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FINANCE AND INDUSTRIAL DEVELOPMENT

HYBRID FINANCIAL INSTRUMENTS AS A STRATEGY TO INCREASE RISK/RETURN SHARING WHEN FINANCING INDUSTRIAL INNOVATION

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Abstract

The financing of innovative activities is an important part of the public policies related to the promotion of innovation, as a component of supply side incentives. It is motivated by private sector underinvestment in projects which are often long term and uncertain, and in many cases conducted by SMEs, which often cannot offer collateral and track record for standard bank loans. Public incentive also happens because part of the new knowledge will not be appropriated by the company as they may drive positive externalities that cannot be monetized privately. This research describes the use of hybrid financial instruments, mixing characteristics of grants, loans and equity, as a strategy to allow a higher degree of risks and rewards sharing when financing innovation.

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Abbreviations

ALADI	Latin American Association of Development Financing Institutions
Cleantech	Clean technologies
ICFC	Industrial and Commercial Financial Corporation
IDFC	International Development Finance Club
IPO	Initial Public Offering
NEFI	Network of European Financial Institutions for Small and Medium Sized Enterprises
POFI	Public Organisation Financing Innovation
R&D	Research and development
SME	Small and Medium Enterprises
TAFTIE	European Association of Leading National Innovation Agencies
TRL	Technology Readiness Level
USPTO	United States Patent and Trademark Office
VC	Venture Capital

1 Introduction

This chapter aims to expose how the study of financial instruments and the public organisations that deploy them is related to one of the core areas of innovation policy. It also creates a definition of a group of public entities whose outcome is partially or entirely targeted at financing innovation and begins to bring awareness on how the use of hybrids can be an alternative to increase risks and rewards sharing.

1.1 Supply side innovation policy

The study of public policies to improve the financing of innovation is relevant since this is a field where the private investment rationale may lead to under-investment, due to the nature of uncertainty and difficulty to appropriate returns (Hall 2002). Governments are interested in expanding economic growth, which comes as a result from private investments in new products and services, thus developing technology and innovation policy to support the entire system of actors that contribute to it (Lundvall & Borrás 2004). When this research mentions innovation policy, other instruments related to technology policy will also be considered, given potential overlaps; as an example both grants used to fund basic research in companies or equity which would support later stages will also be considered as instruments to finance innovation. Innovation policy instruments can be divided into supply side incentives ,i.e. increasing the supply of new innovations available, and demand side support ,i.e. increasing demand for new innovations (Steinmueller 2010). This research is interested in financial instruments to support innovation, which lie in the supply side and are often under represented as an object of study to explain or provide alternatives to successful innovation policies (Santarelli 1995). Therefore, the approach here is not to examine any policy to support innovation system as a whole, but the ones which directly supply finance for innovative companies.

As the government attempts to induce private sector innovations, it needs to consider its institutional arrangement to do so (Karo & Kattel 2015), in terms of public structures, including ministries, agencies and public banks; it also needs to assess the instrument mix that is offered, such as loans, grants, venture capital, among others (Borrás & Edquist 2013).

1.2 Public organisations financing innovation (POFIs)

The deployment of financial instruments to fund innovative business activities implies a whole range of considerations, such as size of companies, risk profile, sectors, distribution (whether direct or indirect, for instance), funding sources (public budget or market sources), legislation, among others. Given the need to access a huge number of clients with agility, while keeping a high level of accountability and transparency, direct administration is not the usual choice – this means that a Ministry (in the federal/national level) or a Secretary (in the State level) is more likely to use an agency, bank, public company or other institutional arrangement rather than implementing financial instruments directly. Therefore, the question of who funds innovation is a very important one as it largely impacts policy implementation.

The main organisations that usually support these activities are innovation agencies, which comprise a heterogeneous group of institutions (NESTA 2016). Development banks are also important as they

have recently shifted from an initial focus on industrial expansion and infrastructure (having project finance as one of their main financial instruments), to increasing investment in technological change and risk (Mazzucato & Penna 2015). Although these types of organisations may be partially referred to in the literature as “Development Finance Institutions”(UNIDO 2016), “State Investment Banks” (Mazzucato & Penna 2015) or “Public Finance Institutions”(OECD 2015b), they will be hereafter identified as Public Organizations Financing Innovation (POFI) as there is no other conventional acronym to denote public organizations in their specific aim to finance innovation. Although these are the two groups largely identified with deploying innovation policy, other actors were added in this research – government agencies, development finance institutions, public banks and funds to some extent also include the financing of innovation among their activities.

1.3 Financial instruments to support innovation

The development of innovative activities (thus including the whole innovation cycle since basic research, product development until commercial maturity) depends on the management of different types of risks – technological, market, regulatory and financial to name the most significant ones. A company cannot be sure whether its new products will be technically consistent and feasible, and it is not possible to predict how their customers, competitors and the regulatory environment will react; these combined risks lead to a very complex business plan development where not only the amount, but also the timeframe of earnings and expenses are very difficult to be calculated, which may expose the firm to inadequate funding options. This ultimately leads to an extreme variety of outcomes and therefore the question of what financial instruments are more adequate to fund innovation is very important.

Given the potential upside of government interventions to support innovation there is an increasing desire to share risks and rewards of public sector intervention (Lazonick & Mazzucato 2013). When indicating the types of financing for each development stage, there is a need for a balance between riskier capital and standard bank instruments; consequently a continuum of financial instruments is needed (Prakke 1988, p.107) and self-financing¹ mechanisms may be a better option to reduce risk and provide return to the funders (Fölster 1990; Cowling and Siepel 2013)

1.4 Motivations and paper structure

There are limited studies that cover innovation policy with an implementation focus at the level of the POFIs (NESTA 2016; Karo & Kattel 2015); additionally, the role of finance is commonly not used as a means to explain technological change and innovation, which is as important as the technology and market (Santarelli 1995; Prakke 1988, p.71). Additionally, there is also limited research on the role of mezzanine finance to support Small and Medium Enterprises (SMEs) (Benink & Winters 2016) It is a multidisciplinary field which comprises innovation policy and finance - each of these areas have their own vast literature, but the intersection between them is more difficult to find – as an example, two search queries (“*hybrid financ* innovation policy*” and “*mezzanine financ* innovation policy*”) in two

¹ These include equity, participating loans and other instruments where funded projects which are financially successful may provide a partial return to the funder, what contributes to the balance of the initial fund

relevant databases (Science Direct and Scopus) do not present papers with a similar concept of this research project²

This research intends to propose policy suggestions for public organisations in terms of how they should structure themselves as effective investors, who are willing to partner with businesses deploying a portfolio of financial support that shares risk and support the solution for society's most complex issues (Mazzucato 2016).

After this introduction, the next two chapters comprise a literature review concerning the main theoretical areas related to this research, with a deep analysis on the use of instruments to finance innovation and the perspectives over hybrids. Then follows a methodology regarding data extraction, a section with results and discussion and the last one concludes the document.

2 Policies for financing innovation

This section builds on how the complexities of financing innovation differentiate it from funding other activities, how it integrates to the theory on growth and entrepreneurial finance, and finally, what types of issues are faced by private lenders/investors that motivate public policies to provide additional funding.

2.1 Financing innovation

When businesses seek resources to finance their activities, they have to consider different sources depending on the risk profile (Frodsham & Liechtenstein 2011). As an example, financing a running commercial operation has a very different risk profile from doubling the industrial capacity of a firm. But even these different examples are similar because the company is not innovating – it is not trying to develop a new product or process, to limit to industrial sectors, or new services and marketing/business model taking into account the wider definitions of innovation in the Oslo Manual (OCDE 2005). This has an implication in the predictability and confidence on the information that is shared with potential funders – information asymmetries and uncertainty arise as the financial institution will not be able to assess the technological and market capacity of the firm and there will be no risk model to evaluate the rates of return and chances of default (Hall 2005). Although innovative activities can range from simple and more predictable incremental improvements to a complex research and development effort, this paper will include all of them when referring to the “financing of innovation”.

Kerr & Nanda (2014) argue that four aspects related to financing innovation put it in a different perspective comparing to other types of investments, making the source of financing and important element. The first issue is the uncertainty of innovation, which makes the evaluation of potential innovation projects a very hard task, and probably only achieved after the investment is done. The second aspect is the skewness of financial returns from innovative activities, which combined with uncertainty, increases the difficulty to evaluate projects on standard rules, relying on the judgement capacity of the intermediaries. The third point refers to higher agency costs since the funder may

² Considering the first 20 more relevant results of each research query

know more about the project capacity and will suffer to define a contract with strict terms. The fourth is the predominance of intangible assets in innovative activities.

