Cascade Funding as an Alternative Funding Source for Innovative Investments

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Abstract: Although promoting an innovation ecosystem is a core priority of the European Commission (EC), evidence indicates that innovation within start-ups and Small and medium-sized enterprises (SMEs) is still constrained by the lack of funding opportunities. Consequently, their capability to realise proofs of concepts or launch new risky business lines is limited. This paper aims to comparatively assess cascade funding initiatives against more traditional funding approaches as relevant alternatives for financing innovation. SMEs and start-ups most commonly fund innovative projects through business angels or venture capital. The disadvantages of risk capital include complex administrative procedures, loss of ownership and control over the strategic decision, etc. Other relevant funding is commonly sourced from private bank loans. In addition to discouraging bureaucracy, prior guarantee or collateral required, longer timing and extended terms, these investors are often reluctant to fund innovation due to their high risk. Preference is usually given to safer investments in which assets can be easily valued and sold in case of failure. In addition, financing opportunities from banks do not include an assessment of the return opportunities of innovative businesses. Out of the traditional schemes for financing innovation, cascade funding is a promising alternative, especially in highly innovative sectors. Cascade funding provides small grants issued by the beneficiaries of projects funded by the EC, typically under the Horizon 2020 (H2020) framework (>800 M€ allocated since 2014). As the EC delegates the selection and monitoring of innovative projects to consortiums, the funding is provided via open calls for proposals, which can provide start-ups and SMEs with grants for an experiment between €50,000 and €150,000. This mechanism also enables applicants to benefit from the technical and/or business expertise of leading European enterprises, universities and technology centres. While focusing on exploitable innovation, cascade funding has also proven to be a more agile financing method with respect to the classical ones. Here, DigiFed project is analysed as a Case Study for cascade funding, as it came to allocate over €3M via three open calls for proposals since 2020. Evidence of the advantages of this funding source for innovative businesses with respect to risk capital and bank debt is the core output of this paper.

Keywords: cascade funding, SMEs/start-ups, innovation ecosystem, innovation financing, DigiFed

1. Introduction

The European Union (EU) has set out innovation as a clear priority for the coming years, especially regarding the energy transition and digitalisation, while considering SMEs and start-ups as the main backbones with the potential to drive it. Nevertheless, they often fall behind when it comes to receiving financial support for their innovative projects since traditional funding mechanisms have been tailored to the specific needs of large companies, disregarding the particularities that innovative SMEs and start-ups entail. In this matter, a relevant research question arises concerning the current need for alternative sources of funding for SMEs and start-ups when developing innovation in contrast to traditional funding sources. Throughout the paper, key information on cascade funding as a potential source of funding for SMEs is retrieved from the experience of the DigiFed project, which was funded by the EC under the H2020 program. The ultimate objective of the paper is to discuss the effectiveness and advantages of cascade funding as a feasible and efficient alternative source of innovation funding for SMEs and start-ups. Firstly, innovation funding challenges will be outlined from a literature perspective, followed by an insight into the EU's priorities regarding innovation. Afterwards, the limitations and obstacles that start-ups and SMEs currently must face when seeking funding for innovative projects are presented. Indeed, traditional funding schemes favour big companies and disincentive the funding of innovation as it is usually riskier and harder to monetize in case of failure. By contrast, cascade funding is a realistic source of funding for innovative start-ups and SMEs that entails several advantages, such as less bureaucracy and greater efficiency, while enhancing collaboration and mutual learning between highly innovative European companies and research centres. The DigiFed case study is presented as a real success story of cascade funding in the EU projects framework.

2. Context

2.1 Innovation funding challenges

Innovation and entrepreneurship have been associated with funding needs from external sources since the early works of Schumpeter (Schumpeter, 1934). Modigliani and Miller (Modigliani and Miller, 1958) highlighted the lack of influence of the source of funding on investment decisions taken at the firm level. However, in the real world, asymmetric information between the actors providing funding (firm outsiders) and entrepreneurs (firm insiders) is the rule. Information asymmetry between outsiders and insiders leads to a "financing hierarchy" for firms *"in which internal funds have a cost advantage over new debt or equity finance"* (Fazzari, Hubbard and Petersen, 1988). The "pecking order theory" postulates that the cost of financing increases with asymmetric information. As *"management is assumed to know more about the firm's value than potential investors"* (Myers and Majluf, 1984), firms give priority to internal financing. When enterprises are small, young and innovative, asymmetric information is more severe and it affects the financing hierarchy until excluding access to specific external sources of funding and reversing the pecking order (Mina and Lahr, 2018).

