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Evaluating the Contribution of Technology Start-up Incubators – Exploring Methodological and Data-related Conundrums

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Abstract

Policy makers in developed economies see merit in supporting the innovative abilities of technology entrepreneurs. It is hoped that from these highly-educated entrepreneur(s), new technology and service-based firms (NTBFs) can emerge. Indeed empirical evidence suggests that it is fast-growing young firms (Gazelles) which provide the bulk of new employment growth (Henrekson & Johansson, 2010; Storey & Greene, 2010). Technology start-up incubators are one of a number of micro-policy interventions with which the state attempts to support these technology entrepreneurs to develop and commercialise their innovations. Incubators offer a range of services such as shared office accommodation, shared support services, business support (hard), business advice (soft) and network provision (Bergek & Norman, 2008). They are typically located in or near universities as they generally fall under the universities knowledge transfer remit. Incubation programmes try to contribute to enterprise sustainability and the professional and entrepreneurial development of participants through *buffering*, which protects participants from the external environment (for a defined period), enabling them to develop their own internal resources; and *bridging*, which facilitates firms in building sustainable competitive advantage through the acquisition of external resources and networks (Amezcuca *et al.* 2013). This paper outlines the methodological and data-related challenges associated with attempting to evaluate the contribution of start-up incubator services to value-adding outputs and outcomes. Following a review of the literature in the area and a discussion on the methodological approaches adopted so far, this paper advocates the use of a theory-based evaluation (TBE) methodology as a possible solution to complex research settings such as this, where a study is unable for a variety of reasons, to meet the stringent requirements of an experimental design e.g. random assignment, establishment of counterfactuals, control groups etc. TBE will deliver findings on the contribution of the multiple factors influencing a result showing whether the incubator in this study made a contribution to an observed result and in what way? Mixed methods research designs and data analysis approaches are particularly suitable for TBE studies. An exploratory case study of the performance of a start-up incubator is used to illustrate the suggested TBE approach. Within the overall case, a nested cross-case analysis (Yin, 2009) can be conducted on participants in the incubator programme focusing on the evaluation of inputs, activities, outputs (Short-term) and outcomes (Long-term) of the buffering and bridging process. Finally suggestions are made for improving evaluation research designs in this domain.

Keywords

start-up incubator, incubation, entrepreneurship, enterprise supports, small business growth, SMEs, public policy, business acceleration

Introduction

Ultimately, the ability of a country to nurture the growth of [Young/High Growth firms - Gazelles] is probably the most important element in enterprise development (Storey & Greene, 2010: 208).

However Storey (1998) notes that in the case of state-funded business incubation there are 'very real methodological problems in linking the provision of incubator support to subsequent economic outcomes'. As a result, there is a gulf between our understanding of the need for such entrepreneurship policies and how such policies might be conceived and designed when needed (Karlsson & Andersson, 2009: 127). Furthermore, if public money is spent on entrepreneurship and SME support then it is vital that rigorous evaluation of the contribution of these initiatives takes place. Regardless, the evaluation of policy performance is important for public transparency and accountability, otherwise a government can simply 'set sketchy objectives' and 'claim that the target is anything it happens to hit' (Harrison & Leitch, 1996).

Macro and Micro Policies for Supporting SMEs & Entrepreneurs

Government policy aimed at supporting the development and growth of SMEs and entrepreneurs can be broadly categorised into macro and micro level policy measures. Micro policies focusing specifically on SMEs

and entrepreneurs while macro policies 'do not have SMEs or entrepreneurs as their primary focus' (Storey & Greene, 2010: p.407).

Macro-Economic Policy

Macro-policies sit within a country's institutional structure and include four key components: (i) macro-economic stability and regulation, business climate, trade policy and FDI; (ii) policies on competition and monopoly; (iii) government economic agency (taxation, public services and expenditures, employment, contracting and social policy); and (iv) government economic strategy, planning and promotion, contribution to the knowledge economy, technology and innovation (Bennett, 2014: p.17).

Macroeconomic policy is therefore aimed at improving broader economic conditions through a plethora of policy measures, many of which can have an indirect positive or negative influence on SMEs and entrepreneurs.

