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Inside the high-tech black box: A critique of technology entrepreneurship policy

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ABSTRACT

Promoting new technology-based firms is the cornerstone of technology entrepreneurship policies in advanced industrial economies. Drawing on quantitative and qualitative empirical evidence from the UK, this paper provides a critique of these policy frameworks. The aggregate analysis shows that vast majority of these firms are micro firms, a small minority of whom grow rapidly. The paper then highlights the incongruence between the nature of these firms and the public sector technology policies designed to support them. The qualitative data reveals that typically these firms are corporate rather than university spin-offs; most do not undertake large amounts of in-house R&D; most do not have protected IP; and only a small minority are VC-backed. Most derive their main competitive advantages from open innovation sources such as relationships with end-users and customers. The paper offers suggestions for how policy could be recalibrated to better reflect the requirements of local entrepreneurial actors and the types of support required by most high-tech SMEs.

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1. Introduction

In recent years, both the OECD and the European Union have strongly endorsed the view that innovation is a key driver of economic growth (European Commission, 2010; OECD, 2010a; Flanagan et al., 2011; Dolfmsa and Seo, 2013; Cox and Rigby, 2013; Mazzucato, 2013). A core component of technology policy since the 1990s has been encouraging the formation and growth of new technology based firms (NTBFs) (Autio, 1997; Storey and Tether, 1998; Almus and Nerlinger, 1999; World Economic Forum, 2011). Despite the fact that these firms comprise a small proportion – around 15% – of the overall population of SMEs within most advanced economies, policy makers view these firms as a disruptive and dynamic part of their entrepreneurial ecosystems (OECD, 2000; Mason and Brown, 2014). For many policy makers it has become something of a ‘stylised fact’ that high-tech industries are a panacea for boosting growth within modern economies (Coad and Reid, 2012). Indeed, there are very few government strategies that do not adhere to the mantra that ‘technology drives growth’.

Consequently, at both national and regional levels (Storey and Tether, 1998; Asheim et al., 2011; Coad and Reid, 2012), the

promotion of technology based firms (henceforth TBFs) has become a central tenet of public policy within advanced industrialised economies during the last thirty years. This focus has been particularly pronounced in ‘liberal market economies’, such as the Australia, Britain, Canada and the US (Hall and Soskice, 2001) and has manifested itself in a fairly homogeneous set of policies designed to promote TBFs. This ‘one size fits all’ approach is often strongly predicated on a linear view of innovation and has typically resulted in a range of generic policy measures across OECD countries such as higher education research commercialisation policies, strong support for university spin-offs, public sector co-investment schemes, science parks, cluster policies and technology incubators (OECD, 2010b; House of Commons, 2013). Firm-based support is dominated by transactional forms of innovation support in the shape of innovation grants and tax credits.

This policy focus is underpinned by strongly held and inter-linked assumptions. First, it became the received wisdom during the second half of the twentieth century that “one of the greatest engines fostering economic growth in the global economy was high-technology industry” (Frenkel, 2012, p. 724). Second, dynamic regional economies like Silicon Valley were seen as evidence of the transformative effect that technology clusters can have on regional economies (Saxenian, 2006; Hospers et al., 2008) by accelerating the growth of technology start-ups (Feldman et al., 2005; Delgado et al., 2010). Third, technological development is an important determinant of entrepreneurial opportunity (Eckhardt and Shane, 2011) which is often exploited

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by 'disruptive' new starts rather than incumbent firms (Shane and Stuart, 2002). Finally, despite the fact that technology-based firms do not disproportionately contribute towards the overall stock of high growth firms (Brannback et al., 2010; Bleda et al., 2013) they are strongly targeted within industrial and entrepreneurship policy frameworks (Brown et al., 2014; Coad et al., 2014).

These views have become well established because there has been a lack of research to identify the nature of high-tech firms which are often viewed as something of a 'black box'. This paper challenges some of these 'stylised facts' which have become entrenched in policy circles about the nature of TBFs and how they should be supported. There is a paucity of research that has closely examined the entrepreneurial dynamics and specificities of high tech firms. The empirical focus of this research is Scotland. This provides a suitable empirical 'case' owing to the strong emphasis on promoting high tech firms both within Scottish and UK technology entrepreneurship policies. By explicitly examining the nature of TBFs within the Scottish regional innovation system (RIS) we show a clear 'mismatch' between the nature of these firms and the types of public policies deployed to foster and support them. The paper addresses this issue by posing the following research question: *what are the characteristics of technology-based firms and how effective is current technology policy deployed to generate and support them?*

Although the empirical focus is Scotland, on account of the high degree of policy isomorphism in the field of technology and entrepreneurship policy (OECD, 2010b), these findings have wider relevance for other regions and countries. Despite increasing lip-service towards more systemic approaches to innovation (Warwick, 2013), the paper argues that the dominant logic and rationale for technology policy "is still primarily shaped by market failure justifications" (Dodgson et al., 2011, p. 1147). This type of approach ignores geographical and institutional context and, specifically, the past and present economic characteristics and consequent resource mix of different regions and countries which constrain the types of policies that are both feasible and desirable. The findings will therefore have a strong resonance for other economies with similar policy frameworks across the OECD. The focus within the paper is exclusively on high-potential new ventures and the policies designed to enhance them rather than the full spectrum of enterprise policies.

