Can Dublin Be Europe's Silicon Valley?

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Declaration

I declare that the work described in this dissertation is, except where otherwise stated, entirely my own work, and has not been submitted as an exercise for a degree at this or any other university. I further declare that this research has been carried out in full compliance with the ethical research requirements of the School of Computer Science and Statistics.

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Fabiano Strey

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Abstract

This research focuses on the city of Dublin, Ireland, and its growth as a high-technology business start-up in Europe. This research draws on theories of innovation and start-up ecosystems that shed light on how particular places become and sustain their position as leading-edge locations in a particular sector of the economy.

The research draws on secondary information and data to evaluate the position of Dublin as an ecosystem which promotes and helps sustain indigenous high-tech business creation. This case study approach uses the leading-edge exemplar of Silicon Valley in order to make direct comparisons between the two locations. This is done to shed light on how Dublin operates and highlights its strengths and weaknesses in terms of becoming a major start-up hub for high-tech businesses in Europe.

The research demonstrates that Dublin is very different to Silicon Valley in the operation of its high-tech cluster. In fact, this direct comparison shows that, whilst being a location that has a high number of high-tech start-ups annually, there remain some significant barriers to Dublin achieving its ambition to be Europe's Silicon valley and thus the number one. Dublin has unique strengths and weaknesses and the research finds that there are a number of policy options which will enable Dublin to enhance its position as a destination for high technology start-ups and help it take further steps in realising its ambition to be Europe's first choice for high technology business germination.

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Abbreviations

AUS   Australia

B-2-B Business to Business

B-2-C Business to Customer

BRA   Brazil

CME   Coordinated Market Economies

COI   Clusters of Innovation

DHDA Digital Hub Development Agency

EU   European Union

FDI   Foreign Direct Investment

FRA   France

H   High

ICT   Information and Communications Technology

IND   India

IP   Intellectual Property

L   Low

LME   Liberal Market Economies

MLE   Media Lab Europe

MNC   Multinational Corporations

MYS   Malaysia

NACE Nomenclature des Activités Économiques dans la Communauté Européenne

OECD Organisation for Economic Cooperation and Development

PhD   Doctor of Philosophy

SIC   Standard Industrial Classification

RSA   Republic of South Africa

SME   Small and Medium Sized Enterprises

STEM Science, Technology, Engineering and Mathematic

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Chapter 1: Introduction

1.1   Introduction

This research focuses on a specific real-world issue of contemporary economic and policy importance. The report focuses on the high-tech industry in a particular place, in this case Dublin, Ireland. It does so to provide an understanding of the contemporary issues that relate to supporting particular places to enhance their economic position in a global context. This study concentrates on business start-ups in Dublin but it does so to understand how it is currently performing and how it might improve its position within the wider economic landscape within the high-tech sector.

This research uses a comparative case study approach to compare, contrast and offer an evaluation of two locations known for their high-tech industries: Silicon Valley and Dublin. This desk-top study utilises a range of information and data which is publicly available to provide insights into how Dublin can fulfil its ambition to become a major destination for high-tech business growth. By comparing Dublin with a world-renowned leading-edge high-tech industry in Silicon Valley findings are presented about how well Dublin is currently performing and what it might do to enhance its performance into the future. As such, this research has real-world implications and potential actionable impacts on policy for business start-up support. Initially, however, it is important to set out the aims and objectives for this research.

1.2   Aims and Objectives

The overarching aim of this research is to critically assess what has been done to position Dublin as a high-tech start-up hub in Europe. Four key objectives have been set to achieve the overall aim, these are:

1.   Synthesise and critically evaluate academic and policy literature relating to understanding the development and support of high-tech sectors in particular geographical locations.
2.   Assess the relevance of literature in relation to economic development and start-up growth in the high-tech sector in specific places.
3.   Evaluate the academic literature and policy interventions that relate to Ireland and Dublin.

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4.   Assess the literature to provide key lessons and policy options to support Dublin's local authorities to foster economic development, cluster development and start-up activity in high-tech sectors.