In relation to SMEs, and regardless of their innovative component, they may encounter more obstacles when looking for funding compared to larger firms. This effect results from SMEs most likely being unlisted, not having clear track records or performing activities that are difficult to value, which are considered as risk increasing factors (Mina et al., 2021). Consequently, access to external capital is restricted and becomes only possible for SMEs if an extra premium is paid (OECD, 2018). As a result, some projects do not get to be funded, since enterprises might not have enough internal capital to do so (Cosh et al., 2009). In this context, innovation activities entail an additional set of obstacles (Coleman and Robb, 2012) since innovation investments usually imply a higher level of uncertainty and are often related to intangible capital, which tends to be easier to monetise. Thus, the innovative component implies an increase in asymmetric information between the enterprise and potential investors, which accentuates the enterprises' financial constraints (Bond et al., 2003).

Beyond the financial aspects, organisations must consider eventual technical and business support associated with the funds and how it complements the organisation's innovation strategy (Macher and Veledar, 2021). In addition, the question of integrity can be raised if there is a lack of shared values between the funding organisation and the funded enterprises, which is particularly coming into prominence with the rise of Society 5.0, where the economic advancement is balanced with the resolution of social problems (Gladden, 2019). To determine the suitability of the funding model, the funded organisation must consider its organisational design aspects, such as business models, structure, values etc. In an ideal scenario, a high level of information symmetry speeds up innovation through the funding mechanism and other forms of support.

2.2 EU priorities regarding innovation

From the First Framework Programme (1984-1987), research and innovation have been considered by the EC as top investment priorities. Nowadays Horizon Europe made available 95.5 billion euros over the period 2021-2027. Within H2020, the establishment of the SMEs Instrument and the introduction of a new type of action (i.e., innovation action) in the *Industrial Leadership* pillar and in the *Societal Challenge* pillar have widened the opportunities for European SMEs to fund their innovative projects. Horizon Europe has further improved these opportunities through the evolution of the SMEs instrument: the European Innovation Council (EIC) Accelerator.

Moreover, the Strategic Plan 2020-2024 issued by DG Research and Innovation includes several targets related to innovation in the General Objective 2 – *A Europe fit for the Digital Age*. Indeed, it sets that the EIC along with relevant clusters and a new wave of public-private partnerships will enhance innovative industries in all Member States, with special support to SMEs (EC, 2020). Furthermore, a third of the 1.8 trillion-euro investments from the NextGenerationEU Recovery Plan will fund innovative solutions in the European Green Deal framework and the Innovation Fund (European Commission, 2019) will provide around €10 billion in funding during the 2020-2030 period for commercial demonstration projects involving innovative low-carbon technologies. Furthermore, compared to the former mechanism, the EIC Accelerator introduced several changes regarding the application process and the type of funding offered for applicants. Data from the results of the first cut-off that took place in June 2021, to which over 2000 start-ups and SMEs applied for funding, was released last December. Out of all the companies that applied, only 65 were granted funding, 22 of them were enterprises in the health field, followed by Engineering and Technology (10 companies) and ICT (7 companies) (EIC Accelerator Data Hub, 2021).

The available data indicates that the success rate of the EIC Accelerator program is less than 3%, which evidences that it is not a reliable alternative for SMEs and start-ups seeking funding.

The prioritisation of the current EU innovation policies is set to accelerate the modernisation of relevant industrial sectors and to reach high exploitation levels through uptake and usage of innovative assets. The intention is to go beyond the classic view of innovation and the associated emergence of novel technologies and to reach higher societal goals by utilizing the innovation outcomes and their exploitation through novel business models. These activities are broadly supported by policies that enable and speed up the execution of the go-to-market strategies, especially for SMEs through cascade funding. The aim is to lift complete industrial sectors to a level that is appropriate for meeting social needs, expanding social relationships, and forming new collaborations.