Micro-Economic Policy

Micro economic policies targeted at start-ups and entrepreneurs 'are those which endeavour to support the start up and growth of businesses by providing direct assistance to the individuals or businesses concerned' (Bridge & O'Neill, 2013: p.323). Such direct assistance or 'intervention' from the government is normally justified on the grounds of 'market failure' i.e. where there are barriers to entry and exit; information imperfections; the presence of externalities (knowledge, network or learning spill-overs); and where willingness to pay does not reflect demand (Storey & Greene, 2010). In other words, the government must have a case to intervene in the market mechanism in order to make it work better (p.381-385). One of the key issues around micro-policy intervention is whether a government can intervene cost effectively, with market failure alone not a necessary or sufficient justification for intervention (Storey, 2008). This is compounded by a lack of empirical support for micro policy intervention in the literature (Bannock, 2005; Davidsson, 2008; Bridge *et al.* 2013). Storey (2008) notes in conclusion that this is exacerbated by the paucity of rigorous evaluation of these enterprise policies. Indeed the OECD (2007) provides seven areas under which policy can be evaluated. These are: Rationale, Additionality, Appropriateness, Superiority, Systemic Efficiency, Own Efficiency and Adaptive Efficiency, although arguing that 'at the core of evaluation is the concept of additionality'. Additionality is thus an appropriate moniker for the attempts by researchers to quantify the impact or contribution of an intervention under study when compared to a 'counterfactual' situation (Oldsman & Halberg, 2002).

Micro policy instruments aimed at growing entrepreneurs and SMEs are broadly subsumed under the rubric of *Enterprise Policy*. Enterprise policy is often then justified on the basis that it helps stimulate and/or facilitate entrepreneurial activity which in turn can provide key benefits to national economies such as job generation, innovation, productivity and growth. On an individual level this support can also help increase the 'utility' functions of individuals by increasing, for example, their satisfaction or income (Van Praag & Versloot, 2007). However the issue remains that whilst there are rigorous and elaborate frameworks developed for evaluating enterprise policy (See: Storey, 1998; OECD, 2004), these have proved difficult to implement in practice and therefore there is a dearth of empirical evidence to support or justify micro policy intervention.

SME Policy & Entrepreneurship Policy

Bridge and O'Neill (2013: p.301) point out that 'there is often confusion about what is meant by [SME and Entrepreneurship] policies' as there is 'a lack of a clear definitions of both terms. Storey (1998) notes 'the important distinction between [these terms] in which [SME policy] applies to existing enterprises whereas [entrepreneurship policy] relates to policies seeking to enhance the creation of such enterprises' (p.6).

SME policies are designed to stimulate the growth of already established small businesses 'and tend to focus on the businesses and what will help them grow, not the entrepreneurs behind them' (Bridge & O'Neill 2013, p.301). On the other hand, Entrepreneurship policies are aimed at 'encouraging and facilitating more people to create their own businesses' and 'are centred on what people and on what will persuade or help them to start businesses' (Bridge & O'Neill 2013: p.301).

In the context of publicly sponsored business start-up incubation, the distinction between enterprise and SME policy is made even more unclear considering this support is aimed at transforming entrepreneurs into successful start-up companies. As a result, incubation programmes will typically provide a combination of supports that fall within both categories.

Policy Rationale for Business Start-Up Incubation

The rationale for business start-up incubators targeting new technology and service-based firms (NTBFs) is that ‘policy-makers view high-technology sectors as the main generators of potential [High growth Firms]’ or Gazelles (Mason & Brown, 2013: 214). Business Incubators aim to stimulate and support entrepreneurs and start-ups (Grimaldi & Grandi, 2005: 111) through the provision of supports that provide a ‘safe harbour’ for firms to develop their internal resources – so called *buffering*, while also connecting them with external resources and networks - referred to as *bridging* (Amezcuca *et al.* 2013: 1633).

Buffering allows fledgeling firms/entrepreneurs to isolate themselves from the environment in order to engage in formational and developmental activities without having to confront directly these ‘general and specific environmental threats’ while Bridging ‘allows them to actively engage rather than be isolated from their external environment to build assets that will hopefully allow for the development of a sustainable competitive advantage (Amezcuca *et al.* 2013: 1629).

Measuring Incubator Performance

Ramsden and Bennett (2005: 229) differentiate between objective - ‘hard’ and subjective – ‘soft’ performance (impact) criteria. The former referring to outcomes such as reduction in business costs; increase in business turnover; increase in business profitability, and the latter referring to softer outcomes such as the ‘ability to cope with problems’ and ‘ability to manage.’

