debt and equity financing are a taken from the H2020 EU-GREAT! project.[33]

[33] As such, no rights cam be claimed by TNO. For the report, see De Heide, M.J.L., and M. Butter (2016). *Deliverable 5.3 Report assessment match/mismatch and issues with combined funding*. EU H2020 project EU-GREAT! (www.eu-great.com).

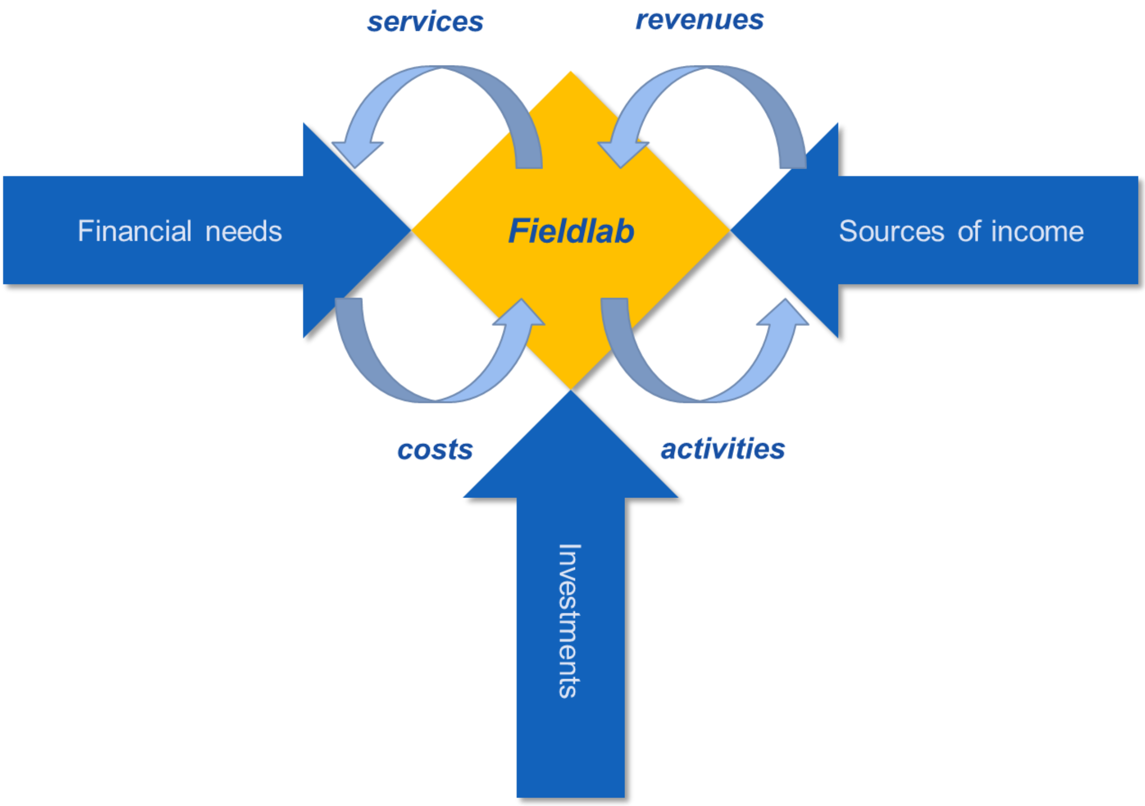

Figure 7: Investments addressing the financing gap of fieldlabs

7.1 Investments addressing the structural financing gap

Because of their role in the innovation system, many PPPs such as fieldlabs are confronted with a structural gap between revenues and costs. Especially in case of what is defined as “Science for Science” and “Science for Society”, financial involvement of industry is not evident, and with that income therefore does not always cover the investments required for the costly research infrastructure that defines the functioning of the fieldlab.

Our analysis indicates that government intervention is essential in order to close this structural financing gap. Successful initiatives such as QuTech thereby suggest an ad-hoc approach towards additional funding, in which different instruments originating from different sources (e.g. NWO, TKI) are combined. A condition in the current context seems to be a wider interpretation of the rules governing the different instruments (e.g. on eligibility, reporting, etc.), such as to allow combined funding.

According to our analysis, also regional governments play an essential role in providing additional funding for fieldlabs. Solliance for example was supported by the province of North-Brabant with a 28 million euro grant which was explicitly awarded to purchase infrastructure. Note that regional public actors have a different objective in providing additional financing. They are in general less driven by policy objectives aiming at supporting knowledge creation because of various underlying forms of market failure, as research results in general spills over to a supra-regional level. By providing financial support, regional policymakers hope to anchor the fieldlab in the region in order to ensure that other positive externalities of the fieldlab (e.g. job creation, eco-system building, creation of new start-ups, etc.) can be reaped in the region.

Note that the abovementioned examples of government intervention are characterised by the fact that no *direct* research related activities (i.e. research project) result from this additional financial support. The funding mentioned here is as a precondition for the establishment of a fieldlab, such that the activities as mentioned in Chapter 5 can be conducted.

It should be mentioned that other studies (notably the mKETs pilot line study) suggest that companies sometimes contribute equipment as a form a sponsoring to a fieldlab.[34] Rationale for such a this type of support would be that a fieldlab provides an optimal environment for testing of such equipment. It should be noted that within the framework of our analysis, we have not encountered such an example.