2.3 Traditional funding schemes for small, young and innovative enterprises

Small, young and innovative enterprises face additional challenges when raising external funds due to their own structural characteristics, as they are considered riskier by providers of funding. First, they are at the early stages of the business and have no track records, reputation, cash flows or collateral. Secondly, innovation leads to something new on the market that can be disruptive and have a long-term impact on societies, as well as can be, a simple failure for the entrepreneur. As the ideas behind innovation are new by default, and often dependent on the adoption of advanced technologies, the assessment of the "goodness" of the enterprise and of the risk associated with a potential investment remains difficult for external investors to estimate and endorse. *"It is indeed well known that high-tech start-ups need large investments to initiate projects offering high potential but also high risk"* (Boccard, 2001). Hence, while innovation needs important investments (e.g., for applied research, testing, prototyping), the intrinsic uncertainty of any innovation directly affects the financial reliability of the enterprises that are promoting it. Indeed, *"…potential investors may shy away from the riskiness of supporting innovation and prefer to invest in routine production"* (Wang and Schøtt, 2022).

According to Rajan (Rajan, 1992), banks' debt, as an external source of financing, provides a concrete answer to the demand of enterprises. The focus is on the type of debt on which enterprises can rely according to the level of information shared: the *informed debt* or the *arm's length debt*. In the first case, banks take the role of investors willing to reduce the agency costs associated with the lending activities. The screening of enterprises and the threats to cut off credit in case of hasty investments are examples of ways that banks can use to reduce adverse selection (e.g., proving funds to the enterprises that prove to be more reliable) and moral hazard (e.g., proving funding to the enterprises for which they can control the investment strategy). Ex-ante sharing of (soft and hard) private information is needed for entrepreneurs to get informed debt. On the contrary, the arm's-length debt essentially relies on information on the enterprise that is essentially publicly available. The main difference between these two types for the entrepreneur lies in the debt cost: higher in the case of arm's-length debt due to its higher uncertainty for the bank.

The work carried out by Rajan (Rajan, 1992) highlights how the relevance of information sharing affects the costs of debt for an enterprise that needs external funding. When such an enterprise is small, young and innovative, its intrinsic features limit the entrepreneur's opportunity to share information in advance with the bank and its possibility to access funds (Petrella, 2001). Taking into account all the potential sources of funding for these enterprises, starting from Rajan (Rajan, 1992), Cavallini (Cavallini, 2002) distinguishes between *informed capital* and *not informed capital* arguing that the absence of ex-ante information to be shared with credit institutions creates information barriers that make risk capital the most suitable private source for funding innovation in the initial business phases (i.e. from the seed phase to the early-growth phase). In the last three decades, business angels and venture capitalists have demonstrated to be effectively informed actors for financing SMEs due to their better reactiveness and reduced asymmetry of information (Ueda, 2000).

In the seed phase and the start-up phase, the entrepreneur of an innovative firm owns the most complete information set about the innovation potential and the growth opportunities of the business. On one side, the entrepreneur can reduce the cost of funding and increase accessibility to funds by sharing information about its innovation, but on the other side, it may lose the competitive advantage in disclosing information that can be exploited by other entrepreneurs (Petrella, 2001). For this reason, entrepreneurs need trusted investors. Business angels are non-institutional investors that mainly support innovative ideas with a limited amount of capital and focus on the seed stage. The financing provided by venture capitalists (i.e., institutional risk capital

investors) usually addresses the most demanding funding needs of innovative firms already established and in the start-up and early-growth phases (Gompers, 1995). Economies of scale prevent venture capitalists to contribute to innovative firms at the seed stage, thus, leaving room for other sources of funding, including, among the private ones, business angels. Nevertheless, business angels' investments are increasingly also addressing the start-up phase (Lerner and Nanda, 2020). To the entrepreneur, both offer business governance competencies, management expertise and networks of contacts to favour the high growth of the business (e.g., clients and suppliers). Risk capital investors carefully select innovation projects to be sustained, based on initial evidence which may consider the innovativeness of the idea (e.g., through a business plan), the business opportunities on the market, and the entrepreneur's commitment (Fried and Hisrich, 1994). Risk capital investors have usually professional experience in business and in the sector of reference of the proposed innovative idea. These investors share the business risk with the entrepreneur and, consequently, apply a *hands-on* approach, but they also participate in the strategic decision-making process of the firm (e.g., selection of the top management), reducing the control of the entrepreneur on its own business (Lerner, 1995). Business angels and venture capitalists reduce the information asymmetries with the firm that they are funding, but also apply strategies to diversify the risk that they are facing. As the failure of the funded business is not remote, they are used to diversifying their investment portfolio and, in some cases, to sharing the risk of the same firm with other risk capital investors to reduce potential adverse selection problems (i.e., syndicate) (Lerner, 1994).

