



Measuring the impact of innovative human capital on small firms' propensity to innovate



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ABSTRACT

The ability to identify and evaluate the competitive advantage of employees' transferable and innovative characteristics is of importance to firms and policymakers. This research extends the standard measure of human capital by developing a unique and far reaching concept of Innovative Human Capital and emphasises its effect on small firm innovation and hence growth (jobs, sales and productivity). This new Innovative Human Capital concept encapsulates four elements: education, training, willingness to change in the workplace and job satisfaction to overcome the limitations of measurements used previously. An augmented innovation production function is used to test the hypothesis that small firms who employ managers with Innovative Human Capital are more likely to innovate. There is evidence from the results that Innovative Human Capital may be more valuable to small firms (i.e. less than 50 employees) than larger-sized firms (i.e. more than 50 employees). The research expands innovation theory to include the concept of Innovative Human Capital as a competitive advantage and determinant of small firm innovation; and distinguishes Innovative Human Capital as a significant concept to consider when creating public support programmes for small firms.

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1. Introduction

Innovation plays an important role in firms' survival (Cefis and Marsili, 2006) and is generally defined as the commercial application of new knowledge and the implementation of ideas. It has been acknowledged as a key driver of firm growth and productivity (Ganotakis, 2012; Slaper et al., 2011) and a driving force for industrialised economies' international competition (Kuhlmann and Edler, 2003). Competitive advantage lies in part with the firm's capacity to innovate, evaluate and exploit internal and external knowledge (Cohen and Levinthal, 1990). Human capital provides a competitive advantage for firms in terms of skills, expertise and their willingness to work (Hewitt-Dundas, 2006). Human capital is an essential part of innovation (OECD, 2011). The ability to identify and evaluate the competitive advantage of employees' transferable and innovative characteristics is of key strategic importance to firms and policymakers. Firms and policymakers are faced with many constraints in light of the continued economic downturn and

reduced budgets, indicating a need to take advantage of existing resources, human capital being one such resource. This research undertakes an evaluation of employee-managers' human capital to create a new concept, *Innovative Human Capital* (IHC). In turn it examines the concept's effect on small firm innovation and assesses the resulting implications for public policy. In this context, this research poses two central research questions. First, does IHC contribute to firm-level innovation? Second, does IHC have differing outcomes in small and larger-sized firms?

There is an abundance of literature pointing to the importance of research and development (R&D) as a major determinant of innovation and include, for example: R&D cooperation strategies (De Marchi, 2012); R&D tax credits (Cappelen et al., 2012); R&D, product innovation, and exporting (Ganotakis and Love, 2011). However, R&D in small firms is constrained by the high costs and risk of undertaking such projects (Hewitt-Dundas, 2006; Rammer et al., 2009). Most small firms do not engage in formal R&D activity (CIS, 2012), which suggests that these firms find alternative ways to innovate (if indeed they innovate at all). Numerous policy initiatives have focused on supporting R&D in the pursuit of innovation but in the current economic climate of severely reduced budgets (European Commission, 2010a; Forfás, 2012) a focus on the internal resources and capabilities of firms is timely.

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The current research explores employee-managers' IHC. The importance of the managers' role in firm-level innovation stems from his/her position in the firm in terms of how the manager makes decisions, allocates resources, sets priorities, controls costs and spending, and filters ideas (Herrmann et al., 2006; Leiva et al., 2011). Such a role emphasises the importance of this group of individuals in the study of IHC. In the current research the managers, in their response to the survey, indicated that they were an employee (not self-employed¹) and were either involved in senior or middle management, or at a supervisory level in the firm. Many studies have focused on efforts to identify tangible internal and external conditions and attitudes towards innovation related to the individual person. Coronado et al. (2008), for example, find a positive significance of employees' qualifications and firm size in terms of their attitude to innovation. McGuirk and Jordan (2012) find that diversity in nationality and educational attainment in the workforce relates positively to firms' probability to engage in product innovation.