Voisey *et al.* (2006: 465) argue that business incubators must demonstrate their success in statistical terms of ‘hard measures’ as well as in ‘soft benefits’ such as increased business knowledge and skills, business awareness and client networking improvements. In parallel, the incubator must meet its own ‘hard’ targets as agreed with key stakeholders. Stephens and Onofrei (2012: 283) identified four additional hard measures of success (location/incubation space; success in entrepreneurial competitions; securing public funding; and customer retention) and three additional soft measures (increased productivity due to incubation structures; networking; and a positive image associated with being on a recognized programme). These authors advocate ‘a holistic approach to the measurement and evaluation of business incubation...utiliz[ing] hard and soft measures’ (Stephens & Onofrei, 2012: 283).

Incubator performance measures are a widely discussed issue in this domain and it has generated some debate amongst researchers in the area. The literature has yet to come to even a broad consensus on what constitutes appropriate measures of performance (Barbero *et al.* 2012: p.891)

Table 1: Studies on Incubator performance measurement

Study/Researcher(s)	Review Period	Sample Size	Key Outcomes (Positive and Negative)
<i>Gti Pre-Incubator Longitudinal Study/ Voisey, Jones and Thomas (2013)</i>	2001-2011	26	“Positive economic and social contributions.” Cumulative turnover in excess of £25 million. More than 130 jobs created in the 26 enterprises. <i>Voisey et. al, 2013 (p.60)</i>
<i>Assessment of Business Incubators in France/ M’Chirgui (2012)</i>	2000-2007	200+	Lack of access to complementary financing structures. Training courses offered to applicants deficient. Deficiency in providing tenants with appropriate human capital resources to build their teams. The tenant selection process is insufficiently rigorous. The number of jobs created by incubatees is relatively low. <i>M’Chirgui (2012, p.68)</i>
<i>UK Business Incubation Study (Body Responsible for Business Incubation in the UK)</i>	N.P.	N.P	Over 90 per cent of companies that underwent the incubation process were still thriving after three years, compared to 41 per cent of UK start-ups in general, over the same period (Bream, 2009)
<i>Israeli Technology Incubator Program/ Yossi Smoller, Director of Israel’s Technological Incubators Program</i>	2002-2011	1300	\$2.5 billion dollars private investment in 1300 companies post incubation. About 30 percent of the companies that graduate[d] the [Israeli] incubators [were] active at least ten years after graduation.”

			<i>Wylie (2011, p.856)</i>
<i>EU 'Benchmarking of Business Incubators Project' / Centre for Strategy and Evaluation Services under guidance of the European Commission</i>	2002	71	85% average survival rate. 20% average growth in client turnover. 6.2 jobs per tenant company on average. 41 new graduate jobs per incubator on average. €4,400 gross cost per job.

Source: Adapted by the authors from M'Chirgu (2012); Bream (2009); Wylie (2011); CSES (2002)

Isolating the effects of business incubation

For any given outcome, a 'policy impact can be considered as the difference between the observed outcome with the intervention, and what would have happened without the intervention' i.e. 'additionality' (Storey, 2008: 16). In order to isolate the effects of public micro-policy instruments, such as business incubation, and determine value creation (additionality), it is essential that such policies have measurable objectives and targets from the outset. Otherwise Storey and Greene (2010: p.384-385) highlight two unintended consequences of government micro policies such as incubation: 'deadweight', where a business would have set up even if the support was unavailable; and 'displacement', where a new business displaces incumbents in the industry with no net economic benefit to the state.

The COTE Framework

In June 2004, a background report prepared for the 2nd OECD Conference of Ministers for Small and Medium Sized Enterprises set out the COTE Framework, aimed at ensuring that whether an intervention is justified or not, 'all SME and Entrepreneurship policies and programmes... [should] have clear objectives and targets.' The components of the COTE Framework are outlined in table 2.