Although these mechanisms proved to be highly effective, information opacity of SMEs can be so relevant that adverse selection problems cannot be solved. Two are the main alternatives: the fragmentation of the risk among a huge number of private investors through, for example, equity crowdfunding (Yasar, 2021) or the establishment of approaches providing publicly funded informed risk capital relying on the assumption that any innovation provides a societal return in addition to the private profits for the entrepreneur. The cascade funding piloted by the EC in H2020 actions is an example of this alternative way to sustain innovative ideas.

3. Cascade funding key elements and benefits

Cascade funding is a specific mechanism that facilitates the delivery of public funds to smaller organisations, which are innovating in the fields that are considered to be of high strategic importance by the EC. The target organisations are predominantly SMEs and mid-caps that focus on digitalisation that can benefit, via open calls for proposals of grants for an experiment between €50,000 and €150,000 (typically corresponding to 70% of the total experiment cost). The financial support is usually equity-free.

One of the key characteristics of this mechanism is a simplified administrative procedure. That makes the scheme more attractive to smaller organisations that are normally not capable of handling high overheads associated with the administrative workload of public-funded projects, such as those funded by H2020 or the Horizon Europe framework programmes. The simplification is generally done by EU-wide collaborations across the network of Digital Innovation Hubs (DIHs) (Volpe et al., 2021) on behalf of the EC. These Horizon funded projects are empowered to issue open calls for funding and consequently monitor and control the cascaded projects. The relationship is built between the funded third parties and the funding consortia, hence keeping the administrative aspect of the Horizon framework at an arm's length from the small organisations. As funding consortia aim to leverage created solutions to generate assets suitable for industrial application, the focus is placed on successfully formulating and implementing go-to-market strategies based on expressed customer needs (Volpe et al., 2021). Hence, the funding consortia often offer exclusive technical and/or business support to aid the development and speed up the industrialisation process. It is the benefits brought by this cooperation that are often more advantageous than the financial aspect of typical funding activities. The key support activities include:

- Facilitation of the submission process and supporting the third-party candidates to formulate their projects adequately, hence indirectly providing a form of training in proposal preparation.
- Provision of constructive feedback resulting from the selection process, hence adding value to the applicants in terms of potential improvements on a technical basis, but also in terms of proposal presentation.
- Technical support through the project implementation phase.
- Practical innovation management and business development training and support throughout the project implementation. The aim is to secure the sustainable success of the generated assets in the post-project phase, which ought to be the target for each applicant, as it is an added contribution towards the existence of the company.

In the whole process, the consortia also act as liability buffers between the small organisations and the EC, as they are accountable for the performance of the third-party projects.

The potential drawback of the mechanism is that the open calls are generally very competitive. Also, some of the consortia and associated open calls address a rather niche industrial sector or request usage of specific technology that is not necessarily familiar to the prospective applicants.

Considering the number of cascade funding consortia and the funded third-party projects, the mechanism is already relatively mature, with continual cyclic improvements in progress. A case study resulting from the DigiFed consortia is presented in the next section. Since 2014 cascade funding has provided small grants under the H2020 framework for more than €800 M.

4. DigiFed case study

DigFed – DIHs federation for large scale adoption of digital technologies by European SMEs is a concrete case of a cascade funding project financed under the H2020 programme and kicked off in January 2020. The project forms part of the Smart Anything Everywhere (SAE) initiative aimed at testing innovative tools to support start-ups, SMEs and midcaps in terms of digitisation while fostering cross-border open collaboration with the support of DIHs (European Commission, 2018). Specifically, in the framework of DigiFed, three innovation funding pathways have been implemented i.e., Application Experiment (AE), Generic Experiment (GE) and Digital Challenge (DC). Under all the 3 pathways, financial support is combined with technical expertise provided by the partnering research organisations (RTOs) of the DigiFed consortium, and innovation management and business support.