To date, however, there is limited empirical research on the combined tangible and intangible characteristics of employee-managers' human capital and whether these characteristics contribute to firm-level innovation and differ between small and larger-sized firms. In addition, the current research is motivated by the change in the proportion of the labour force with tertiary education. In Ireland, for example, the proportion of the labour force with a third level degree increased from 25% in 1996 to 36.2% in 2006 (CSO, 2012). By mid-2011, 38% of people in Ireland aged 25–64 year held a third level qualification (CSO, 2011). This increase in educational attainment is also evident in the Organisation for Economic Co-operation and Development (OECD) figures for the adult population: in 2005 the OECD average was 26% and 6 years later this had increased to 33% (OECD, 2007, 2013). Having employees with higher levels of education may no longer be a sufficient criterion for competitive advantage in terms of firm-level innovation: in fact, the proportion of skilled workers has increased in the context of developed countries, as the rate of technological change increases, there is an increase in demand for skilled labour (Piva et al., 2005). Furthermore, there is a growing consensus that Europe must develop citizens' knowledge and skills to create an economy where innovation is part of daily economic life (Ederer, 2006). The importance of human capital to innovate is evident in the Irish Government's *Action Plans for Jobs* (DEJI, 2012, 2014) which state that as skills needs change, the education and training system needs to respond and adapt. The plans also state that investment in management skills is vital. Additionally, the Irish government, through the National Development Plan (2007–2013), set out to invest €8.2 billion in initiatives to enhance human capital, physical infrastructure and commercialisation related to science, technology and innovation (Innovation in Ireland, 2008, p. 3).

Against this backdrop, the aim of this research is to extend the traditional measure of human capital by developing the concept of IHC. It builds on the traditional tangible measure of third level education by adding training, as well as the intangible attitudes and characteristics of the employee-manager including willingness to accept change in the workplace and job satisfaction. The research then proceeds to estimate the effect of IHC on small firm innovation and hence growth (jobs, sales and productivity). The empirical analysis is based on a large rich firm-level dataset extracted from the *Irish National Centre for Partnership and Performance (NCPP) 2009 Workplace Survey*.

The remainder of this paper is organised as follows: Section 2 discusses the theoretical framework underpinning the analysis; Section 3 presents the model and variables. Section 4 describes the data used; Section 5 discusses the empirical analysis and is followed by a final discussion on the results and policy implications in Section 6.

2. Theory and hypotheses

From a theoretical and policy perspective, this research is predicated on the case that sustained competitiveness depends upon the innovation-based strengths of the economy and what determines them (Montalvo, 2006; Santos-Rodrigues et al., 2010). The theoretical framework considers: firstly, the concept of innovation, the determinants of innovation and the types of innovation a firm undertakes; secondly, the theory of human capital as a factor of firm-level innovation and finally, the theory underpinning the newly developed IHC is presented.

2.1. Firm-level innovation

The importance of innovation for economic growth is well documented and has long been part of growth theory, beginning with Schumpeter's (1934) seminal work. His definition of innovation is still used in contemporary innovation studies (Fagerberg et al., 2012). Schumpeter highlighted the role of science, technology and human capital in explaining differing growth rates at both microeconomic and macroeconomic levels through entrepreneurial actions. Schumpeter's 'creative destruction' is the engine of growth (Grossman and Helpman, 1994; Romer, 1990). Innovation is the carrying out of new combinations in the form of: a new good; a new method of production; the opening of a new market; a new source of supply of materials or half-manufactured goods; and finally, the new organisation of an industry (Schumpeter, 1934).

The theory of innovation must incorporate explicitly the stochastic nature of innovation and must have room for organisational complexity and diversity (Nelson and Winter, 1977). Stochastic growth assumes that firms grow randomly (Teruel-Carrizosa, 2010). In addition, Nelson and Winter (1977) emphasise that non-trivial change in product or process, without prior experience, is an innovation. Theory also tells us that innovation is an interactive process, a learning process between people and organisations (Schneider et al., 2010). It is an intentional act to improve the performance in a job, organisations or society, where creative ideas play an explicit role (Williams and McGuire, 2010).

Growth in R&D is an important social and economic change in the twentieth century (Freeman and Soete, 1997), though Shipton et al. (2006) argue that innovation often refers to other activities beyond technical specialists such as R&D professionals and involves those with knowledge of the task and technology to ensure effective completion.

2.2. Firm size and innovation

Firm size as a determinant of innovation activity has long been the subject of empirical research (e.g. Acs and Audretsch, 1990; Hall et al., 2009). In the case of small and medium enterprises² (SMEs), such firms can survive and grow "if they are flexible, innovative,

¹ The National Centre for Partnership and Performance (NCPP) 2009 Workplace survey (employees) includes employees only – not the self-employed. An employed manager would be included but not a business owner.

² The main factors determining whether a firm is an SME are number of employees and either turnover or balance sheet total – Medium-sized <250 employees (\leq €50 m turnover or \leq €43 m Balance Sheet), Small <50 (\leq €10 m turnover or \leq €10 m Balance Sheet) Micro <10 (\leq €2 m turnover or \leq €2 m Balance Sheet) (European Commission, 2011).

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