2. Mapping the contours of current technology policy

Technology policy in advanced capitalist economies can be categorised as either 'mission' oriented or 'diffusion' oriented (Ergas, 1987). In mission-oriented countries technology policy is often focused around big science projects which aim to reap major scientific discoveries in cutting edge technological areas such as aeronautical engineering and microelectronics. The countries which best exemplify this approach are the UK, the US and France (Ergas, 1987). The co-creation of Concorde by the British and French governments is a good example of this kind of mission-oriented approach within technology policy (Mustar and Laredo, 2002). In diffusion-oriented countries, on the other hand, the primary goal of technology policy is to create a broad-based approach so that the firms within their economies can adapt to changing technologies. In these economies much greater emphasis is on fostering networks of SMEs and creating linkages between these firms, and public and quasi private technology-transfer institutions. This relational, or 'bricolage', approach towards innovation (Spencer et al., 2005, p. 325) is often underpinned by a strong corporatist institutional framework consistent with so-called 'coordinated market economies' (Hall and Soskice, 2001).

Countries which have adopted this approach to technology policy include Germany, Sweden and Switzerland (Ergas, 1987).

While, arguably, the onset of globalisation and inter-governmental learning has eroded the distinctiveness of these dichotomous approaches, differences nevertheless remain (Spencer et al., 2005). Indeed scholars continue to find quite distinctive institutional differences between countries like the UK and Germany where the former concentrates heavily on producing 'radically innovative' firm competences while the latter focus on 'competency enhancing' human resource practices (Casper and Whitley, 2004). Indeed, the strong policy focus on creating NTBFs is consistent with the "breakthrough approach to technological entrepreneurship" embedded within mission-oriented economies (Spencer et al., 2005, p. 325). Spurred on by the success of Silicon Valley in California, governments around the world, especially in 'mission' oriented countries, have increasingly focused on promoting knowledge based starts within their technology policies (Acs et al., 2009; Delgado et al., 2010; Lerner, 2010). This is evident in the huge upsurge in public policy programmes over the past 20 years aimed at developing high-tech, high growth starts (Tether, 1997; Storey and Tether, 1998; Almus and Nerlinger, 1999; Mason and Brown, 2013).

A central thread running throughout the majority of these policy approaches is the belief that TBFs predominantly arise from the commercialisation of university generated intellectual property (IP) through the establishment of university spin-outs (USOs) (Dahlstrand, 1997). USOs are viewed very positively by policy makers as an "economically powerful subset of high technology start ups" (Shane, 2009, p. 1) that provide a key conduit for the creation of new high-tech firms (Lockett et al., 2005; Rothaermel et al., 2007; Harrison and Leitch, 2010). However, the evidence indicates that very few USOs grow and many remain very small (Targeting Technology, 2008; Harrison and Leitch, 2010). Indeed, recent comparative research of USOs and company spin-offs (CSOs) found that the performance of CSOs in terms of sales growth and survival rates is considerably higher (Wennberg et al., 2011). These findings have led some to claim that the prominence given to spin-offs in the transfer of university research to the market place and has been greatly exaggerated (Perkmann and Walsh, 2007; Harrison and Leitch, 2010).

While public policy has strongly focused on producing 'new' high-tech firms (Brown and Mason, 2012a), established TBFs have also been heavily supported. Indicative of this is the central and enduring role given to transactional R&D support across most OECD economies (OECD, 2010a). Despite a lack of concrete evidence, policy makers at various spatial levels view R&D support as a central mechanism for fuelling productivity growth within their respective jurisdictions (Dosi et al., 2006; Coad, 2009; Mazzucato, 2013). While the different interventions and tools adopted to support innovation are diverse and multifaceted, a number of common features unite these policy approaches. Indeed, most advanced economies now appear to have the same universal 'toolkit' of grants, soft loans and tax incentives for supporting innovation (Lerner, 2010; Currid-Halkett and Stolarick, 2011).

In the main, the most high profile and resource-intensive forms of support are direct grant-based mechanisms which support capital expenditure for R&D in SMEs. As Fig. 1 shows, these direct forms of assistance are the dominant forms of policy support across the OECD, especially in the US, France, Korea and Spain. Research has typically found quite low levels of additionality from these kind of approaches on account that they 'crowd-out' private investment (Feldman and Kelley, 2006) and generally fail to generate high growth firms (Coad and Reid, 2012; Mason and Brown, 2013). This has prompted a shift in recent years towards a more pervasive use of indirect forms of support such as R&D tax

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