To understand what, and more importantly evaluate how, effective interventions have been to support the technology sector start-ups in Dublin it is first necessary to understand the context in which Dublin sits and use a framework to comprehend the business ecosystem in which it is embedded. This is the purpose of objective one, to use existing academic and policy-related literature to understand the mechanisms and processes behind innovation and business start-up in particular localities which underpin economic development.

The second objective seeks to assess the relevance of the theoretical literature on business innovation and start-up ecosystems by exploring the multifarious dimensions or components that combine to make up the necessary 'recipe' which, combined, foster business generation.

The third objective involves narrowing the focus to the specific context of Ireland and Dublin. It assesses the relevance and relative importance of the components of cluster theory and varieties of capitalism approaches to understanding and evaluating the particularities of the Irish and Dublin contexts as they relate to business start-ups in the high-tech sector. It will be possible to apply the understanding from objectives one and two to evaluate their importance in one particular business ecosystem.

The findings from objective three will feed into objective four, which is to evaluate the specific Dublin and Ireland experience to identify key gaps and limitations relating to the approach to supporting business development. The theoretical models, particularly as they are understood in relation to Silicon Valley in the US, will help illustrate shortcomings in the planners' approach to supporting high-tech start-ups in Dublin.

1.3   Defining the High-technology Sector

To set the parameters of the research project it is important to set boundaries around the central focus of the research. The high-technology sector, also known as high-tech, is a high-profile sector which is made up of a range of different sub-sectors, not all of which reside in the public's consciousness about what constitutes the high-tech sector. Typically, a common- sense view of the high-tech sector has been associated with computers and

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more recently software. However, there are major sectors which are less likely to be immediately apparent such as biotechnology, which is again a leading edge sub-sector and which includes medical product innovation.

To clarify this definition it is useful and important to use official classifications of the high-tech sector. There are many officially sanctioned definitions, primarily developed by governments and their national statistical units. In the UK the National Statistics office has developed a system to compartmentalise sub-sectors of the economy into units, which supports the collection of data and analysis. This is called the Standard Industrial Classification (SIC) system. Likewise, the European Union has developed a similar and complementary classification called NACE; a term derived from the French Nomenclature des Activités Économiques dans la Communauté Européenne. The architecture of both systems is similar, they use a hierarchical structure: NACE is a four-digit classification framework and SIC a five-level structure (SIC 2007). The levels are based around narrower fields of economic activity. Below are key sectors within the SIC 2007 classificatory system that are relevant to activities undertaken within the high-tech industry. It is observable that a range of different levels within the SIC structure are relevant to high-tech businesses when considering the full range of activities they undertake (e.g. levels 1-4 are presented here).

- Section G Wholesale and Retail Trade
    - 47.4 Retail sale of information and communication equipment in specialised stores
    - 47.91 Retail sale via mail order houses or via Internet

- Section M Professional, Scientific and Technical Activities
    - 72 Scientific research and development

- Section J Information and Communication
    - 58.2 Software publishing
    - 61 Telecommunications
    - 62 Computer programming, consultancy and related activities
    - 63 Information service activities

- Section N Administrative and Support Service Activities
    - 82 Office administrative, office support and other business support activities

o   82.2 Activities of call centres

This is an important point. Business growth and start-up support initiatives have to appreciate the breadth of activities undertaken by businesses in the high-tech sector. These companies are not just organisations developing intellectual property (IP) or commercialising IP; they operate across the full supply chain and interact and overlap with a wide range of industries (if not all), which is due to the inherent and comprehensive nature of the technology industry. This classificatory issue and understanding of the breadth of the sector will have an important bearing on the remainder of the research since support for new businesses will have to offer specific answers to particular dilemmas and issues that particular subsets of the high-tech industry experience. The issues of protecting IP and its commercialisation will be very different to the needs of call centres offering services for business to business (B-2-B) or business to customer (B-2-C) support in specific software applications, for example.

Thinking about this high-tech industry and in particular start-ups is stimulated by considering the types of activities that underpin this sector. This understanding is also informed by approaches such as cluster theory which emphasise the full supply chain, from research and development, design, manufacture, and retail and ongoing servicing of high-tech 'products'. This view of what is incorporated within the high-tech sector means there is also significant overlap with sectors not immediately considered as high-tech, including those in the creative industries for example, particularly if considering issues around web, web design and software development or publishing.