AE pathway has been the main instrument for DigiFed implementation, as well as possibly the most classical one as it aimed at financing the initial prototyping of Cyber-Physical Systems (CPS) with up to €55,000 per applicant (typically corresponding to 70% of the total experiment cost). This instrument foresaw two applicant types. The TWIN AE enables 2 SMEs to jointly propose a project, while SINGLE AEs enable a single SMEs to seek the support of a selected DigiFed technical partner whose competencies and facilities are made available to the AE beneficiary. In both cases, beyond the most innovative (in terms of scientific excellence and market potential) prototypes, DigiFed also includes a mandatory requirement to establish cross-border collaboration among the partners. DigiFed has successfully launched 3 Open Calls for proposals for AEs, selecting for funding 46 AEs which involved 71 companies located in 23 EU and associated states, for an overall investment of €3.6 M. At the time of writing this document, approximately a third of the AEs have been completed. The final monitoring interviews of the completed experiments have so far generated positive feedback from beneficiaries. In particular, the trade-off between limited funding and contained administrative burden (both in the application and implementation phases) was appreciated, as well as the possibility to collaborate with the atypical partners, either referring to the cross-border peer collaboration or to the opportunity to collaborate with DigiFed technical partners (otherwise difficultly reachable).

The other funding pathway, GE, fosters collaboration among SMEs, Mid-Caps and DigiFed partners (GE owner) around the definition of a specific technical topic of investigation, creating thematic collaborative communities (supported with a small budget for participation expenses) and leveraging European and regional funding, where possible. In this framework, the community members have direct access to the GE owner technical experts, share their requirements and use cases and contribute to the technology roadmap of a leading research centre. This instrument proved to be very effective in attracting the interest of SMEs, in particular on secure Internet of Things (IoT), digital asset management, energy-efficient smart LED lighting and IoT for agriculture, and enable collaboration among them and with the GE owner. Overall, the four DigiFed GEs account for 51 members in 15 member states and leverage €280,000 of regional co-funding.

Finally, the DC pathway involves directly a major large enterprise (DC owner) with an unsolved need (challenge) that requires tailored prototyping. Once defined in its technical terms, the challenges (three in total) are promoted to prospective SMEs to be solved. Unlike a hackathon, in this case, the applicants are selected primarily based on their competencies, expertise and experience, in order not to disclose publicly sensitive details about the technical need of the DC owner. Yet, once selected, the beneficiaries are requested to prototype a very concrete solution tailored to the needs and requirements specified by the DC owner, which serves as an early adopter and accelerator of innovation within the SME itself. In this scheme, SMEs get access

to funding for the development of the prototype (50% DigiFed investment-50% DC owner), to innovation support (provided by DigiFed partners) and to pilot sites and specific information provided by the DC owner.

5. Conclusion

Accessing innovation funding still poses several challenges, most of them related to the asymmetric information between SMEs and firms, which commonly results in the former having to pay a prime to access the needed funding. However, the EC is aware of the relevance of innovation as the main driver to address its key priorities, such as digitalisation and energy transition, and the significant role that SMEs and start-ups will have. At the same time, traditional funding schemes have proven to have several shortcomings when it comes to funding innovative SMEs and start-ups, as their requirements do not typically match the situation of smaller companies, often having little or no experience in the market and developing products and services with a high-risk component. Hence, many such organisations limit their innovation scope because of an inadequate level of financial support. In this framework, cascade funding complements other possibilities, not necessarily excluding other forms of funding. In particular, the reduced administrative complexity, ability to retain equity, low level of interference in key strategic decisions, and invaluable level of cooperation that would otherwise not be reachable make this funding mechanism an attractive proposition for many smaller organisations. Cooperation is what drives the implementation of the go-to-market strategies and has the potential to speed up access to the markets and deliver improved final assets that are more likely to generate sustainable impact. Hence, cascade funding is a viable and efficient alternative innovation funding option for SMEs and start-ups that should be considered for adoption when experiencing funding needs for the development of highly innovative solutions. The three DigiFed pathways previously presented (namely AE, GE and DC) provide different options for innovative SMEs and start-ups seeking funding. The advantages of three DigiFed's mechanisms are:

- AE: prototype and cross-border collaboration with not traditional partners (going beyond own comfort zone)
- GE: to offer low effort-high level networking opportunities among peers and with the experiment owner
- DC: to provide funding for risky prototyping (highly innovative but very specific to a single client) and an opportunity to kick-start collaboration with major companies.

To sum up, cascade funding is a feasible and efficient way for SMEs and start-ups to access funding, as the DigiFed case study has proven. As stated above, it entails numerous advantages that make it suitable and appealing for young, small and innovative firms while in parallel enhancing collaboration and mutual learning between European stakeholders.

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