2.2 Growth/entrepreneurial finance

An important distinction must be done between established and growing business, and this can even happen inside large corporations that are developing spin-offs or new business units. One important indicator that relates to it is the investment needed to innovate comparing to past years' turnover or the company's assets.

The concept of ISMEs (Innovative SMEs) indicates that the finance gap is more critical for this particular type of firm involved in complex technologies with untested business plans, in comparison with average SMEs (OECD 2006). It has also been claimed that innovative firms are more likely to be rationed both in debt and equity markets (Cowling & Liu 2017)

Innovation finance should be conducted as growth finance, because firms are not investing in risky projects to be kept in the same market position. Innovation seeks a shift in the company from stage A to B. The idea is that on stage B the company will have better products or margins, thus being able to demonstrate a stronger financial performance, but on a loan application this company will be assessed only by its past. Therefore, growth finance instruments applicable to intense innovative projects should be different than the corporate finance ones which could finance incremental innovation in a large corporation. In fact, innovative companies may have a gap exactly in the two of the most important elements for corporate finance lending, which would be collateral and track record (van der Schans et al. 2012). Innovative firms would often need a higher portion of funds in comparison with their turnover when comparing to a company running and growing steadily.

In the United Kingdom the 2009 Rowlands Review identified a funding gap in the supply of growth finance, suggesting mezzanine instruments as a possible solution (British Business Bank 2015). When comparing with the Pecking Order Hypothesis (Myers 1984), which states that the entrepreneur would always want to avoid dilution, starting with own resources, then debt and equity, growth finance would be a possibility of creating one more step before finally reaching equity. In fact, evidence that high growth technological firms are going from self-financed to receiving equity investment (Santarelli 1995, p.41) may not be a contrast to the theory or a praise to the equity mechanism, but a sign that debt operations must address these firms' nature.

This section gives theoretical background for including growth finance institutions targeted at SMEs into the POFI group. As a matter of research focus, the interest here is not restricted to SMEs, as the low end of the larger group of businesses can also face similar challenges, but they are very likely to be the ones in greater need for hybrid instruments.

2.3 Motivations for policy – funding gap and externalities

The structure and aims of innovation policy depend on the political objectives and context in which it is created. Policies can range from limited horizontal framework conditions set to enable competition to a more directed and ambitious strategy, which may include not only giving better competitive perspective for companies to innovate, but also supporting transformational changes (Lundvall & Borrás 2004). Therefore, governments need to assess their country's context and connect their innovation policy with the long term development goals in order to decide which level of

intervention to be used. One aspect that should be considered before the government establishes organisations and instruments to finance innovation is to evaluate the private financial sector capacity to do so. This is a rationale that led to several governments both in developed and emerging countries to nurture the Venture Capital sector, or to dispose guarantees (Cowling & Siepel 2013) to the private funding of innovative SMEs.

Private companies are assumed to underinvest in R&D (especially considering basic research and pre-competitive areas) because of three factors: appropriability (the research results can lead to private returns being outperformed by social returns, which cannot be appropriated), externalities (firms cannot fully capture the positive spill overs of their research) and indivisibilities (projects need to be done as a whole and their total time or investment to be efficient in scale may be too much for the private firm) (Santarelli 1995, p.220). The development of innovation requires a complex system of actors and support tools where supply side design plays an important role (Steinmueller 2010). One critical aspect for POFIs is the choice of instruments to support different stages of the innovation process, as Figure 2 exemplifies.

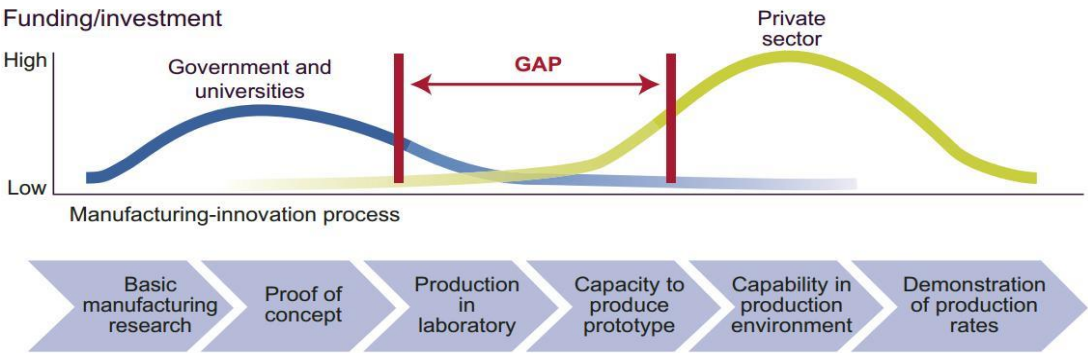


Figure 1. Funding / investment gap in the U.S. manufacturing-innovation process. Source: US. Government Accountability Office ³

In intermediary maturity stages business may underinvest due to the risks associated with innovation (Murray 1999), creating space for public support. Although a linear view of the innovation process does not properly represent the most recent research (Cantner & Pyka 2001), this simplification is used to support policy making as an example with TRL⁴ used as a linear framework (EARTO 2014). A similar exercise is used at a World Bank (2014) report, which separates three stages: knowledge creation and idea generation, prototype development and market demonstration, and commercialization and scaling up / replication.

The next figure presents another practical exercise of using TRL in innovation policy:

³ Available at <http://www.gao.gov/products/GAO-14-181SP>

⁴ TRL (Technology Readiness Level) is a concept created by NASA to classify technology developments in terms of their maturity from 1 to 9, being the highest ranks applied to projects where there are less technological risks and they are ready to reach commercial use (Mankins 2009)

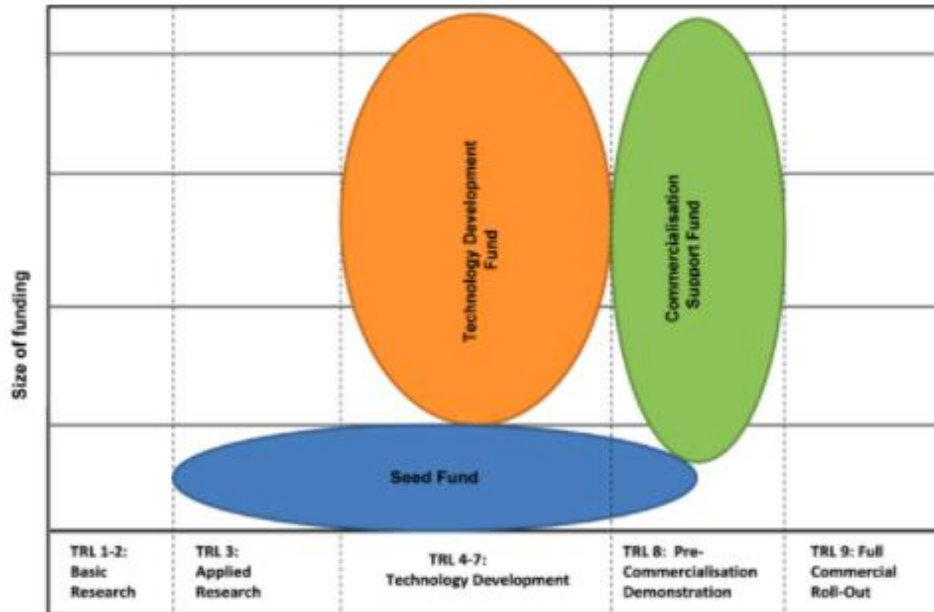


Figure 2. Use of the TRL framework to categorize financial instruments. Source: Technology Innovation Agency in South Africa⁵

The type of finance used depends on the stages of technological maturity, which can be Basic and Applied R&D, Demonstration, Pre-commercial, Supported Commercial and Commercial (Foxon et al. 2005). Whereas it is largely acknowledgeable that basic research needs strong government-backing and that later closer-to-market stages are more likely to find private funding, the intermediary phases, also named “death valley”, require specific attention (Bonvillian 2014). The market imperfections for financing risk ventures lead policy makers to create lending institutions that may address specific categories of borrowers (Hay & Morris 1979), thus it would be expected for a POFI to deal with this issue properly. Another concept used to make the case for policy to support innovative SMEs is the wall of debt which is, for example, experienced by German companies⁶.

A similar rationale to the relationship of financial instruments with project maturity may also be done in regards to the company development stage. Starting from the initial R&D and startup phases, then to growth and maturity stages, companies face different levels of uncertainty and demand for investments. Figure 3 indicates this relationship in a graph:

⁵ Available at: <http://www.tia.org.za/funding>

⁶ http://www.eif.org/what_we_do/resources/MDD/index.htm

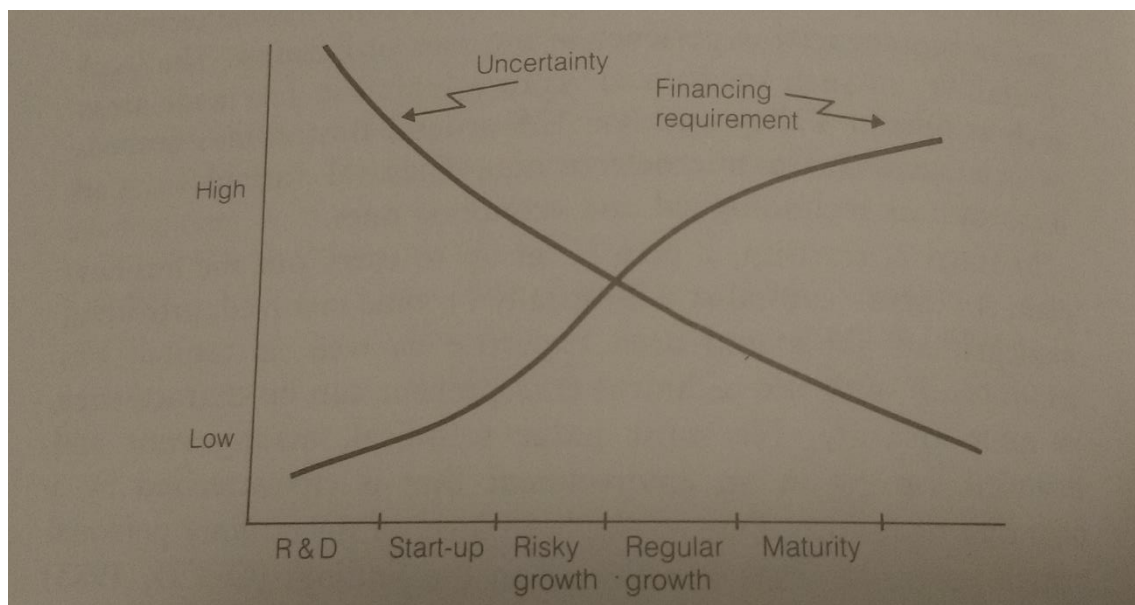


Figure 3. Level of uncertainty and financing requirements over the stages of firm development. Source: (Prakke 1988, p.82)

Therefore policies for improving the financing of innovation are developed by the government as a means of tackling market underinvestment (which would exist because externalities cannot be fully appropriated and asymmetric information increases agency cost) and also performing its role as a coordinating agent in the innovation system (World Bank 2014).

Policies that addressed this funding gap go as long as the early 1930s where the Report of the Committee on Finance and Industry (known as Macmillan committee) found a perceived failure by banks and capital market to supply long term funds to industry, especially small and medium sized (Cooley & Clarke 1995, p.8). This gap was further addressed with the creation of the ICFC⁷ in 1945.

3 Review on financial instruments

The main financial instruments used to fund innovative activities are compared to hybrids and other alternative mechanisms in terms of their risk sharing capacity.

3.1 Risk/return sharing of the current main instruments

This section assesses the main instruments used to finance innovation according to their capacity to share risks and rewards of the projects funded. This is an important feature as it creates an incentive for riskier and more impactful innovation alongside with providing direct returns to the funder, which can reinvest the resources (Lazonick & Mazzucato 2013).

⁷ Industrial and Commercial Financial Corporation, currently 3i

3.1.1 Grants

Grants are non-refundable resources directed to research institutes or companies, which have a higher public cost when comparing to other instruments (Sonnenschein & Saurabh 2013; Ruester & Olmos 2012). Grants have a very important role on supporting very high risk projects, but they put a significant pressure in public budget – as an example, Innovate UK is going through a process of replacing grants with other innovative finance products such as the Israel Innovation Authority, which deploys repayable grants which now comprise up to 30% of their budget (Glennie & Westlake 2016). UK Government officials were concerned about the need for taxpayers to be repaid in case of successful projects⁸

3.1.2 Loans

Subsidised asset based loans⁹ are an important instrument deployed by POFIs as it allows for higher leverage of private resources when comparing to grants, puts less pressure on public budgets and its operation can be standardised while the risk is managed by collaterals. However, asset-backed loans are not adequate to deal with the intangible assets usually associated with innovative companies (Goodacre & Tonks 1995). And, most importantly, there is no risk sharing – both previous financial track record and collateral are used as a source of risk management (Lee & Brown 2016).

Consequently, a limited number of companies are granted loans, mostly for incremental innovation projects¹⁰. Although a very important instrument, it should not comprise such a huge part of the portfolio of a POFI. They are hardly accessed by early stage companies and may present less favourable terms when comparing to equity (Koester 2011, p.92), which indicates that for companies at this size the usual Pecking Order is less likely to be followed (the theory indicates debt financing before equity) (Myers 1984).

To provide funds via asset-based loans means simply squeezing value of a tangible asset, instead of understanding and assessing the proposed business model (Brown & Swersky 2012). An alternative would be using intangible assets as collateral – recent experiences have happened in Singapore¹¹, Israel (as profiled in section 6) and the USA, where 16% of the aggregate stock of patents in the USPTO (United States Patent and Trademark Office) has been used as collateral, and companies whose patents are used to secure loans represent 40% of USPTO since 2003 (Mann 2014).

⁸ <http://www.sciencecampaign.org.uk/news-media/guest-blog/what-does-the-future-hold-for-innovate-uk.html>

⁹ The most recent annual report (2015) indicates that more than 90% of Finep disbursements to support corporate R,D&I was made through loans, the rest divided in VC and grants. Portuguese only version available at <http://www.finep.gov.br/aceso-a-informacao-externo/transparencia/114-relatorios/relatorios-de-gestao/4975-prestacao-de-contas-2015>

¹⁰ The same report also indicates 386 loan operations from 2012 to 2015, and most of them are large companies

¹¹ The Intellectual Property Financing Scheme provides loans backed by patents. <http://www.channelnewsasia.com/news/singapore/singapore-approves-first-loan-application-using-ip-collateral-7966928>

Nevertheless, even when using intangible assets as collateral, debt finance was acknowledged as not having a reasonable risk-reward balance¹²

3.1.3 Equity

Equity is deemed as the most effective instrument for Venture Capital funds due to its intrinsic nature of sharing risks and rewards, with no pressure on the cash flow for the early stages of the recipient (Sahay & Sharma 2008, p.253). Venture Capital could be an alternative to conventional loans when risk sharing is targeted – it funds ventures in different stages (from seed to later stages) in exchange for a percentage of the company’s shares, which will later bring the investment back in a liquidity event as a sale or IPO¹³ or/and through dividends (EVCA 2007). Therefore, there is a large component of risk sharing, since the funder becomes one of the company’s main shareholders (although usually without a controlling position) and its financial return is related to the company’s results.

However, some drawbacks shall be noticed. Firstly, a POFI is limited on offering what is the key benefit of a VC investment, which is management expertise and networking – as a public organisation, it may lack the market experience that a private VC manager would provide (Lerner 2013). As an alternative to the argument above, the government can invest in funds, in order to build on their experience, or compose hybrid public/private funds (NESTA 2009) – but this is limited by short termism and exit strategies that may differ (Goodacre & Tonks 1995; Hall 2005). High management costs limits its scale, being available to a limited number of companies (Frodsham & Liechtenstein 2011; Murray 1999). In some specific sectors, such as Cleantech, the VC model of rapidly scalable business with limited capital requirements does not fit properly (Gaddy et al. 2016).

According to Nightingale et al. (2011), VC is specialised, meaning that very few sectors are targeted by the firms (such as ICT or online services); this makes a more complicated case for other important capital intensive sectors such as energy, manufacturing, life sciences, which are very important for economic development. It is also skewed, which means putting a huge pressure into one or two cases to balance the other losses. (Pisano 2010) argues that although venture capital is of the most appropriate funding instrument for young innovative firms, its timescale and investment diversification (capping the investment for each firm to compose a portfolio) limit the capacity to invest in science-based industries.

3.2 Hybrid instruments

3.2.1 Definitions

The limitations outlined before for the mainstream instruments can be eventually softened with the use of alternatives that stands in an intermediate position between pure debt or equity, such as quasi-equity or mezzanine finance (EVCA 2007; OECD 2013). The term “hybrid” will be used to refer to the different types of instruments associated with quasi-equity, mezzanine finance and others

¹² <https://www.ipos.gov.sg/growing-your-business-with-ip/funding-assistance>

¹³ Initial Public Offer

which share debt and equity capabilities¹⁴ (Khan & Jain 2007, p.20.1), as they can be seen in Figure 5. In lack of a common definition, mezzanine may define a variety of hybrid, flexible financial instruments between pure equity and pure debt (OECD 2014). Other names currently used are hybrid securities, layered capital, blended finance, quasi equity, equity-like debt.

Low Risk/ Return	Low Risk/ Return	Medium Risk/ Return	High Low Risk/ Return
Asset-Based Finance	Alternative Debt	"Hybrid" Instruments	Equity Instruments
<ul style="list-style-type: none"> • Factoring • Leasing • Purchase Order Finance • Warehouse Receipts 	<ul style="list-style-type: none"> • Corporate Bonds • Securitised Debt 	<ul style="list-style-type: none"> • Subordinated Loans/Bonds • Silent Participations • Participating Loans • Profit Participation Rights • Convertible Bonds • Bonds with Warrants • Mezzanine Finance 	<ul style="list-style-type: none"> • Private Equity • Venture Capital • Business Angels • Specialised Platforms for Public Listing of SMEs • Equity Derivatives

Figure 4. Alternative Financing Techniques (OECD 2013)

Hybrids fit a need to balance risk capital and traditional instruments to provide funding for innovations (Prakke 1988). They are also self-financing* mechanisms which can be a better option to reduce risk and provide return to the funders (Fölster 1990). In fact, it is expected that if the government spends public resources to take more risks while pursuing the public goods associated with innovation, it should also have mechanisms that allows it to reap the returns on the successful projects, which can later be used to fund other initiatives (Lazonick & Mazzucato 2013). As indicated in Figure 5, hybrids appear to be an option to mitigate the most critical issues related to debt and equity – as an example, it can avoid the tough collateral request from debt instruments at the same time it does not require the funder to be a shareholder.

¹⁴ An interesting description is available in this factsheet elaborated by the Financial Instruments Compass, and institution managed by the European Commission and the European Investment Bank, available at <https://www.fi-compass.eu/sites/default/files/publications/ESIF-factsheet-FI-products.pdf>

	Senior debt	Mezzanine	Equity
Economic perspective	Debt	Equity	Equity
Legal perspective	Debt	Debt	Equity
Ranking	Senior	Contractually subordinated	Junior
Taxation	Debt interest deductible	Debt interest deductible	Tax on capital
Covenants	Comprehensive restrictions	Tracks senior, but looser	None
Security	Yes -1 st ranking	Yes -2 nd ranking	No
Investor's involvement in management	No direct involvement	Moderate involvement; board seats	Direct involvement
Purpose	Contractually specified	Not specified	Not specified
Term	4-5 years	5-10 years	Open ended
Interest Costs	Cost of funds + 255-350 basis points	150-300 basis points above senior	None
Repayment	Amortizing from cash flow	Bullet* upon exit or at maturity	None
Warrants	None	Almost always	None
Total Expected Return	5-13%	13-25%	>25%

* The payment for the principal is not made over the life of the loan, but rather as a lump-sum payment at exit or maturity

Source: adapted from Credit Suisse (2006).

Figure 5. Comparison of mezzanine finance and other financing techniques (OECD 2013), adapted from Credit Suisse (2006)

Convertible grants

Although hybrids are more commonly seen in the form of mezzanine instruments combining debt and equity, grants can also be part of it, mixing with both debt and equity features. For instance, grants can be given in exchange of a stock option that can be exercised should the value of the company rise significantly. Large firms who may receive grants for just part of their projects' portfolio may create separate ventures to segregate this stock option from the overall company. The next quote synthesizes a key advantage of mixing a non-repayable finance with other options that can allow for reaping the rewards, such as equity:

"If they put all this effort into screening applicant companies and then grant them significant amounts of money, why shouldn't they also take a share in the companies? Just one great success story could pay back a whole annual budget of the scheme." (Sonnenschein & Saurabh 2013)

3.2.2 Taxonomy

The three main instruments to finance innovative business discussed in section 1.3 can be combined in different arrangements and be used as hybrids. These combinations would usually start as one single instrument but with the capacity of turning to another characteristic depending on a specific event happening during the contract term. In some of the cases a hybrid instrument can be used entirely as a single standard mechanism, in case the event does not happen.

Starting as	Becoming	Names	Event	When it is used
Grant	Loan or Equity	Convertible	Project resulting in sales	Funder reaping rewards of successful

		grant		projects
Loan	Grant	Conditional loan	Project not succeeding due to agreed reasons (commercial, technical failure, but well executed)	Support riskier innovations. It can work as an individual grant component or a portfolio tolerance
Loan	Equity	Mezzanine finance	Reach a defined valuation or other milestones	Equity can balance a initial riskier debt (less collateral, for instance)
Equity	Loan		Exit	When a profitable exit is not possible payback can be arranged by loan
Loan/equity	Loan/equity		Specific loan / equity schemes defined initially	When a mix of return payment schemes are necessary to deal with uncertainty

Table 1. A macro taxonomy of hybrids depending on the combination of grant, debt and equity. Source: author's elaboration.

When opening the full spectrum from “pure” debt (senior) to “pure” equity, there are several intermediate possibilities as subordinated debt, soft loans, preferred loan stocks. Since there is significant variety of instruments and mechanisms that would fall in this category, the following taxonomy can be useful for aligning them in two axes: the vertical goes from more debt-like in the top to more equity-related features in the bottom; the horizontal groups the mechanisms in terms of categories, which are often represented in the same level in other literature (e.g. mezzanine finance and subordinated loan, but the latter is part of the first). The European Commission acknowledged the need for more clarity in terms of the classification of mezzanine product, which eases the process of SMEs choosing them (European Commission 2014)

Category	Mechanism	Risk sharing	Brief description
Debt	Senior loan	Collateral, track record	Standard secured (asset-backed) loan
Higher risk debt	Senior unsecured loan / cash-flow loan	Track record	Senior loans issued to high creditworthiness companies
	Catalytic credit enhancement ¹⁵	Externalities / impact	Loan guarantees, First loss loans (OECD 2014)
	Step-up rate loans	Growing interest rate	Interest rates grow in stages (as a step curve)
	Pay-in-kind (PIK) notes	Increasing debt	Allows the company to avoid using cash to pay interest and then paying the same amount into new debt
	High yield loans/bonds	Higher interest rate	High paying bond from a low credit rating company (as a startup or a capital-intensive firm)
	Second lien debt	Higher interest rate	Type of loans that stands in the middle of senior and subordinated loans ¹⁶
Revenue	Subordinated loan	Higher interest	Ranks lower than senior debt and is often not 100%

¹⁵ <https://thegiin.org/assets/documents/pub/CatalyticFirstLossCapital.pdf>

¹⁶ <http://www.internationallawoffice.com/Newsletters/Securitisation-Structured-Finance/Canada/Blake-Cassels-Graydon-LLP/Distinctions-between-Cash-Flow-Second-Lien-and-Mezzanine-Debt>

based finance		rate / Revenue Participation	collateralized, but in turn the interest rates are higher and participates in the upside of the project ¹⁷
	Conditional loan	Revenue participation	Paying back according to the turnover, a true concept of sharing risk and reward (Sahay & Sharma 2008)
	Option-linked (or index-linked) bonds	Revenue participation (derivative)	Payback is paid as a derivative from the underlying equity (price of a commodity that affects a company)
	Income notes	Royalty participation	Combines conventional and conditional loan (both interest and royalties are paid) ¹⁸
	Royalty / IP based	Royalty participation	Royalty investments are repaid as a percentage of each new product sold (Flip Finance 2017)
	Revenue/profit participation agreement/rights	Revenue participation	A contract that entitles the funder a fixed participation in the investee's revenues, forming a clear sharing of risks and rewards of the investment (Venturesome 2008).
	Participating loans	Revenue participation	A loan that entitles the holder a share of the company's turnover
	Participative debentures	Revenue participation	Allows the holder for a mix of interest rate (as a standard debenture) with a component of profit participation
Possibility of equity	Equity kicker	Equity option	Give the lender option for ownership as a trade-off for higher risk assumed
	Bonds with warrant	Equity option	Allows a holder to buy shares at a set price
	Convertible loans/bonds	Equity option	Allows a holder to trade the bond for shares
	Silent Participation	Limited liability equity	Investor's liability limited to the capital invested and do not involve management support to the company
	Preferred shares	More liquid equity	Investors are paid before common shares holders and have more guarantees on dividends (although fixed)
Equity	Ordinary / common shares	Equity	Owners are the last to be paid and have less guarantees on dividends (but variable rate)

Table 2. A Taxonomy for Mezzanine Finance types of hybrids Sources: Author's work, partially adapted from (Giurcă 2007) and (Nijs 2014), Investopedia.