1.4   Structure of the Dissertation

This dissertation is structured into a number of discrete but interlinked chapters. The following chapter, Chapter 2, provides a thorough critical review of the literature. In doing so it sets out the intellectual terrain for the remainder of the dissertation. It also provides the analytical framework for the research. A number of important different, yet complementary, theories of high-tech industry growth are presented. The third chapter provides the methodological approach that was taken in this research. It situates this approach, through a reflexive and analytical lens, within other approaches that could have been taken. The approach is justified, but the author also recognises that all approaches to research could be enhanced in some way. The fourth chapter pulls together the analysis and evaluation of the data collected from secondary sources and this is analysed

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with the literature reviewed in mind. The final chapter, Chapter 5, summarises key findings and ties up the issues in a conclusion.

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Chapter 2: Literature Review

2.1   Introduction

This literature review presents the theoretical content and therefore provides the intellectual context for the remainder of this research project. The review is organised around a number of sections.

The Ssection 2.2 broadly sets out the theoretical terrain to be covered in the remainder of the literature review. The section seeks to justify the literature's use and inclusion, particularly in regard to the overall project aim and objectives. The sSection 2.3 seeks to set out the main theoretical contours of cluster theory and provide some detail to identify why it is such a useful analytical tool to evaluate the potential for a high-tech start-up hub in Dublin, Ireland, which forms the case study. To do this, the section is further sub-divided. The sub-section 2.3.1 seeks to define what a cluster is and delineate its main characteristics. The sub-section 2.3.2 seeks to present the main features of the theory in order to understand how Michael Porter's diamond cluster model might operate. The sub-section 2.3.3 attempts to critically assess cluster theory. An attempt is made to explain why this theory is so useful in the context of evaluating policy interventions that support high-tech hub growth in a single location. The final sub-section 2.3.4 then moves on to a very specific territory within the theory, but one which is highly relevant to this review and the research project overall. The emphasis is on understanding how cluster theory accounts for new business generation and an attempt is made to make explicate the relevance of this theory to understanding how particular places can generate prolific numbers of business start-ups.

The Section 2.4 seeks to introduce other, yet argued to be complementary, theoretical approaches to understanding business generation in specific localities. The first of these approaches could be argued to be a branch of cluster theory. Yet, in the form that is presented it represents a sufficiently significant departure from the traditional cluster model to warrant special attention. Most importantly, this approach to clustering opens its analytical lens wider than traditional cluster theory to take account of global networks and connections within the innovation process. Section 2.5 focuses on a specific example, that being Silicon Valley in California, USA. This high-tech cluster has been chosen for its unique position as a leading-edge, high-profile cluster. Silicon Valley was chosen to explore the unique issues related to business creation in order to link the theory identified previously in the literature review and the specific case study in Dublin. The intention is to

use the detailed and intimate understanding of Silicon Valley to evaluate what has been done in Dublin to understand what more could be done to secure the city as a leading high-tech hub for business creation in Europe.

2.2   Innovation and Business Start-up and Growth

A consideration of the recipes and ingredients for business innovation start-up and growth requires informed analysis of key examples of where this kind of business stimulation has been particularly successful. There are a multitude of examples and various theories have attempted to understand and evaluate the key factors that impact on the relative success in securing an enterprising environment to stimulate economic development. Economic geographers, economists and industrial sociologists alike have given significant attention to these issues, adopting a range of theoretical orientations as frameworks to understand and evaluate the conditions and processes behind successful ecologies which foster business start-ups. Many of these analyses have focused on the high-tech sector.

To understand the particularities of Dublin's high-tech industry and the various interventions in supporting the development of new start-ups is highly complex. To evaluate the interventions, their value and likelihood of success it is important to use a coherent theoretical framework to understand the processes, linkages and wider economic and political dynamics which underpin such economic activity. To do so, this research adopts two such analytical frameworks. The first is a model of competitive economic clustering put forward by the economist Michael Porter (1990; 1998), who presented an evolved model for understanding how particular industries, like the high-tech industry, succeed in specific places and importantly how they come to be leaders in innovation and economic development. Porter's cluster model is presented in later sections of this literature review but for now it is worth stating that the model proposes an approach that considers how in particular places, such as Silicon Valley, a range of conditions, pre-existing and contingent, combine to foster a grouping of institutions and organisations that come together to foster a leading-edge innovation ecology, one which is ripe for supporting business innovation, economic growth and start-up generation, which have massive profit and economic development potential.