[34] See www.mkpl.eu.

Table 4: Investments addressing the structural financing gap of fieldlabs (Source: EU-GREAT!)

	Actiors involved		
	Business	HE / PNP	Government (supra)nat. / reg. / local
(Financial) support not linked to services, to address structural financing gap	in-kind / equipment (sponsoring)		additional funding (addressing societal challenges, employment, eco-system building, etc.)

7.2 Investments addressing immediate financing gap

Our analysis suggests that fieldlabs come upon problems with financing especially at the initial phase, or when trying to continue the initiative, when high investments are required to cover the purchase / renewal of costly equipment, or the involvement of human research capital. It seems especially difficult to align and match the potential financial commitment by the different actors in the PPP, specifically when the implementation / delivery of the specific activities of the fieldlab has not yet commenced, and revenues are not generated.

Policy makers are increasingly emphasising the potential role of non-conventional modalities of financing, and the involvement of corresponding (external) actors, to address immediate financing needs of fieldlabs. Suggestions include different forms of debt financing (commercial or otherwise) or equity financing (see Table 5).[35]

Note that there are limitations to the effectiveness of debt and equity financing as a means to initiate (or continue) a fieldlab, as these measures do not address the structural financing gap.[36] A fieldlab (defined here as a legal entity that would be able to take a loan), would never take out a loan sum that would exceed its potential revenues (nor would it be given one). Equity financiers would require a certain return on their investment, implying that income should exceed costs.

Rationale for emphasizing debt and equity financing is that the risks and financial implications in case of failure of the fieldlab do not lie with the government. It is furthermore argued that there are no forms of market failure that would legitimize a form of direct support (i.e. with the help of for example a subsidy that does not have to be reimbursed) to address an immediate financing gap.

This section briefly introduces the relevant forms of debt and equity finance, as a basis for a discussion on how to combine these (with funding) in the next chapter.

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[35] Rationale for government intervention addressing debt financing are forms of market failure that limit the functioning of capital market for initiatives such as fieldlabs.
[36] See De Heide, M., & Kothiyal, A. (2011). *How to select Instruments supporting R&D and Innovation by Industry*. Tinbergen Institute Discussion Paper, TI 2011-021/2; and De Heide, M.J.L., and M. Butter (2016). *Deliverable 5.3 Report assessment match/mismatch and issues with combined funding*. EU H2020 project EU-GREAT!.

Table 5: Investments addressing the immediate financing gap of fieldlabs (Source: EU-GREAT!)

	Actors involved			
	Business	**HE / PNP**	**Government (supra)national / regional / local**	**Other**
Debt financing, to address immediate financing needs	(subordinate) loan, guarantees	(subordinate) loan, guarantees	(subordinate) loan from a fund, guarantee	Banks, FFF, etc. (loans)
Equity financing	participation	participation	seed facility, participation	VC (skills and investments), Private equity (investments), Angels / Seed Capital (investments)

7.2.1 Debt finance

There seem numerous public loans and government guarantees for loans available on EU, national and regional level for the financing of a fieldlab. The European Investment Bank offers debt financing solutions for entities like fieldlabs to pre-finance equipment. In 2014 the "Toekomstfondskrediet OnderzoeksFaciliteiten (TOF)" was launched by the Dutch government also as a tool to pre-finance research infrastructure. The TOF is currently modified to address amongst others the specific characteristics and needs of fieldlabs. The Netherlands Investment Agency (NIA) furthermore is in the process of developing a mechanism to deploy the EFSI as a mechanism to support entities like fieldlabs with debt financing.[37] The above initiatives are currently not yet established, or fieldlabs seem not yet that familiar with them.

Also private loans could support fieldlabs in addressing the immediate financing gap. Commercial banks would seem the most obvious actors to provide debt financing, although different forms of market failure limit access of fieldlabs to the capital market.[38] Also other actors, such as the partners in the PPP, could provide a form of debt financing, under conditions (i.e. interest rate and time to return the debt) that they define themselves.[39]

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[37] EFSI is an initiative launched jointly by the EIB Group - European Investment Bank and European Investment Fund - and the European Commission to help overcome the current investment gap in the EU by mobilising private financing for strategic investments. EFSI is one of the three pillars of the Investment Plan for Europe that aims to revive investment in strategic projects around Europe to ensure that money reaches the real economy.

[38] Notable information asymmetries, which make it difficult for a commercial bank to assess the risks involved.

[39] Note that public actors need to define the conditions within the constraints set in the State Aid rules. The basis for the actual assessment of the request for the loan (i.e. evaluation of potential failure and subsequent risks involved) and the subsequent decision on whether or not to provide debt financing should be similar for all public and private actors involved in debt financing for fieldlabs.

Box 3: Additional forms of debt financing

Next to regular loans, several forms of special loans exist, such as subordinate loans, unsecured loans and guarantees.[40] Our analysis indicates however that these types of loans seem currently not considered widely for the financing fieldlabs.

Note that loans that only have to be paid if the project or activity that was funded was successful (in monetary terms) do alter the behaviour of the actors involved in the PPP, in that they would be willing to contribute more to the fieldlab. As such, they would be able to address the structural financing gap. Funding with a revolving element could be considered as such a “conditional loan”.

7.2.2 *Equity financing*

When a fieldlab receives equity financing, it implies that it receives financing in exchange of (part of) the ownership of the entity. The equity financier subsequently earns the right to (part of) the potential profit. As such, equity financing could address the immediate financing gap.

Most relevant for the support of fieldlabs would seem to be private equity.[41] Two types of investors providing private equity can be distinguished: i) formal investors that have specialised in providing equity finance (e.g. investment firms, regional development agencies); and ii) informal investors, also called business angels, which are mostly private person that invest in companies on an individual basis and are sometimes organised in ‘business angels’ networks.

Most often mentioned as potential investors in fieldlabs are Venture Capitalists. VCs tend to get involved in what they define as prospects that are still in the early stages of their lifetime, and that have a potential to grow. Financing by VCs is attractive for new companies with limited operating history that are too small to raise capital in the public markets and have not reached the point where they are able to secure a bank loan (or complete a debt offering). VCs not only invest in a prospect, they also provide additional skills and knowledge. They often focus on specific sectors, where they have extensive knowledge about the market. This insight allows them to better assess the potential of a specific prospect.

Our analysis did not reveal any involvement of equity financiers in fieldlabs. In the following chapter, we will assess the potential relevance of equity financing for fieldlabs.

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[40] See Tirole, J. (2006). *The Theory of Corporate Finance*. Princeton University Press; and De Heide, M., & Kothiyal, A. (2011). How to select Instruments supporting R&D and Innovation by Industry. Tinbergen Institute Discussion Paper, TI 2011-021/2.

[41] Public equity (i.e. equity in the form of shares of stock which are freely traded on a stock exchange) seems less relevant for fieldlabs, especially in order to address the immediate financing gap that arises at the start-up phase.

8 Conclusions: issues with (combined) financing of fieldlabs in the Netherlands

Our analysis indicates that the annual budgets of the studied fieldlabs average at circa 25 million per year, and cover a range from 1 million (DITCM) to 50 million (NanoNextNL). Table 6 provides an overview of the annual budgets of some of the fieldlabs that have been analysed. Note that these fieldlabs differ not only in subject, actors involved and services provided, but also in stage of their lifecycle.

Table 6: Estimates of the annual budgets of some fieldlabs.[42]

Name of fieldlab	Annual budget estimates (in euro)
NanoNextNL	50,000,000
Holst Centre	42,000,000
DOC	40,000,000
GSV Voeding en Biobased Economy	30,000,000
ESI	25,000,000
Solliance	14,000,000
Biorizon[43]	7,500,000
DITCM	1,000,000

This budget is constituted by the contributions of the actors involved in the PPP (e.g. in the form of funding), as well as other financiers (e.g. in the form of debt and equity financing), in order to address the costs associated to setting-up and running of a fieldlab. In this chapter we first assess the ratio between public funding and private financing generally observed within fieldlabs, and the legal framework that governs intensities of public support. We subsequently analyse key bottlenecks in public financing for fieldlabs. Last we assess issues with obtaining debt and equity financing by fieldlabs. Note that this specific section is summary taken from D5.3 of the H2020 EU-GREAT! project.[44] As such, we obtain insight in the problems with (combined) financing of fieldlabs in the Netherlands. This chapter builds on the results of the H2020 EU-GREAT! project.

8.1 Ratio between public funding and private financing

The level of private financing differs significantly for the different fieldlabs that have been reviewed. Some fieldlabs such as the Holst Centre or ESI reach roughly a 50/50 ratio. For many other fieldlabs the share of private funding is lower (i.e. ca.

[42] Note that these numbers are intended to provide a high-level overview of the range of annual budgets of fieldlabs. They are rough estimates and not calculated according to a consistent methodology.
[43] Amount refers to plan for 2016. For 2015 Borazon's budget is approximately 2.5 million euro.
[44] As such, no rights cam be claimed by TNO. For the report, see De Heide, M.J.L., and M. Butter (2016). *Deliverable 5.3 Report assessment match/mismatch and issues with combined funding*. EU H2020 project EU-GREAT! (www.eu-great.com).

30% to 40% for DITCM, 25% to 30% for NanoNextNL, and about one third for Biorizon once the initial phase is over).

The level of private as well as public funding contribution to fieldlabs is defined primarily by the characteristics of the fieldlab, such as for example the type of research conducted within the PPP. Public support is governed by the State Aid rules on R&D&I. These define field labs and their corresponding activities as a form of industrial research or experimental development (depending on the exact characteristics of the R&D&I).

Table 7 provides the associated maximum aid intensities for fieldlabs. When different sources are combined (e.g. national with regional funding), their overall financing should not exceed the suggested intensities. This also holds for indirect funding via RTOs or Universities. Funding from framework programmes is exempt from the State Aid rules.

Based on the table with the maximum aid intensities for fieldlabs, it should be concluded that under certain conditions, aid intensities of over 50% are allowed. The implicit policy objective generally adopted by many national and regional governments of limiting public funding to 50% to PPPs therefore seems mainly politically motivated.

Table 7: Aid intensities associated to different forms of R&D&I.