Table 2: The COTE Framework

Component	Description
Clarity & Coherence	The policy should be clear to those delivering and benefiting from it, and should be delivered in a 'unifying and mutually reinforcing' way by governments.
Objectives	Objectives of the policy, such as the creation of new firms or employment creation, should be clearly specified. According to Lenihan (2011) a logic model outlining a theory of change for the programme should be mapped out to 'ensure from the outset that objectives are well specified, and that issues of opportunity cost regarding public funds are addressed' (p.330).
Targets	Measurable 'targets' reflecting the policy objectives should be specified, e.g. to increase the number of new firms by X% by 2016.
Evaluation	'Policy can only be considered to be effective if it passes the challenges of high level evaluation, but Evaluation can only be undertaken when clear policy targets exist.' The OECD (2004, P.16) emphasises the importance of feedback in this process, stating that 'implementing evaluation as a process can be achieved, by feeding the results of evaluation back into the debate, once the evaluation is complete.'

Source: Adapted by the Authors from Storey (2008: 13-14)

Designing Evaluation and Performance Measurement

Evaluation 'seeks to determine...the relevance, efficiency and effectiveness of an activity in terms of its objectives' (Papaconstantinou and Polt, 1997:10). However, in reality, effective programme evaluation is very difficult to achieve and 'only rarely, do we see the application of evaluation methodologies which address the effects of selection bias and incorporate appropriate counterfactual scenarios' (Lenihan *et al.* 2007:313). Lenihan *et al.* (2007) complains that too often, evaluation studies [of public policy instruments] do not get beyond first base because they focus on resource inputs and monitoring impacts of particular programmes, schemes and initiatives with little reference either to context or longer-term outcomes (p.313). However Stame (2010) asserts that 'black box' or experimental forms of evaluation (where possible) are equally deficient because of the 'successionist theory of causality' on which experiments are based. They do not tell us why something changes, only that something has changed thus making it difficult to say whether the change can be attributed to the programme (p.62).

Incubation programme evaluation is not suited to the exacting requirements of a true experimental ‘black box’ impact evaluation which requires the establishment of counterfactuals and valid control groups, given its complex research setting and multiple intervening variables before an outcome is achieved. For this reason and on the basis that ‘strong theoretical underpinnings give rise to robust evaluation methodologies’ (Lenihan 2011: p.330) - theory based evaluation is a more appropriate methodology for evaluating an incubation programme. Proponents of ‘new’ programme evaluation, such as Lenihan (2007), are calling for new methodologies to be adopted by public programme evaluators. Methodologies such as theory – based approaches map out a clear theory of change (ToC) and therefore allow for multiple or mixed research methodologies to be deployed within the broader framework. This methodological dexterity opens up the possibility for micro policy instruments to be evaluated in a broadly consistent manner as theory-based evaluation (TBE) involves examining the assumptions underlying a causal chain from inputs to outcomes and impact (White, 2009: p.3) or contribution (Mayne, 2001, 2008, 2012).

Incubator Evaluation Metrics using TBE

Lenihan (2011) suggests that ‘new’ enterprise policy interventions such as incubation programmes should encompass a wide array of evaluation metrics. She provides a list of twelve (hard and soft) policy evaluation metrics but does not provide any guidance as to how policy interventions can be evaluated against these metrics nor does she provide empirical evidence of similar evaluations.

McLaughlin and Jordan (2004) propose that a logic model theory of change is useful for designing evaluation and performance measurement as it focusses on the important elements of a programme and helps to identify what evaluation questions should be asked and performance measures used (p.7). Lenihan (2011) notes that: ‘well-constructed logic models can serve as ex-post measures to see whether objectives have been attained, enabling robust ex-post evaluations’ (p.330) that ultimately feed back into future programme design.