The second approach, which the researcher argues as complementary, is that of varieties of capitalism. This approach prioritises the institutional conditions within the wider political economy, which emphasises the national context. Such conditions, which can be influenced by governments through setting legislative and policy frameworks, and other

key factors such as trade unions or special interest industry groups, come together to influence the conditions which can support, or inhibit, the development of particular types of economies, and the emergence of different pathways for economic development in specific territories. As such, these wider institutional or political-economic factors can have some important influence over the development of a thriving high-tech cluster or business start-up regime. In short, the institutional conditions or regime can impact on how existing firms operate and grow, and this impacts on whether and how innovation is realised through business creation.

This section therefore makes the case for a theoretically informed analysis which will inform the content of this research project. The use of theoretical frameworks will provide a lens through which to make an evaluation of the situation in Dublin, which is based on a wider understanding of innovation, and business start-ups which have come before and also exist in other locations across the globe. This insight will enable the use of particular analytical categories which are known, in practice, to influence business start-ups. Ultimately, this theoretical appreciation will allow for a series of recommendations which can spill into policy prescriptions for enhancing the business start-up infrastructure in Dublin and Ireland more broadly.

2.3   Cluster Theory

Michael Porter's cluster theory of industrial agglomeration, competitive advantage and as an engine of new business creation came to dominate the economic and regional development discourse over a period of 20 years. The model of clusters, heavily influenced by an analysis of Silicon Valley's unparalleled rise to dominance in the high-tech industry, was adopted as a key tool by global organisations such as the Organisation for Economic Cooperation and Development (OECD), the European Union (EU), as well as a plethora of national and regional governments throughout the world (Snow, 2013). Governments, such as the UK, have also adopted cluster theory and offered their own definition: "a concentration of competing, collaborating and interdependent companies and institutions which are connected by a system of market and non-market links" (DTI, 1998, p. 22). This section sets out some key features of the theory of clusters to illustrate the main components of a functioning cluster.

2.3.1   Defining a Cluster

At the outset, it is worth defining what a cluster is and how it is conceptualised. Cluster theory came to prominence in academic and policy circles during the 1990s and its main

proponent was an economist called Michael Porter (1998, p. 78), who, in a landmark text which proposed cluster theory, put forward the definition below:

> Clusters are geographic concentrations of interconnected companies and institutions in a particular field. [They] … encompass an array of linked industries and other entities important to competition. They include, for example, suppliers of specialized inputs such as components, machinery, and services, and providers of specialized infrastructure. Clusters also extend downstream to channels and customers and laterally to manufacturers of complementary products and to companies in industries related by skills, technologies, or common inputs. Finally, many clusters include governmental and other institutions – such as universities, standards-setting agencies, think tanks, vocational training providers, and trade associations – that provide specialized training, education, information research, and technical support.

Wieser (2002, p. 398) identifies, using the definition above, that there are a multitude of high-tech clusters across the globe. Indeed, clusters appear in almost every 'sector' of the economy. Neither are they a new phenomenon; rather, they are argued to have a long lineage which reaches back to the Fordist period and beyond to the industrial revolution. High-profile examples include the textile cluster in Manchester immediately following the industrial revolution, through to those which dominated the Fordist period, which included textiles in northern Italy, and shipbuilding in Glasgow, Pittsburgh and Detroit (Kuah, 2002, p. 207). Wieser (2002, p. 398) illustrates the ubiquity of high-tech clusters that can be identified across the globe. He argues that Silicon Valley in California, USA, has been taken to be widely understood as the archetypal or prototype high-tech cluster but cites a litany of other examples such as Route #128, Austin, Park City (all USA), Cambridge, Leeds, Livingston (all UK), Shenzen (CHINA), Subiaco Valley (AUS), