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Growing challenges and research gap

The search for levers to sustain economic growth, which is a key and topical challenge for public policy and private actors, has turned into an intensive research topic in both economy and management. Sustaining growth through investments remains at the heart of public policies insofar as growth is assumed to be correlated to economic drive notably through increased firms' profit and employment rate. Therefore, search for a better understanding of growth determinants has been extensively discussed in numerous theoretical and empirical studies (Coad 2007).

Throughout the continuous refinement in the economic models investigating the dynamics of investment for sustained growth, technological progress and, further, innovation have taken an increasing role. In Adam Smith first theory on macro-economic growth (Smith 1776) technical progress emerged as a key factor driving macro-economic growth. Over time, several theories further developed causal links between technological progress and both macro and micro growth rate. First defined as an exogenous and undefined variable it has gradually been endogenised since neoclassical models, and refined as, among others, a productivity factor (Solow 1956) or a stock of knowledge (Arrow 1962). Overall, innovation stands out as one of the main growth driver (Ahlstrom 2010), a result that is thought to help steering the investment choices. Yet, the underlining processes linking investment to innovation on the one side, and innovation to growth on the other remain ill-understood.

On the one hand, despite voluminous and diverse literature (Cameron 1998) produced by the study of innovation impact on economic growth, a precise relationship has yet to be unequivocally established (Demirel and Mazzucato 2009). As for now, correlations based on static and in retrospect input-output economic models remains inconclusive (Gupta, Guha et al. 2013). In these studies, the several growth indicators (e.g. turnover, employment rate, productivity) follow independent paths and are not correlated to any innovation factor (e.g. R&D expenditure, patents, propensity to innovate) (Del Monte and Papagni 2003). Thus characterizing the relationship between firm innovativeness and growth raises the stake of identifying accurate and appropriate measurements for both growth and innovative activities.

On the other hand, the classical thought that R&D spending is statistically linked to innovation, thus far roughly correlating the issue with the right amount of resources invested, has been repeatedly proven false over large sets of data. The absence of a mechanical impact of investment on innovative output, known as “the R&D paradox” (Le Masson, Weil et al. 2010), shows that beyond the initial financial inputs, appropriate design management and governance models seem necessary to support sustainable innovative activities.

A wide range of researches in the field of innovation management has built on this perspective to offer refined patterns of innovative activities process (e.g. spillovers theories, resource based view, dynamic capabilities (O’Connor 2008). However, their impact on firms’ growth dynamics has not been pinpointed. Because of this failure in understanding growth drivers, investors lack of managing strategies allowing them to guide their investing policies. Thus, my researches aim at describing new growth dynamics in order to shape investment guiding tools.

My researches will be conducted in partnership with Bpifrance venture capital fund. Bpifrance is a state-owned organism backing national public policies by assisting companies through different types of investments. Bpifrance doctrine states that it should “behave like a prudent investor operating under market conditions to serve public interest”. Therefore, the venture capital fund has both to meet financial performances and to carry out a public service mission. This dual goal is assumed to be reached by ensuring firms forthcoming growth. Bpifrance share the view that innovation capabilities are an accurate indicator of firm’s growth, as a breeding ground for both economic value and public benefit. Thus, Bpifrance investors challenge lays analyzing firms innovative capabilities to identify high-growth potential.

Research goals

Based on recent management researches finding, my thesis aims at answering to the following questions raised by the above assessment:

- How to characterize innovation capabilities in order to assess firms' growth potential (i.e. indicators, measurement methodology, and dynamics)?
- How can investment reach greater impact on firm sustainable growth? How to shape investments tools (i.e. innovative firms' selection mechanisms, financial vehicles) and steering process accordingly?

As regards the empirical basis, my research will focus on middle market companies as there are assumed to be one of the main growth engines. This firm category is of particular interests as it is a quite new one so the relationship between innovation and growth has been little examined and stays even more mysterious. In 2008 a French law created this new business category to reach more precise analysis on these firms considered as valuable assets for French economy. It gathers companies employing between 250 and 5 000 workers with an annual turnover below 1.5 billion euro. In-between SMEs and large firms, French middle market companies' category, as German Mittelstand, gathers long lasting firms, half of them being family firms, with entrenched innovation capabilities that should drive value generation and employment opportunities. However, this single category hides a large diversity of innovation and growth patterns. These various potential growth dynamics could explain why middle market companies growth lack of steadiness and persistence. Growth process remains tricky to characterize and monitor with current statistic tools used for SMEs and large firms, hence the need to adjust current tools and investigate new indicators.

Theoretical framework

Despite abundant literature, the relationship between innovation and growth remains ill-understood.

Historically, economists were the first to pinpoint and explore technological progress as a driver of economic growth through macro-economic frameworks (Smith 1776). Over time, various theories refined causal links between technological progress and growth rate at different level of analysis ((Solow 1956), (Arrow 1962), (Romer 1986)). Gradually, a shift happened from theories developed at an aggregate scale to a firm and an individual scale (Nelson and Winter 1982). Various disciplines contribute to model economic growth including economy (macro, micro and political economy) (Cameron 1998), management

(Teece 2007), finance (Timmons and Bygrave 1986), law (Levine 1997) and psychology (entrepreneurship literature). Nevertheless, the relationship between innovation and growth at the firm level remains an intellectual puzzle.

I conducted an analysis of 29 articles selected among the most relevant papers (i.e. taken among the most cited and published in highly ranked papers) mainly extracted from three literature review ((Ernst 2001), (Del Monte and Papagni 2003), (Demirel and Mazzucato 2009)). Most of these quantitative studies are based on correlation tests either to investigate if growth follows a random walk (literature on Gibrat's Law (Mansfield 1961)) or to evaluate the impact of endogenous (i.e. patent granted, R&D expenditure, new product) and exogenous indicators (i.e. spillovers, clusters) on past firms' growth. While theoretically, economic approach assumes that innovation fosters firm performance, quantitative researches has failed to generate cumulative results:

- Heterogeneity of growth measure is a first obstacle (Delmar 1997, Delmar, Davidsson et al. 2003) as the several growth indicators (e.g. turnover, employment rate, firm survival, productivity, market value) are not correlated (i.e. an increased in turnover can go along either with a fall or a rise in employment rate). As growth is heterogeneous in nature (Delmar and Davidsson 1998), a definition of growth including several dimensions (i.e. instead of one single indicator) is needed to distinguish several kinds of growth. Similarly, measuring innovation is one of central methodological issues. The question is: how to find accurate measures of innovation and examine its impact on firm's performance? Innovation is often measured in retrospect through R&D spending or numbers of patents. Both are quantitative indicators failing in differentiating how disruptive innovations are.
- Despite some studies highlighting a positive correlation between innovative activities and growth, its conclusions often cannot be duplicated. Besides, others (e.g. (Brouwer, Kleinknecht et al. 1993)) demonstrate that innovation and growth remains unrelated (Bottazzi, Dosi et al. 2001).
- Those economic studies mainly analyze innovative outcomes in retrospect (counting patents or new products and processes) more than innovative capabilities hence a need for further investigation.

It reflects both a technical issue (i.e. time period, firm size, type of industry) and a debate about the nature of targeted growth (i.e. sales, employment, market share, goodwill). Establishing a correlation between innovation capabilities and growth potential raises stakes in identifying accurate and appropriate measurements for both growth potential and innovative capabilities beforehand. Management literature should contribute to overcome these issues.

Management literature on design functions and ecosystems enables to refine the concept of growth

Theories on public action often assume a correlation between R&D investments, innovation outcomes and growth. However, current economic studies, aiming at defining in retrospect a correlation between inputs and outputs, are not sufficient to demonstrate such a relationship. The difficulty to demonstrate the impact of R&D investment on companies' innovation and growth is known as "the R&D paradox" (Le Masson, Weil et al. 2010). An analysis of top 700 international companies' investments in industry demonstrated no correlation between R&D expenditures and firms growth rates of turnover. Other studies confirm those results whatever timescales, performance indicators or sectors used (Jaruzelski and Dehoff 2005). For example, among the most innovative companies, some, like Apple in 2010, have reached high-growth rates spending less in R&D than the average firm in their field. Therefore, taking into account the intensity of R&D investment only seems too restrictive. Beyond the initial financial inputs, appropriate design management and governance models seem necessary to support firms' innovation capabilities and assess innovation potential beforehand. Recent researches on innovative design regimes (Hatchuel and Weil 2003) should help reviewing traditional economic indicators, develop new ones tailored for measuring beforehand firms innovation dynamics and thus guide future growth and investments strategies.

Based on these works I build two research hypotheses:

- Micro-economic growth can be fruitfully described as the increase of innovation capabilities. Literature on design functions (Hatchuel and Masson 2006) shows that production function (Ricardo 1817) (Romer 1986) is insufficient to account for the development of firms, especially innovative firms. They show that considering a single financial output (such as turnover) does not take into the account the capacity to create new products, concepts and knowledge/skills (Hatchuel and Masson 2001). Instead, most of the recent developments in innovation management show that innovative capabilities building, absorptive capacity, etc. are pivotal elements to account for firms' growth potential (Teece 2007). We hypothesize that growth regimes can be differentiated based on whether companies are able to expand their knowledge, goods and ideas or not
- Growth can be better observed at an ecosystem level: as literature on knowledge spillover (Audretsch and Feldman 1996) has shown effects beyond a single company, the challenge lies in identifying appropriate patterns to describe partnerships and all kinds of social returns (Griliches 1992) (Griffith).

To summarize, my researches aim at refining the concept of growth:

- By investigating growth process as the expansion of design capabilities instead of the usual economic growth patterns. The empirical case studies should enable identifying several growth path linked to several investment patterns, contribution to economic value and public interest.
- By providing criteria that would allow taking into account firms ecosystems dynamics. For instance through the analysis of the diversity of partnerships, platform-based designs diffusion, spillover impacts ...

New approaches for research on relationships between investment and innovation

Literature discusses the coupling between investment and innovation by questioning how a firm capital structure influences its innovative projects performance. Several studies advocate that venture capital funded R&D generates substantial increase in innovative outputs compared to corporate R&D without debating on causes of this productivity differential (Kortum and Lerner 1998). Compared to corporate R&D or relationship lending, venture capital main asset relies in its ability to combine an initial financial input and support throughout the project lifetime. Capital venture, by interfering in firms at critical stages of development affects their design management and governance models. Then, different hypothesis could be investigated to explain R&D investment performance differential, for example whether it is due to strict project selection mechanisms ex-ante, to closer ex-post monitoring (Gerasymenko, Clercq et al. 2015) or to specific innovation management methods (Engel 2011). Effects of growth support policies through investments can now be reviewed in the light of recent literature on design theories and innovation capabilities. The issue lies in identifying the right investment models according to the aimed growth dynamic.

Research approach

My research is following multiple paths:

- Contextualization through historical cases of public policies strategies that have supported firm growth. The aim is to size a public operator's specific assets for sustaining firms' growth compared to external private partners or internal corporate capabilities.
- Identify different growth dynamics according to the several innovation capabilities paths.
 - Characterization of innovation capabilities through multiple bodies of literatures. Both economic literature and management literature on dynamic capabilities theories (O'Connor 2008) argue on innovative capabilities dynamics.
 - Thanks to Bpifrance records, cases study of financed firms following several growth models will contribute, in the light of design theories (e.g. Concept-Knowledge theory (Hatchuel 1996)), to model innovation capabilities and suggest news indicators.

Qualitative studies enable the focus on surprising cases that are essential to single parameters out before proceeding to quantitative tests on databases.

- Understanding of the impact of investments on innovation and growth to adjust investments tools and steering processes through finance, innovation management and public action policies literatures. At the same time, I will conduct empirical analysis of investors' reasoning (notably when assessing firms' innovation capabilities, forecasting potential growth or shaping strategic guidance).
- In parallel of the above mentioned qualitative analysis, quantitative tests based on multiple databases provided by Bpifrance, completed if necessary by external sets of data (INSEE, CASD Community innovation survey and social data statements) will contribute to refine hypothesis on the coupling between investment, innovation and growth.

Expected outcomes and implications for future research and practitioners

On one hand, I expect the following theoretical implications:

- An in-depth study of design capabilities expansion determinants leading to a better understanding of the determinants of growth and the role of innovation capabilities in firms' growth trajectories.
- Original model with parameters linked to the description of innovation capabilities.
- Clarification of diverging firms growth objectives which are not always in line with public interest and its potential impact on innovation and investments strategy.

On the other hand, I aim at managerial implications regarding tools to steer the investment strategies (i.e. innovative firms' selection mechanisms, financial vehicles). Besides, I also expect findings regarding public policies as this research will question the hypothesis that the best strategy to serve public interest, as a state-owned venture capital fund, is maximizing a few individual firms' growth.

Central issues to be advised on during the doctoral workshop

The theoretical background of my research project builds on several bodies of literature such as: innovation management, economic growth theories, finance. Therefore, one challenge is to identify which research communities to discuss my work with. The doctoral workshop would be a great opportunity to discuss this issue.

I am also interested in feedbacks on the methodological approach. What are the potential drawbacks of analysing a few empirical cases before going on with quantitative tests?

Finally, I would be pleased to receive any comments on the following topics at the heart of my thesis:

- Insights on literature bodies dealing with the indicators measuring the impact of externalities
- special features of middle market companies' (including family firms) innovation capabilities management and economic growth dynamics

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