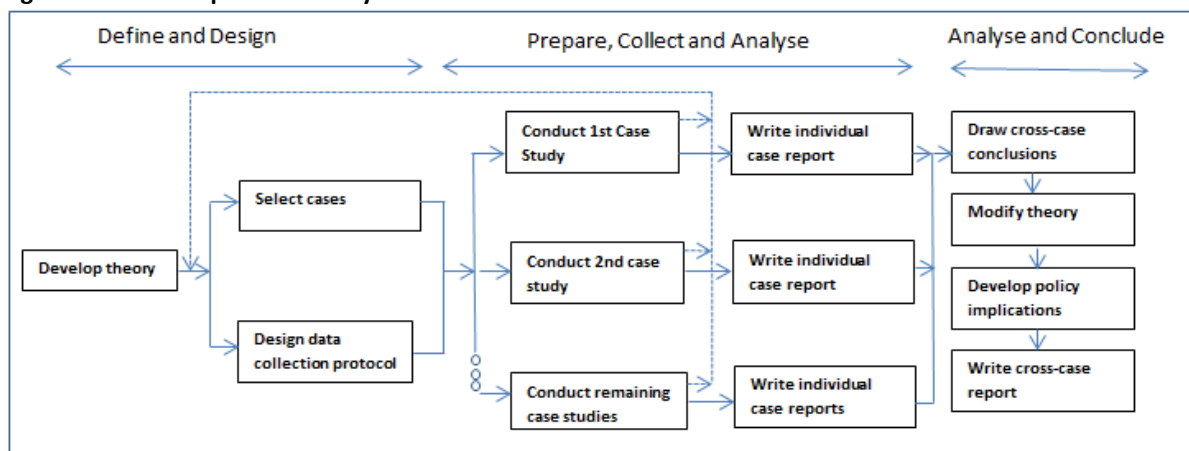
Theory-based Impact Evaluation (TBIE) involves examining the assumptions underlying a causal chain from inputs to outcomes and impact (White 2009:3). The theory-driven method is based on the rationale that ‘evaluation should not be dictated or driven by one particular [research] method’ (Chen, 2015:25) and that ‘the success of a program has to be judged not only by its results but also by its context’ (Chen, 2015:26).

Case Study Methodology

This research employs a multiple-case study methodology. Yin (2009) posits that ‘evidence from multiple cases is often considered more compelling [than single case designs], and the overall study is therefore considered more robust’ (Yin, 2009: 53). Comparing more than one case allows for ‘the special features of cases to be identified much more readily’ (Bryman, 1989: 171).

Figure 1 outlines the process for conducting multiple-case study research, which is further described in the sections that follow.

Figure 1: The Multiple-Case Study Method



Source: Adapted from Yin, 2009: p.57

To determine the most appropriate theoretical sample for the multiple-case analysis, secondary information on all 32 Hothouse New Frontiers 2012 programme graduates was acquired through a variety of sources. The

32 cases were analysed collectively in an attempt to identify a ‘theoretical sample’ (Eisenhardt, 1989) which also illuminated ‘transparently observable’ progress between participants (Pettigrew, 1990).

The final case study sample consisted of three graduates from each of the two 2012 cohorts (six in total), three of whom were currently still trading and classified as *Surviving Firms and Entrepreneurs* for the purposes of this study. The remaining three firms were not currently trading and were therefore classified as *Ceased Firms and Entrepreneurs* for the purpose of this research. The sample was deemed to be representative (Martinson & O’Brien 2010) in that it enabled direct comparison between surviving firms and ceased firms.

Interviews undertaken with all six programme participants followed a similar semi-structured format and questions were based largely on the key theoretical determinants of firm growth as posited by Storey (1998) and Smallbone and Wyr (2012). Peripheral studies on the same topic, such as Dobbs and Hamilton (2007), Hansen and Hamilton (2011) and Barrow *et al.* (2011) also influenced the questions and framing of the interview guide. Finally, the findings of incubator performance studies, such as those by Voisey *et al.* (2006) and Onofrei and Stephens (2011), discussions with the Hothouse incubation centre manager and review of previous incubator impact surveys informed the programme-related questions.

Following a detailed review of the six individual case reports, a ‘data reduction’ process was undertaken that involved categorising, tabulating, comparing and contrasting all information into ‘data displays’ to enable the identification of patterns and key themes (Caudle, 2004: p.421).