	Small Enterprise	**Medium sized Enterprise**	**Large Enterprise**
Aid for R&D projects			
Industrial research	70%	60%	50%
• subject to collaboration between undertakings (for large undertakings cross-border or with at least one SME) orvbetween an undertaking with a research organization; or • subject to wide dissemination of results	80%	75%	65%
Experimental development	45 %	35 %	25 %
• subject to collaboration between undertakings (for large undertakings cross-border or with at least one SME) orvbetween an undertaking with a research organization; or • subject to wide dissemination of results	60 %	50 %	40 %

8.2 Key bottlenecks in public funding for fieldlabs the Netherlands

Our analysis indicates that fieldlabs perceive problems in obtaining public support for the financing of their entity (including equipment) and activities. The key bottlenecks fieldlabs can broadly be categorized in the following three categories: 1) an overall shortage of funding; 2) fragmentation of funding instruments, and 3) problem relating to funding modalities.

It should be noted that these three bottlenecks are interlinked (i.e. the individual impact is aggravate by the occurrence of the other bottlenecks). For example the reduction of the overall funding since the introduction of what is called the “top sector” approach has forced fieldlabs in recent years to seek for numerous funding sources simultaneously.[45] Fragmentation is hence for a significant part caused by a shortage of funding.

Figure 1 provides an overview of the bottlenecks and their underlying causes that were most frequently mentioned during the interviews. In the following section we will describe the key bottlenecks fieldlabs experience in obtaining public funding.

8.2.1 Shortage of funding

Many fieldlabs mention a lack of available funding as key bottleneck. They attributed this shortage of funding mainly to two developments. Firstly, the general decrease in subsidies for public-private-partnerships in innovation since the introduction of the “top sector” approach seems to play a role. While in the past large subsidies were available to fund public-private research, e.g. in form of the ‘Technological Top Institutes’ or FES subsidies, most of the public funding for research and innovation is nowadays allocated through tax incentives, such as the WBSO or the ‘Innovation Box’.[46] The public resources devoted to generic subsidies, such as the TKI allowance or the MIT regulation, are much smaller than the resources devoted to tax incentives. For example in 2016 the TKI allowance has a budget of 75 million euro, compared to budget of 1,1, billion of the WBSO.[47]
Secondly, many fieldlabs mentioned the decrease of TO2 funding in recent years as a major problem. As knowledge organisations, such as TNO, are often partners in fieldlabs the reduction of their budgets inhibits their capacity to be involved in fieldlabs.[48]

In the following we describe the bottlenecks experienced by fieldlabs resulting from the reduction in funding.

Difficulties in matching private commitment

A result of the shortage in funding is that private contributions in fieldlabs cannot be matched by the necessary public funding. Some fieldlabs, such as Holst and ESI, have been very successful in attracting cash contributions from the private sector, reaching a share of almost 50% private funding. However, they experience difficulties in matching these contributions from the private sector with public funding.

Difficulties in funding the start-up of fieldlabs

The shortage in funding also leads to difficulties in the start-up of new initiatives. For example the Smart industry fieldlabs ‘Digitale Fabriek’ and ‘Flexible Manufacturing’ have not been able to secure the necessary public funding, despite sufficient private

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[45] See www.government.nl/topics/enterprise-and-innovation/contents/encouraging-innovation.
[46] FES (nl: Fonds Economische Structuurversterking) was a fund that was financed through the profits from the Dutch gas expoitation and used in parts for investments in the Dutch research and innovation infratsrcuture. The FES
[47] Minsiterie van Economische Zaken (2015), Rijksbegroting 2016 xiii Economische Zaken
[48] TO2 is the umbrella term for the applied research institutes in the Netherlands.

commitment. In addition, many existing fieldlabs stated in the interviews that they consider the initial lack of funding for their start-up a crucial problem (e.g. Biorizon, GSV Voeding en Biobased Economy, NanoNextNL). Many initiatives, such as Holst or BPM, could not have taken off without ad-hoc, not institutionalised substantial public investment during the start-up phase. Often the decreasing TO2 budget is mentioned as problem, as knowledge organisations often take the lead in the initial phase of a fieldlab.

Difficulties in acquiring funding for fieldlabs that are primarily driven by the government or knowledge institutes

The shortage of funding, in combination with the TKI allowance that only rewards private contributions, leads to difficulties in funding fieldlabs that are primarily driven by the government or knowledge institutes (i.e. fieldlabs that address “Science for Science” or “Science for Society). While these fieldlabs can also have a high societal value, for example by bringing disruptive ideas and technologies to the market or by addressing societal challenges, they usually receive much less private funding than fieldlabs that are driven by companies. Companies are less likely to invest in this type of fieldlabs because the value of their innovation is not yet clear. For example, while OncoXL and DITCM aim to address important societal challenges (e.g. cancer and sustainable mobility), the tangible benefits for companies of the innovations they will generate are hard to predict. Moreover, in the case of DITCM, it is not clear which party will be able to internalise the benefits.

In fieldlabs that are driven by knowledge institutes or the government we see that private funding usually does not amount to more than 30% of the overall budget of these kind of fieldlabs. While these fieldlabs would require more funding to achieve their societal goals, the mechanisms of the TKI allowances actually leads to a situation in which they receive less funding. As consequence fieldlabs that are driven by knowledge institutes or the government find it difficult in the current regime to obtain sufficient funding.

Difficulties in acquiring funding for fieldlabs with many SMEs

Fieldlabs that are funded by the TKI allowance that rely mainly on SMEs as partners (e.g. DITCM, fieldlab ‘Digitale Fabriek’) find it difficult to obtain sufficient funding. SMEs generally do not have the financial capacity to spare large amounts of cash to invest in fieldlabs. Instead they prefer to contribute to fieldlabs through in-kind contributions. However, in-kind contributions are only to a very limited extent rewarded in the current regime, meaning that fieldlabs with strong SME involvement face challenges in obtaining funding.

Difficulties to cover operational costs

Some fieldlabs (e.g. Biorizon, fieldlab Flexible Manufacturing, NanoNextNL) mentioned a lack of funding for operational costs. As many activities that aim to spread the knowledge and benefits generated in fieldlabs more widely (e.g. incubator activities to support start-ups, ecosystem building and networking, information dissemination and awareness raising) are usually funded from its operational budget, a lack of funding of operational costs bears the risk of undermining the fieldlabs’ ability to reach their full impact. Though it should be noted as well that many fieldlabs did not mention difficulties in covering their operational costs.

Difficulties to fund infrastructure

Some fieldlabs mentioned problems in acquiring sufficient funding for the purchase of infrastructure (e.g. fieldlab Flexible Manufacturing, Biorizon, NanoNextNL). These fieldlabs stressed that funding for infrastructure is often ad hoc, for example through ad hoc grants from the national or regional government, as no dedicated instrument to fund infrastructure exists. The interviews also showed that many of the now mature fieldlabs received substantial government funding to purchase infrastructure. For example Solliance received an initial grant of 28 million euro from the Province of Noord-Brabant to buy equipment and cover start-up costs. If public funding to purchase infrastructure is not available, this can seriously hamper the development of a fieldlab.

8.2.2 Fragmentation of funding instruments

Many interviewees stressed that financing fieldlabs is hampered by fragmentation of funding instruments. Fieldlabs are faced with a multitude of different subsidies that are at times difficult to understand and hard to combine. Some interviewees even spoke of a true ‘jungle of subsidies’. The funding of the Holst Centre illustrates very well which efforts fieldlabs have to go through to deal with the fragmentation in funding instruments (see **Box 4**).

There are several underlying cause for the fragmentation of funding instruments. Firstly, the reduction of the total amount of funding available for public-private partnerships in innovation and research has led to a situation in which large fieldlabs are not able to cover all their expenditures by one, or a few, funding sources. Instead, large fieldlabs, such as Holst, have to tap numerous sources to achieve a critical mass. Secondly, the numerous funding instruments on national, regional and EU-level are not aligned. They have different (and sometimes diverging) objectives, thematic priorities, modalities, and reporting requirements. This makes it difficult for a fieldlab to combine several funding instruments. Thirdly, there is no central authority that facilitates the combination of instruments in the Netherlands. One could imagine that the TKI’s could take up a more active role in organizing funding for major initiatives, for example by negotiating with the different sponsors. However, practice shows that the TKI’s are rarely able to take up this role, as they lack the overriding authority to allocate funding.

In the following we describe the bottlenecks experienced by fieldlabs resulting from the fragmentation of instruments.

Lack of knowledge of funding instruments

The interviews showed that actors in fieldlabs are often not familiar with the wide variety of funding instruments on regional, national and European level. Hence, they find it challenging to make optimal use of the available instruments. For example some interviewees were not aware of the recent changes in the rules concerning the TKI allowance, which makes it possible to finance operational activities and receive funding up-front.

Box 4: Public funding instruments supporting Holst - Dealing with fragmentation in public funding instruments

The annual budget of Holst is approximately 42 million euro. In March 2016 Holst received funding from the following public funding sources:

Dutch instruments

1) TNO budget in form of 'Samenwerkings Middelen Onderzoek (SMO)'
2) Contribution from the Dutch Ministry of Economic Affairs
3) Contribution from the municipality of Eindhoven
4) Contribution from the province of Noord-Brabant
5) Contribution from the metropolitan region Eindhoven
6) Contract with the regional development agency 'Brabantse Ontwikkelings Maatschappij (BOM)'
7) TKI allowance
8) Contribution from NanoNextNL
9) Contribution from the research funding organisations STW
10) Tax breaks within the WBSO

EU instruments

1) Horizon2020
2) Ecsel
3) Eniac (pre-Ecsel)
4) European Regional Development Fund (ERDF), including Interreg
5) Knowledge and Innovation Community (EIT) Digital

Every subsidy has different reporting requirements. The requirements differ regarding content, format and timing. Especially the competitive funding instruments, e.g. Horizon2020 or ERDF, have very elaborate reporting requirements, which must be strictly adhered to. In addition to the reporting requirements, also the fee structures differ between instruments; meaning that the funding percentage differs between projects. Moreover, significant effort is needed to obtain funding from the different sources, leading to acquisition costs. Acquisition costs for a major EU project (e.g. more than 750k; Holst as consortium leader) require circa 400 to 800 hours of work.

To deal with the fragmentation of funding instruments Holst had to build up significant "financial engineering" expertise. Its staff needs to be familiar with the modalities of the different funding instruments. Moreover, the reporting requires that all financial information is documented precisely and reported in the different reporting format. As these processes cannot be fully automated, much of the work (e.g. entering the data in the reporting formats) must be done manually.

High acquisition and reporting costs

Many fieldlabs highlighted the extensive acquisition and reporting costs they incur to combine different public funding sources. To create and maintain a coherent and stable research programme over some years, based on a variety of funding sources, extensive 'financial engineering' is necessary. Extra capacity, for example is in the area of accounting or writing proposals, is often needed. The subsequent costs for acquisition and reporting makes up a significant share of the fieldlabs' budgets. Most of them dedicate 10% to 15% of their budget to acquisition and reporting. It was mentioned various times that especially for EU funding the chances of success are relatively low, which means that more time must be invested in acquisition.[49]

[49] For example submitting a proposal to the ERDF for setting up a fieldlab can cost 50.000 euro and more (estimates obtained from interviews with the Digital Factory and Flexible Manufacturing fieldlab). This is a substantial and risky investment, considering that there is no guarantee that the funding will be awarded. An additional complication, which is especially relevant to reporting, is that many fieldlabs use multiple public funding sources, meaning that they have to deal with different substantive and formal reporting requirements which are staggered throughout the year. For example the Holst Centre receives in 2016 direct funding from 16 different public sources . Across all case studies the costs for acquisition and reporting acquisition lay between 10 and 15% of the overall budget.

Lack of continuity and predictability of funding

Using multiple funding sources also bears the risk of undermining continuity. If a fieldlab relies on several sources, fluctuation in funding is likely, as it cannot be predicted how much funding will be awarded per year. This makes the planning of programmes complex, and can deter private parties from investing.

Difficulties in funding fieldlabs that cover the whole innovation chain

Several fieldlabs stressed that the existing funding instruments are not suitable to fund large initiative that span the whole innovation chain. While there are instruments addressing the different stages of the innovation chain (e.g. NWO funding addresses fundamental research, TO2 funding covers applied research, the ‘Toekomstfonds’ addresses activities close to the market), fieldlabs that integrate all these stages have to combine these instruments.

Difficulties in funding cross-sector fieldlabs

Also cross-sectoral fieldlabs, such Smart Port and Biorizon, experience difficulties in obtaining the necessary funding. The current Dutch top sectors policy stimulates innovation within a number of sectors. Initiatives that “don’t belong” to one certain sector find it harder to receive funding, as the funding rules between TKI’s often differ.

8.2.3 Problems relating to funding modalities

Next to bottlenecks connected to a shortage in funding and the fragmentation of instruments, several interviewees mention problems relating to the modalities of funding instruments.

Difficulty to fund long-term programmes in fieldlabs

Several interviewees (e.g. DITCM, ESI, Holst) stated that they would appreciate a shift from project-oriented funding to programme funding of especially EU support. With project-funding it is more difficult to work towards an ambitious and visionary long-term goal, as aligning projects is challenging. Moreover, continuity can easily be undermined in case a proposal for an important project is lost. Furthermore, a programmatic approach has the advantage that it would enable the fieldlabs to respond more swiftly to new developments and emerging market needs.

Inflexibility of funding sources

Some interviewees perceived a lack of flexibility in the current funding regime. For example within many funding instruments, e.g. TKI, Horizon2020, ERDF, it is common to agree on fixed project steps and deliverables, which are monitored throughout the project. In case a new opportunity arises, for example due to a new technical innovation, fieldlabs sometimes find it difficult to work on this opportunity within existing projects as they are obliged to deliver the promised outputs, and deviations are not foreseen.

Box 5: Use and appropriateness of tax incentives as a tool to support LSIs

Within the framework of our analysis, we have also analysed the use and appropriateness of tax incentives as a tool to support LSIs. The relevant tax measures for our analysis reduce the amount of taxes that need to be paid under the condition that a certain activity is carried out (e.g. money is invested in R&D). There are different type of tax incentives; the most important ones being: (i) tax exemptions (certain organisation, individuals or activities are exempted completely or to a certain extent from taxation); (ii) tax deductions (certain expenses can be subtracted from the taxable income); (iii) Tax credits (taxpayers receive a credit which is subtracted from the amount of taxes they have to pay). Table 8 provides an overview of the tax incentives available for research and innovation in the Netherlands.

Experience from the cases shows that tax incentives only contribute to a very limited extend to the funding of fieldlabs. The Holst Centre received in 2013 and 2014 circa 1 million euro annually through the WBSO. Part of the labour costs of research staff carrying out projects on behalf of industrial partners could be deduced form the total project costs. The savings generated in this way were not reimbursed to the participating companies but directly paid to the Holst Centre. In 2015, this arrangement was revoked, with the justification that the WBSO is intended to directly support companies and fieldlabs. The ‘Innovatiebox’ is not relevant for fieldlabs, as it only applies to profits of entities that pay corporate taxes in the Netherlands. The only fiscal instrument that can be used for fieldlabs is the RDA. Companies that use fieldlabs to develop a concrete product or piece of equipment can deduce these costs (e.g. fee paid for business-to-business projects) from their taxable income.

Some interviewees suggest that the current system of tax incentives in the Netherlands discourages companies from conducting R&D&I within the framework of fieldlabs. They argue that the benefits from using WBSO or the ‘Innovatiebox’ (i.e. tax deductions / exemptions that lower the costs of conducting R&D&I, and the fact that the project results do not have to be shared with partners) are such that conducting R&D&I in-house is preferred over collaborative co-funded research as performed within the framework of an LSI (although the probability of success of a project in such an environment is probably higher).

Table 8: Available tax incentives

Name of tax incentive	Type of tax incentive	Description
Wet Bevordering Speur- en Ontwikkelingswerk (WBSO)	Taks deduction	With the WBSO companies can deduct costs for R&D personnel from their taxes. For 2015 companies receive a 35% deduction of the payroll taxes for R&D employees for the first 250.000 euro of labour costs. For labour costs above the 250.000 euro threshold the deduction is 14%. Start-ups can even receive a deduction of 50% for the first 250.000 euro of labour costs.
RDA (Research en Development Aftrek)[1]	Taks deduction	With the RDA companies can deduct costs for R&D other than personnel (e.g. equipment) from their taxes. For 2015 companies can deduce 60% of the R&D costs from the company's profit tax.
Innovatiebox	Tax exemption	With the ‘Innovatiebox’ companies that have developed a new product or process benefit

	from a reduced tax rate on the profit generated by their innovation (e.g a patent). Instead of 25% the tax rate is 5%.

8.3 Potential role of debt financing for the set-up or continuation of fieldlabs

Debt financing is often mentioned as a promising instruments for financing fieldlabs by policy makers. Our previous analysis suggests that its role seems limited to addressing the immediate financing gap. The corresponding interviews however suggests that debt funding in general is not considered as an effective solution by the vast majority of actors involved in fieldlabs. Many fieldlabs have a non-commercial (i.e. not for profit) character, and the income it generates, especially at the beginning, is far from ensured. This limits their willingness to commit to the requirements of a loan.

The results of the H2020 project entitled EU-GREAT! indicate that commercial banks adopt specific and dedicated models to assess a request by a loan for either an entity like a fieldlab, or a project running on it.[50] The models are currently subject to changes in the regulations that govern granting of credits, initiated by the ECB. The outcome of the new regulations are currently subject to negotiation.[51] Providing debt financing for a PPP like a fieldlab (i.e. for the financing of the entity itself) is subsequently considered by a commercial bank, because of its specific characteristics, as providing a loan for real estate. Complicating factor in the case of the financing of such a PPP is that the assets (i.e. equipment) are unique, and specific in use. In case of insolvency of an entity like a fieldlab, the execution value of the assets is subsequently rather limited. Basis for the evaluation of a request for the provision of a loan is therefore primarily the assessment of the cash-flow generated by the PPP (i.e. profit and its uncertainty).

Because of the above, commercial banks seem not able to finance an fieldlab. It is explicitly mentioned however that a guarantee for a loan (by *any* of the partners in the PPP) would (of course) alter their decision concerning investing in an entity such as a fieldlab.

The use of not-institutionalized ad-hoc government support as a form of basic funding (i.e. not part of a long-run programme) for a PPP to balance the budget (i.e. to address the structural financing gap) seems for most commercial banks an indication of high risk with respect to the long-run continuation of the entity. The willingness to provide debt-financing is subsequently limited.

Commercial banks would be interesting in financing projects that would be conducted within the framework of an entity such as a fieldlab. But for banks it is difficult to assess the potential failure rate and impact of R&D&I (because of information asymmetries). Also, because of banking regulations, their perception of the subsequent risks is also not favourable for projects with high uncertainty concerning failure and impact. Commercial banks are therefore willing / able to get involved only in the very late stages of the innovation process.

[50] See www.eu-great.com.
[51] It should be noted however that a loan based on (future) IP seems no longer possible due to changes in (internal) banking regulations.

The above implies however that requests for debt financing of projects are assessed in a different way than requests for the financing of a fieldlab. Commercial banks describe that as a bottom up approach where also non-tangible assets are assessed (i.e. project characteristics, participants (based on reputation), corresponding business plan, etc.).

8.4 Potential role of equity financing for the set-up or continuation of fieldlabs

Results of the H2020 project entitled EU-GREAT! furthermore indicate that private equity firms usually only invest in what they define as a “prospect” only if it has the potential to grow rapidly (i.e. a convex growth curve).[52] An important aspect in the assessment of the possibilities for growth is the potential scaling-up of the underlying concept from a single (geographical) market to multiple markets.[53]

An important condition for involvement of venture capital is the possibility of an exit strategy to capitalize the increase in value of the company. An exit strategy is a way to transition the ownership of a company to another company (e.g. through a merger or acquisition) or to investors (e.g. through an Initial public offering). Other types of exit strategy include management buyouts or employee buyouts (common in the manufacturing industry).

Our analysis within the framework of the EU-GREAT! project seems to suggest that a PPP such as a fieldlab is not an interesting prospect, as the underlying concept is not scalable (i.e. it is duplicable), and it (subsequently) does not seem to have rapid growth potential. An exit strategy seems furthermore very complicated.

A fieldlab could be interesting for other actors involved in equity financing, that adopt a different strategy concerning the weighted risks in their portfolio of participations, such as those involved in private equity and real estate. Condition for their participation would be a certain level of assets and return on investment (with low risk).

[52] A prospect is a company with a corresponding product - and rarely a service - the VC considers investing in.
[53] An example in this perspective is the taxi app Uber from Uber Technologies Inc.; a successful concept that has been implemented 66 countries and 507 cities worldwide.