Figures 6 and 7 present previous works that provided elements to the elaboration of Table 2.

Company balance sheet		Financing instruments
Assets	Equity and liabilities	
Current assets	Liabilities	- Bank loans
		- Bonds
		- Supplier credits
		- Customer advances
		- Subordinated loans

¹⁷

<http://www.dbsa.org/EN/About-Us/Publications/Documents/Project%20finance%20and%20obtaining%20sufficient%20funding%20for%20the%20successful%20completion%20of%20your%20project.pdf>

¹⁸ <https://pt.slideshare.net/soumya6045/venture-capital-64317698>

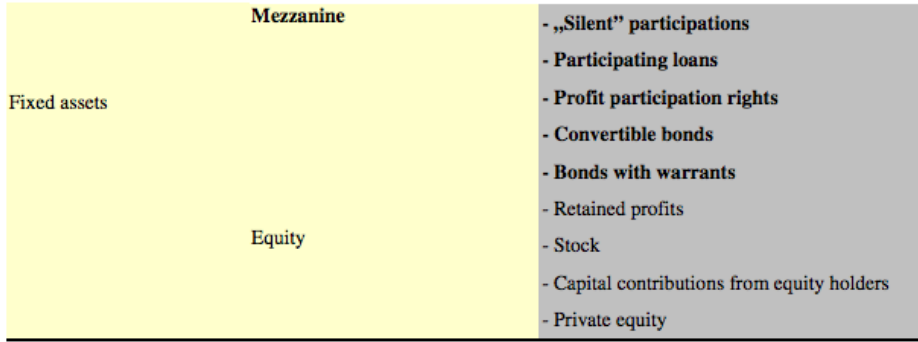


Figure 6. Position of mezzanine in terms of the company balance sheet (Giurcă 2007)

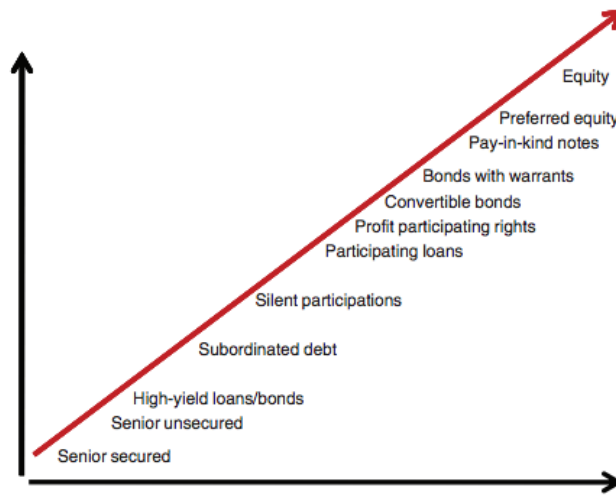


Figure 1.2 The risk–return paradigm
 Source: Adjusted from CS economic research

Figure 7. The risk-return paradigm. Source: (Nijs 2014, p.11)

3.2.3 Examples of hybrids use

This section contains examples of different pieces of literature that recommend or praise the use of hybrid financial instruments to finance innovation, and are important to answer Research Question 3.

A study on the challenges of funding high risk biopharmaceutical products issued a clear recommendation on the use of mezzanine finance as an interesting alternative to bank loans and venture capital (European Commission 2009). A KfW research indicates that this instrument is important to fund activities that would not provide collateral for a bank loan, such as research and development investments, while it also avoids gaining a healthier debt/capital ratio by opening up capital to foreign investors (KfW 2004). In the UK the ICFC¹⁹ expanded its support to SMEs using mezzanine instruments, mixing debt and equity (British Business Bank 2015).

¹⁹ Formerly Industrial and Commercial Finance Corporation, currently 3i

The United Nations Industrial Development Organization acknowledges the fact that development banks use hybrid instruments when supporting SMEs due to their nature (UNIDO 2016). The MTA report on Advanced Manufacturing recommended developing mezzanine finance as one of the key actions to enhance competitiveness in high tech SMEs, because of its intermediate position between lower risk and return of bank operations and the high risk, high return and share diluting context of VC (MTA 2012) . In a sample of 3,083 Canadian corporate and limited partnership venture financing transactions from 1991 to 2000, 30.5% of the mechanisms used were hybrids (convertible debt, convertible preferred equity and preferred equity) (Douglas et al. 1998).

Mezzanine Finance is a source of funding more likely to be used by companies who had received Venture Capital or other previous investments and are more established (Yerramilli 2005). A study on public financial institutions and the low-carbon transition acknowledged junior debt and mezzanine financing as tools to promote risk sharing and contribute to private capital mobilization (OECD 2014), alongside with loan underwriting, specialized fund structures and first loss provisions. (Santarelli 1995, p.148) recommends royalty R&D partnerships, where equity investors can receive cash returns as soon as the company sells their products, independently from having profits or being sold with an increased value.

The next two figures indicate example of hybrids in the portfolio of financial institutions that supports innovative companies and can be used as an example of their integration between other instruments in a portfolio.

EIB Group Products for SMEs and Midcaps



Figure 8: European Investment Bank and the use of hybrids. Source: EIB²⁰

20

Available at http://www.eib.org/attachments/general/events/20150227_innovfin_portugal_caldeira_bruhn_leon_lopes_en.pdf

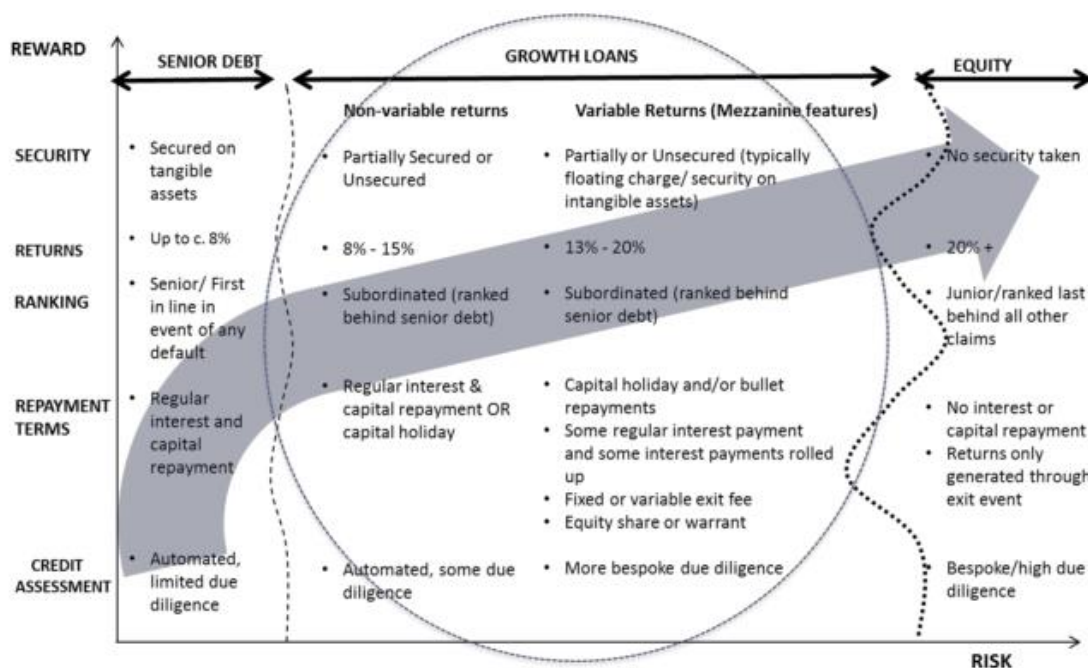


Figure 9 – Use of hybrids in the British Business Bank. Source: (van der Schans et al. 2012)

4 Methodology

As explained in section 1.4, this research is designed to indicate evidence of hybrid instruments in use and eventual policy implications for them to be adopted by other POFIs. Both the object of study (hybrid instruments) and the target audience (POFIs) are rather fluid concepts with limited available research and public information on them, therefore it requires an attempt to cover a shallow superficial aspect of the whole spectrum before any deep diving is executed to process information with more detail. In other words, nor there is an organised list of POFIs neither a systematic overview of hybrid instruments and their use for the object of interest in this research (the financing of innovation). The research questions are:

- (i) “Are hybrid financial instruments being used by POFIs to finance innovation?; How different POFI categories use these instruments?”
- (ii) “If so, how representative are they in the portfolio? What is the trend?”
- (iii) “Are they increasing the risk/return sharing when comparing to traditional instruments (grants, loans and equity)?”;
- (iv) “What would be the best strategy to implement them in other POFIs?”.

Since this research was subject to limited time resources and capacity to cover an exhaustive list of POFIs, a final number of 90 was reached after an iterative approach of collecting different sorts of references (from academic papers to surveys, reports, newspapers).

A similar approach was used in terms of the transversal attempt to find hybrid instruments in the target audience described before. Since there is no database that extensively covers the use of hybrid for the financing of innovation, the strategy was rather using a broad definition and collecting at first any weakest evidence of hybrids in these organisations. This could range from a clear use of hybrids confirmed by academic research or reports, or an indication of a specific product or webpage section describing the instrument, to a quick description of the use of mezzanine elements without further details.

Once a superficial coverage of the spectrum was executed, the next strategical decision was to conduct short case studies that could provide a profile with qualitative characteristics of these instruments. The decision on the number of cases was also made iteratively because it depended on the information made available in the initial screening, the acceptance rate of participants balanced with having enough qualitative material that would contribute to the research analysis.

Primary data was collected from individual semi-structured interviews with the use of questionnaires. Secondary data was extracted from academic research and grey sources such as company reports, innovation policy surveys or policy reports. The primary research activities were approved by the School of Business, Management and Economics Ethical Review process.

4.1 Initial screening

The initial source of research was the theoretical total population of POFI (**Group A**). This is naturally a population that would not be possible to address in this research, because it is uncertain (there is no official number of such organisation) and large (although not certain, it is possible to estimate over 300 organisations with a simple rationale of half the countries in the world having at least three POFIs). Therefore, a workable and relevant but non-exhaustive (90 organisations which are part of the main associations, such as TAFTIE or IDFC – this is equivalent to 30% of the estimated number of innovation agencies and development banks) sample of POFI (**Group B**) was designed as the initial list.

From the workable sample of POFI (**Group B**), the following categories were used to rank the organisations in terms of the range of instruments used:

Category 1: Strong evidence of using hybrids - at least one dedicated hybrid instrument (referrals in third party studies and/or the existence of a specific product in the portfolio)

Category 2: Weak evidence of using hybrids - at least one mention of having hybrid instruments or other mechanisms with hybrid characteristics (hybrids use mentioned in the website or a third party reference but without indication of a dedicated instrument)

Category 3: Use of guarantees – they are not the object of the study, but they may stand in the range from full secured senior loans and a typical mezzanine instrument

Category 4: Usual instruments (loans, grants, equity)

Category 5: Not Applicable (organisations that do not support innovation, only grants for research institutions, etc.). The decision to keep this group in the database was to strengthen the number of organisations assessed

This made possible the creation of a sample of POFIs with at least one hybrid instrument (**Group C**), which was used as a source of organisations that would receive invitations to the case studies. As this list was larger than what would be initially thought, and there would be no available time and resources to send and manage invitation for all of them, and even more importantly, to eventually manage a very high number of cases, the invitation was sent to a partial number of Y due to convenience and respecting each group's representativeness (avoid sending only to innovation agencies or only European organisations). More information on the analysis of the subcategories of **Group C** is available at section 4.

Finally, a **Group D** comprised the organisations that accepted to participate in the case studies section of the research and reflect, as expected, a profile of institutions more similar to Finep where the author's contacts could be more effective (this explains why most of the POFIs in this group are innovation agencies).

Expected analysis outcome	Analysis	Sample / sources
- Evidence of the use of hybrid instruments in POFI	- % of POFIs that use at least one hybrid instrument	- Secondary research in academic papers, reports, surveys and websites

Table 3 – Initial Screening

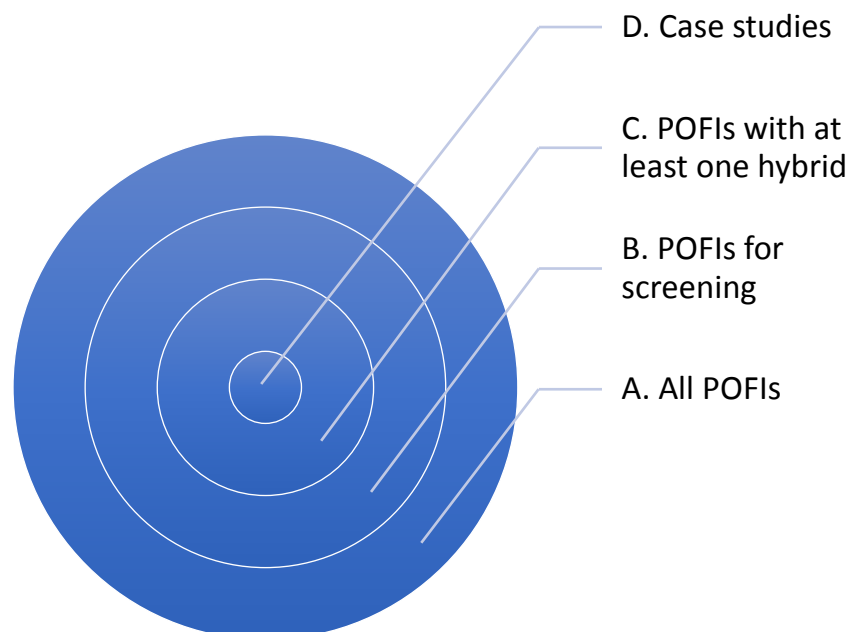


Figure 10. Graphic demonstration on how different groups of POFIs were used in the research

4.2 Case studies

The qualitative study comprises a short case study with 11 organisations selected from the previous quantitative assessment. They were all part of category C, as explained in the last section, and result from a mix of availability of contact, representativeness in different groups, interest and time disposal of the interviewees.

The short case study was conducted with the support of a questionnaire, and the table below indicates the main outcomes expected from this part of the research, the analysis conducted and the sources of information used.

Expected analysis outcome	Analysis	Sample / sources
<ul style="list-style-type: none"> - relevance of current hybrid instruments in POFIs' financial instrument portfolio - indicate most relevant hybrid instruments in place - portray their positive and negative aspects - suggest policy implications 	<ul style="list-style-type: none"> - percentage of hybrid instrument use (in terms of overall disbursements) - describe instrument operation - expose types of incumbent firms - indicate financial model 	<ul style="list-style-type: none"> - case study with 11 instruments/organisations highlighted in the previous analysis - secondary data and interviews

Table 4 - Qualitative analysis

5 Results and Discussion

5.1 Initial Screening on POFIs using hybrids

5.1.1 From Group A (all POFI) to B (workable sample)

The first step on creating a working sample is to define what sort of organisations finance innovation, in the terms defined in section 1.1 and 1.2. As introduced in the methodology section, since there is no research or report available that would present a list of POFI that are using hybrid instruments, an initial list was built based on associations; some of the sources are described in the table below:

Types of POFIs	Associations	Number in the workable list
Innovation Agencies	TAFITIE (Association of Leading National Innovation Agencies)	25
National Development Banks	ALIDE (The Latin American Association of Development Financing Institutions),	25
Multilateral Development Banks		12
Public Banks, Funds and Agencies	Network of European Financial Institutions for Small and Medium Sized Enterprises (NEFI)	15

International Development Institutions	IDFC (International Development Finance Club), EDFI (European development finance institutions)	13
TOTAL		90

Table 5 – Mains sources of POFIs

It was important to observe that the POFIs listed represented a balance between different regions of the world and country development stages²¹, to avoid a bias in the analysis.

5.1.2 From Group B (workable sample) to C (POFIs with at least one hybrid)

Once a sufficiently robust list of POFIs was developed the next step in terms of the results was to find how these organisations would fit in the four categories of hybrids use (section 4.2).

Types of POFIs	Total	Category 4+	Category 3+	Category 2+	% Category 2+ / 4	Category 1
Innovation Agencies	25	22	5	6	27%	5
National Development Banks	25	20	18	17	85%	5
Multilateral Development Banks	12	12	10	10	83%	5
Public Banks, Funds and Agencies	15	14	12	12	86%	4
International Development Institutions	13	13	13	13	100%	1
TOTAL	90	81	58	57	70%	18

Table 6 – use of hybrids in different categories of POFIs

It is important to notice that this research did not find evidence of hybrids use in Categories 3 and 4, but it does not claim that these organisations do not use hybrids at all, since (i) the secondary research may have missed information and/or (ii) these organisations can internally use hybrid elements without noticing the fact publicly.