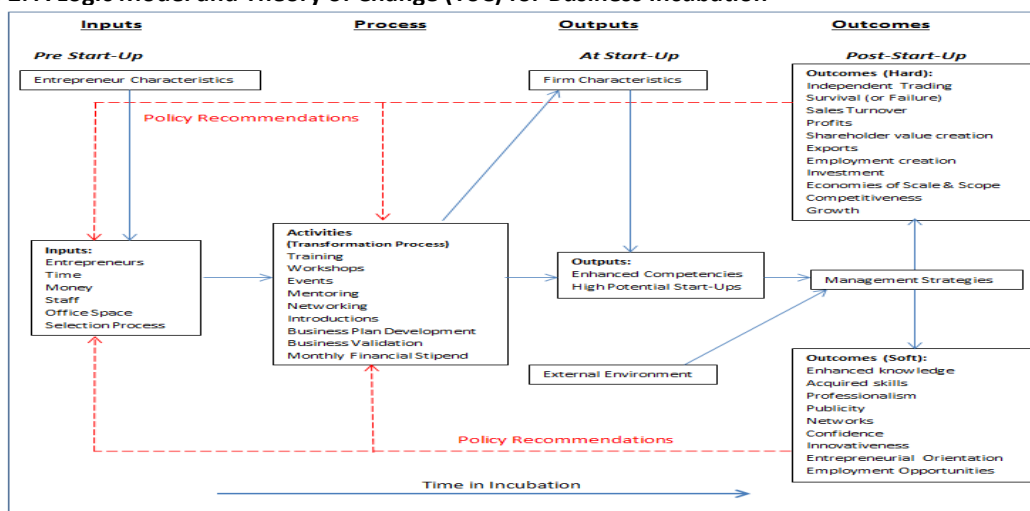
Business Incubation Logic Model and Theory of Change (ToC)

A logic model and theory of change draws attention to the potential importance of the incubation process in helping explain incubation outcomes (Hackett & Dilts, 2004a,b). A logic model was developed that represented the ‘theory of change’ hypothesised to occur through a business incubation programme. By comparing and contrasting the actual outcomes of the theoretical sample with the hypothesised theory of change allowed for tentative conclusions to be drawn on the contribution of the incubation process to firm and entrepreneur survival. This Logic Model and Theory of Change (ToC) is depicted in Figure 2.

Findings and Discussion

Although each of the six cases analysed were largely idiosyncratic, a number of common themes emerged during the analysis stage. In particular, the three trading firms appeared to have had a more compelling technological offering than the three companies that had recently ceased trading. The surviving firms seem to have benefitted significantly more from the establishment of a quality leadership team from the outset of the venture. The greater levels of absorptive capacity (Cohen & Levinthal, 1990) in the leadership teams thereby increasing the resilience of the ventures. They appear to have derived more benefit from the incubation programme than those participants that subsequently returned to paid employment.

Figure 2: A Logic Model and Theory of Change (ToC) for Business Incubation



Source: Buckley (2014: p.4); Hackett and Dilts (2004a: p.44); Voisey *et al.* (2006: p.465); Lenihan (2011: p.329); Smallbone and Wyr (2012); Storey and Greene (2010)

How Incubation contributed to the firm survival and entrepreneurial development

Through a combination of buffering and bridging processes - mentoring, training, and networking activities, incubation positively influenced the growth process of small firms, specifically by improving the ability of their owner-managers to develop niche market strategies; delegate authority and responsibility, internationalise; develop innovative technologies, and foster formal planning processes.

The majority of participants in the sample considered the buffering elements of the incubation programme to be beneficial. The programme-related factors which appeared to have been most beneficial for participants were one-to-one mentoring; strategy workshops and financial management training. However on the least beneficial aspects of incubation, opinions diverge between the surviving and ceased firms. The ceased firms considered the networking activities, such as events and introductions to be the least important in terms of the role they played in influencing their entrepreneurial and professional development. The surviving firms, on-the-other-hand, valued the more structured components, particularly formal business planning and financial management training least important, valuing networking, events and introductions (Bridging processes) as most important.

Conclusion

This exploratory study indicates that publicly funded incubation programmes may make a contribution to firm growth and performance, as well as the entrepreneurial and professional development of individual participants. However, further research is required to identify aspects of incubation are the most beneficial to either the incubated firm or the individual programme participant. This research has also highlighted the idiosyncratic nature of firms and the important role that fortune (and misfortune) can have in shaping the growth of firms. Although there is no 'one-size-fits all' approach to an incubation programme - both buffering and bridging mechanisms would appear to play some part in influencing firm performance and individual success. An important tentative finding in this study is that the leaders of surviving firms placed a higher value on the networking, events and introductions aspect of the bridging process than the leaders of firms which subsequently ceased.

Recommendations for Future Research

There is a dearth of empirical evidence on the effectiveness of start-up incubation in influencing long term firm growth. Indeed there exists a significant level of uncertainty regarding the effectiveness of and justification for enterprise micro-policy interventions in general. Whilst the methodological and data related challenges in this area are significant, it would seem that longitudinal mixed methods research nested in theory-based evaluation approaches have the potential to make a significant contribution to future research in this domain.

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