9 Recommendations

The objective of this report is to provide Dutch policy makers and other interested actors with information that helps them to further improve the current system of financing fieldlabs. To this end we have assessed possibilities for the funding of fieldlabs in the Netherlands and related bottlenecks.

Our analysis indicates that the relevance of fieldlabs in the Dutch innovation system is acknowledged by policy makers. However, the financing of fieldlabs is currently problematic. The reduction of direct funding since 2010 (e.g. phasing out of FES subsidies, reduction of TO2 budgets) has led to a situation where many existing fieldlabs struggle with finding the resources to continue operating, and new initiatives have problems getting started. The perception is that this has resulted in unmatched private commitment for investments in R&D&I. Moreover, the reduction in funding has also led to a situation in which many fieldlabs have to obtain funding from various sources. This increases transaction costs for fieldlabs and makes it more difficult to finance long-term initiatives with a programmatic approach.

The primary objective of this report is not to provide recommendations for changes in policy addressing PPPs. We would like to suggest however some subjects for future analysis that could improve the way fieldlabs are financed in the Netherlands:

- How can public funding be increased, such that the structural financing gap can be addressed?
- How to simplify policy delivery within the context of the structure governing the Dutch innovation system?
- The set-up of a Public Private Partnership with its corresponding (infrastructure-based) services / projects requires (commitment concerning the) initial financing. What's the role of public support and private financiers in this initial stage. Who is the first to indicate commitment, and why?
- Combined financing of public funding and private equity and / or debt financing could result in the situation that part of the public support is used for the financing of debt and equity. Would that be possible / advisable under the current regulations?
- Why is public support in practice almost always limited to 50%?
- Is it necessary to design a dedicated public instrument for PPPs such as fieldlabs, or is ad-hoc support better?
- Should public support for a fieldlab be such that there is a revolving element?
- What's the potential of subordinated debt in the financing of fieldlabs?
- In case of guarantees, who takes the risks?

A List of interviewees

The following people were interviewed for the project.

Name	Organisation	Topic of interview
Interviews on cases / fieldlabs		
Yuri Piepers	TNO	Case: Fieldlab Flexible Manufacturing
Peter van Dijken	TNO	Case: GSV Voeding en Biobased Economy
Joëlle van den Broek	TNO	Case: DITCM
Leon Gielgens	STW	Case: NanoNextNL
Mike van Altena	STW	Case: NanoNextNL
Martie Vervoort	STW	Case: NanoNextNL
Jan Harm Urbanus	TNO	Case: Biorizon
Barend Vermeulen	TNO	Case: Solliance
Reinier van Eck	TNO	Case: ESI
Frans Beenker	TNO	Case: ESI
Hans Sprangers	Dutch Ministry of Economic Affairs	Case: Biobased Performance Materials (BPM)
René Bok	Dutch Ministry of Economic Affairs	Case: Holland Innovation Potato
Astrid Boschker	Dutch Ministry of Economic Affairs	Case: Impact 2
Jaap Lombaers	TNO	Case: Holst Centre
Paul Apeldoorn	Province Noord-Brabant	Case: Fieldlab Digital Factory and Holst Centre
John Blankendaal	Brainport Industries	Case: Fieldlab Digital Factory
Interviews on funding instruments and other topics		
Ben Ruck	Rijksdienst voor Ondernemend Nederland (RVO) *English: Netherlands Enterprise Agency*	Available funding instruments

Wilbert Schaap	Rijksdienst voor Ondernemend Nederland (RVO) *English: Netherlands Enterprise Agency*	Available funding instruments
Casper Langerak	Rijksdienst voor Ondernemend Nederland (RVO) *English: Netherlands Enterprise Agency*	Available funding instruments
Michiel Janson	Dutch Ministry of Economic Affairs	Available funding instruments
Niek Joankrecht	Dutch Ministry of Economic Affairs	Instrument 'Toekomstfonds'
Eva Jonker	Dutch Ministry of Economic Affairs	Instrument 'TKI-toeslag'
Freeke Heijman	Dutch Ministry of Economic Affairs	Available funding instruments
Hans Netten	Rijksdienst voor Ondernemend Nederland (RVO) *English: Netherlands Enterprise Agency*	Instrument 'TKI-toeslag'
Leendert van Damme	Dutch Ministry of Economic Affairs	Public funding for large technical facilities
Jan de Vlieger	TNO	Funding needs in fieldlabs
Peter de Haan	TNO	Funding needs in fieldlabs
Edgar Janssen	TNO	Funding needs in fieldlabs

Next to the interviews the report draws heavily on the work of the 'PPS5050 working group'. The aim of the working group is to identify options to improve the financing of PPPs in the Netherlands. Members of the working group were:

- TNO: Arnold Stokking, Tom van der Horst, Marcel de Heide, Laura Seiffert, Maurits Butter
- FME: Geert Huizinga (FME)
- Dutch Ministry of Economic Affairs: Luuk Klomp, Anne Reitsma, Michiel Janson

The analytical work for the working group was carried out by Tom van der Horst, Marcel de Heide, and Laura Seiffert from TNO and Anne Reitsma from the Dutch Ministry of Economic Affairs.