As for the interest group of this research (Categories 2 and 1), the analysis indicates that a large number of POFIs (57) is using hybrids, independently from the level of evidence found. It is worth highlighting that the hybrids use level is above two thirds in most of the groups, with the exception of innovation agencies, at 20%. This can be explained by these organizations having more possibilities of using grants, eventually their entire budget, and also less experienced with business sectors and being managed as a financial institution (that would have more expertise on different financial instruments). However this can be changed in the future as there is more pressure to move away

²¹ According to the World Economic Situation and Prospects 2017 – United Nations

from grants to more sophisticated instruments with participation in results, as with the Innovate UK (Glennie & Westlake 2016)

Development status	Percentage of hybrid use
Developed	69%
Developing	52%

Table 7. Hybrid use in terms of each country's development stage

As expected due to the complexity of the instrument and the need of a mature financial and business market to operate them, this sample indicated a higher use of hybrids in developed countries, although no further statistics analysis was conducted because of the nature of this research paper.

5.1.3 Overall use of hybrid instruments

Apart for providing a rationale for the selection of companies that would be profiled in the case studies section, this screening provided relevant information about the use of hybrid financial instruments in POFI. The most important outcome expected was answering Research Question 1:

Research Question 1: "Are hybrid financial instruments being used by POFI to finance innovation?"; How different POFI categories use these instruments?

ANSWER: 70% of the POFI assessed in secondary research present evidence of using hybrid instruments

This is a relevant figure and brings new knowledge on the use of these instruments to finance innovation. It is important to add that all the POFI categories showed evidence of using hybrid instruments, with the smaller percentage on innovation agencies, and hybrid instruments appeared relatively more in developed countries.

This can be compared to a global survey of development banks indicating that 25% of them offered unsecured loans for intangible assets, and 73% offer loan guarantee products to support private lenders to bear specific types of risks (de Luna-Martinez & Vicente 2012). The analysis of this part of the research presents a new and detailed picture of the use of hybrid instruments in POFI, which will be added with the qualitative profile of selected instruments in the next section.

5.1.4 Identified products / instruments

From the group of 57 POFI were at least weak evidence of hybrid instrument was found, in 18 cases it was possible to identify a specific product or instrument that could be classified as hybrid. As indicated in the methodology, the strong evidence was the indication of a specific product in the website or a referral in an external research or report. The following list present the hybrid instruments encountered:

Category	Name	Mention in external research or report	Specific product or fund
Innovation Agencies	CDTI		Partially refundable loan
Innovation Agencies	Innovation Norway	(OECD 2013)	Innovation Loan
Innovation Agencies	Israel Innovation Authority	(NESTA 2016)	Conditional grant
Innovation Agencies	TeKes		Convertible loans (R&D loans)
Innovation Agencies	TIA		Risk Funding Schemes
National Development Banks	BNDES		BNDES THAI
National Development Banks	BPI France	(British Business Bank 2015)	Prêt participatif de développement Innovation
National Development Banks	Business Development Bank of Canada	(OECD 2013; British Business Bank 2015)	Growth & Transition Capital
National Development Banks	KfW Bankengruppe	Mezzanine Product Family	ERP Mezzanine Finance for Innovation
National Development Banks	Small Industries Development Bank of India (SIDBI)	(UNIDO 2016, p.32)	Growth Capital and Equity Assistance
National Public Banks	ALMI	(OECD 2013)	Innovation Loan and Growth Loan
National Public Banks	British Business Bank		Help to Grow Loans
National Public Banks	Finnvera	(OECD 2015a)	Growth Loan
Public fund	Vækstfonden (Danish Growth Fund)	(OECD 2013; UNECE 2007)	Subordinated loans
Multilateral Development Banks	African Development Bank		Equity and Quasi-Equity
Multilateral Development Banks	Asian Development Bank		Darby Asia Mezzanine Fund II
Multilateral Development Banks	European Investment Bank -	(OECD 2015a)	InnovFin MidCap Growth Finance

	EIB		
Multilateral Development Banks	European Investment Fund - EIF		Mezzanine Facility for Growth
Multilateral Development Banks	Inter-American Development Bank		Investor in the Latin America Mezzanine Finance Fund
International Development Institutions	PROPARCO (AGF subsidiary)		quasi equity

Table 8. Dedicated hybrid instruments found in the working sample of POFIs, with 90 organisations.

This is a table that contributes to the literature as it is more comprehensive than the studies who were listed in it. Hybrid instruments mixing grants with loans or equity account for 6 of these cases, whereas the rest would include debt and equity mixes. All the five dedicated hybrid instruments in innovation agencies involve grants, and the other POFIs, with the exception of one, base their hybrids in the debt and equity mix.

5.2 CASE STUDIES - From Group C (POFIs with at least one hybrid) to D

5.2.1 Common structure and interview strategy

The interviews were conducted in a semi-structured way, with a questionnaire that worked as a reference but with some flexibility in terms of the order of questions, including new topics or even mixing or deleting the ones that would not fit the context of the conversation.

They all started with a quick explanation of the research, the objectives of the interview, and a context of the organisation found in secondary research, that would be followed by a first rather open question were the respondent would eventually complement the secondary research by stating all hybrid initiatives or exposing the portfolio of financial instruments in place. The next figure indicates the main elements that were covered in the interview and are showcased in the next session:



Figure 11. Interview flow

5.2.2 Key insights from the case studies

The table below presents a quick overview of the organisations and their representatives interviewed. All the interviews were conducted by phone in the dates mentioned. The cases described ahead have some variance in terms of the amount of information and sequence of topics

since each organisation, respondent and interview have its own dynamics and the programs are different from each other.

Label	Type	Role of respondent	Date (2017)	Country
POFI 1	Innovation Agency	Head of Studies and Communications	10 August	European
POFI 2	Innovation Agency	Acting Director of Innovation Politics and analysis	8 August	European
POFI 3	Innovation Agency	Acting Director of the Growth Division	8 August	Israel
POFI 4	Innovation Agency	Head of Technology Stations Programme	17 August	South Africa
POFI 5	Development Bank	Manager of the Chemical Sector department	25 August	Brazil
POFI 6	Development Bank	Executive Director	17 August	France
POFI 7	National Public Bank	Director of Communications	17 August	Sweden
POFI 8	National Public Bank	Senior Manager / Economic Advisor	4 August	United Kingdom
POFI 9	Public Fund	Senior Relationship Manager	24 August	Denmark
POFI 10	Multilateral Development Bank	Private Equity Banker	18 August	European
POFI 11	Multilateral Development Bank	Senior Private Sector Specialist	16 August	United States of America

Table 9. Interviews conducted

The organisations and instruments profiled are summarised in the following table:

Org/Item	Name of instrument	Type of instrument	Motivation	Risk sharing	Range of operations (£thousand)	Funding model and financial targets	Participation in overall budget
Org 1	Partially refundable loan	Convertible loan (to grant)	Covers a higher part of project comparing to grant	Loans converted to grants if projects are not successful	From 462	Funding considers "equivalent grant" (reduced interest and the grant itself)	70%
Org 2	Innovation Loan	Convertible loan (to grant)	Commercial lending market failures (long term, innovation)	Flexible collateral and payback times	From 97 to 1,900	30% limit for overall loss, no individual limit	14%
Org 3	Conditional grant	Royalty based Loan	Develop IP in the country	Company pays royalties if it sells, otherwise it is a grant	No limit, focused on early stage	Repayment reaches 40 to 50%	67%
Org 4	Risk Funding Schemes	Convertible Grant	Provide good incentive and share expectations, risks and rewards	Company pays percentage of turnover or issue shares if it sells, otherwise it is a grant	471 to 884	Receives funding as grant with no target in repayment	Up to 70%
Org 5	Hybrid Bond to Finance Innovation	Participating Debenture	Cover a gap for funding project scale up (radical innovation in basic industries)	No collateral, payment in royalties or shares	2,452 to 49,057	Same funding as equity operations	0%
Org 6	Unsecured Loans	Unsecured Loans	Develop intangible assets	No collateral, higher interest rate	46 to 4,627	Different sources, may request a fee from participants	18%
Org 7	Innovation Loan and Growth Loan	Convertible loan (to grant)	Support the growth of early stage companies	Loans can be turned to grant if project does not succeed	Up to 27 (Innovation) or 92 (Growth)	Receives funding as grant with no target in repayment	25%

Org/Item	Name of instrument	Type of instrument	Motivation	Risk sharing	Range of operations (£thousand)	Funding model and financial targets	Participation in overall budget
Org 8	Help to Grow Debt funds	Growth loan (unsecured and participating loans)	Support riskier projects not serviced with debt	Intangible assets Unsecured Equity share or warrant	Up to 2 Open	Freedom for the instrument, 2% overall	Help to Growth (new instrument, very limited). Deb: 19% of funds
Org 9	Subordinated Loan	Subordinated Loan	Provide risk capital for companies that are not able to reach equity investment	No collateral, in exchange for higher interest rate and subscription bonus in liquidity event	247 to 2,466	Keep the same invested capital	5%
Org 10	No specific product	Equity kicker, convertible loan	Support clients with limited collateral, growing revenues, high cash consuming, debt rationed	Equity shares depending on the results of the project	Not defined	Compose portfolio	No estimates
Org 11	No specific product	Convertible debt	Being an alternative to equity investments in emerging markets	Co-investment with private sector, guarantees	Not defined	Compose portfolio	No estimates

Table 10. Summary of interviews

The next table presents a summary of the most relevant findings from the case studies in terms of their contribution to the proposed research questions that were not able to be answered by the first screening (second and third).

RQ	Suggested findings	Evidence in cases
2	Loan / grant types of hybrids are more relevant in portfolio than Loan / Equity	The only cases where hybrids accounted for more than 50% of overall budget was with grant and loan / equity mix
2	There is a trend of increasing their use	Growth trends indicated in 9 interviews; in one case (Bpifrance) it is regarded as the fastest growth segment of the organisation
3	Hybrids increase risk sharing comparing to grants	Evidences of biggest funding capacity and better incentives when comparing to grants
3	Hybrids increase risk sharing comparing loans	Evidences of private lending market failure for early stages and/or SMEs. Indication of collateral and track record as limiting points for the growth of these companies on usual debt products
3	More selective risk sharing when comparing to equity	Critics to equity investment, especially in emerging markets, due to lack of profitable and quick exit, complex management of shares for public entities
4	Have a previous research / clear market need	All the organisations indicated a clear need for hybrids as capable of filling financing gaps
4	Institutional design to support risk	Funding allow losses
4	Smart instrument operations	Given the complexity of the instrument, it has to be well designed to avoid being as long as equity without the same benefits; smart contracting and overseeing are important to avoid principal-agent issues

Table 11. Main findings from the case studies section

Research Question 2: "If so (if they are used by POFIs), how representative are they in the portfolio? What is the trend?"

ANSWER: The participation in the cases varies from zero (in the case of recent instruments) up to 70% (when grants are involved) or up to 18% in debt/equity mix. There is a clear growth trend evidenced in 9 out of 11 interviews.

Research Question 3: "Are they increasing the risk/return sharing when comparing to traditional instruments (grants, loans and equity)?"

ANSWER: Interviews indicated a clear improvement in risk and return sharing when comparing to grants and loan operations; when comparing to equity, it is not possible to assume a comparison since both share risks and rewards, but hybrids are acknowledged as a better option as they are more selective and better applicable to emerging markets

Research Question 4: "What would be the best strategy to implement them in other POFIs?"

ANSWER: It is important to define a niche (most successful cases target upper small to middle companies, thus avoiding very risky startups or large corporations), having an institutional design that allows risk taking, and developing smart instrument operations. More discussion on the next section below.

5.3 Policy implementation

Based on the insights from the interviews a set of policy guidelines will be described as an orientation for POFIs who would consider hybrids as a means of complementing their portfolio and increasing their risk and return sharing capacity.

5.3.1 Funding and financial performance issues

The execution of a hybrid instruments requires expertise in the evaluation of the financial prospects of the projects submitted. This is opposed to the common practice of assessing the applicant's historical financial results or its current real assets to offer as collateral, as it would be evaluating the project and its future cash flow. Literature exposes that common practices used to evaluate more predictable assets as NPV²² or ROI²³ are less adequate to these strategic investments because of the uncertainty of outcome and long term, irreversibility of committed resources and inaccurate use of discount rate, suggesting the use of real options (Vornatas & Lackey 2003).

Considering the degree of risk involved in these unsecured operations, the funding used to deploy hybrid instrument must be tailored for this activity. It is important to consider the effect on interest rates and overall access to finance (comparing basic interest rate, IRR and CAPM); if mezzanine requires a higher return than debt, this still has to be capped by the internal rate of return capacity of the projects funded.

5.3.2 Instrument design

Problems of adverse selection should be considered, since the mechanism of payments according to the project's result would turn confident companies away from hybrids and, conversely, attract recipients that know their activities are likely to fail commercially (Venturesome 2008). Information

²² Net Present Value

²³ Return Over Investment

asymmetries, Principal-Agent and market opacity are also relevant to draw attention to the fact that hybrids require much more information than standard debt, so designing the right contract with proper incentives and an efficient supervision and accountability system is very critical. An attention alarm has emerged from two cases where revenue-based schemes were discontinued due to the difficulty of having payment returns.

Mitigation for the main potential drawbacks of hybrids from the interviews and (Flip Finance 2017) the FI Compass fact sheet²⁴.

Issue	Possible solution
Quasi-equity deals are more complicated to set up when comparing to conventional loans	Both recipient and funder need to be compensated by the extra time and complexity (more flexible lending, more revenue opportunities, respectively).
Revenue participation-based models are more difficult to monitor	Create simple mechanisms to attach payback with company's revenues, as a return cap/multiple.
Recipients may think of it as a grant	Establish clear rules on eventual trigger mechanisms
In successful cases, investees may feel "ripped off" by investors	Setting a limit in the revenue stream; if investee can prove business is viable, charge smaller percentage in change of solid warrant (sales prospects, etc.)
Charging more interest rate to balance the higher risk may be unfeasible, especially in developing countries	Rely more on the use of convertibles rather than just managing the risk of unsecured financing with higher interest rates

Table 12. Issues and possible solutions with hybrids

The design of this instrument must consider whether it intends to reach final recipients directly or through funds. Cooperation with private sector funders was highlighted several times: it is important to draw a mechanism that complements what private lender offers and request capital raise or leverage of private resources to avoid the government having a major concentration in the project.

Operations should follow the intermediate position and risk profile and be deployed in a different system currently used for senior loans, since this is a more tailor-made and less standardised process.

Since it is a more complex mechanism and not well known in the target audience (SMEs) (British Business Bank 2015), it is important to consider methods of reaching the potential customers and guiding them through the process. As from interviews, just charging more interest would not be the best mechanism, because more pressure is put on cash flow and it is more difficult for additional finance to be sourced.

²⁴Available at: <https://www.fi-compass.eu/sites/default/files/publications/ESIF-factsheet-FI-products.pdf>

6 Conclusion

This research paper brings important new contributions to the field of financing innovation. The first one is an attempt to define a category of public organisations that funds innovative businesses (POFI). It indicates that not only innovation agencies and development banks fund these companies, and this is important to open the spectrum of the sample for any study on financing innovation. A taxonomy for hybrid financial instruments is proposed; although similar classification exist for mezzanine, they are not comprehensive, and more importantly, do not include grants in the portfolio. The screening of 90 organisations in terms of their use of hybrids has no parallel and provide interesting insights into the way these institutions operate to deliver financial instruments to support risky projects. Finally, the case studies with 11 organisations looking at the qualitative aspects of these instruments presents details on the motivation and the mains mechanisms used. As presented in Section 5, the research questions were answered and a promising perspective related to hybrid use for financing innovation in public organisations appears.

6.1 Best practices and policy implication

There are several positive outcomes form this research that can impact supply side innovation policy. The first important aspect is the high degree of financial support additionality – new hybrid instruments are not expected to cannibalize mature options (as loans, grants, equity), but may be an option for many innovation projects that are constantly not funded because of lack of collateral or rapid scaling-up (which would benefit from VC). This additionality happens not only in terms of the POFI's portfolio, but also in relation to private financial sector funders, as it is a complementary financing option. If well designed and operated, they can provide support to innovative projects without a significant burden on public budgets, given its self-funding nature; even when they are based on grants, thus not presenting an integral return, they are still more capable of refunding in comparison to a standard non-refundable operation. It may be able to support riskier projects, where, for the successful cases, lay most of the benefits associated with disruptive innovation, such as economic development, high-skilled jobs or upstream and downstream efficiencies. Its characteristics of including the project's returns as one of the main securities can be an incentive to the companies and the funders to aspire for and track better results. Finally, they are an important mechanism for tackling the need for more growth finance.

6.2 Limitations

The initial screening of POFI might have missed organisations that deploy hybrid instruments, so this is a not by any means a comprehensive and final list of organisations using hybrids to deploy innovation policy. It is also very difficult to certify whether the organisations listed are entirely covering innovative activities.

The conclusion points towards a favourable view on the use of hybrid instruments to increase risk sharing when financing innovation, however, as with any mechanism, some limitations will apply. This instrument is used more widely in developed countries – its implementation in a developing country subjected to political and economic instability is more complex.

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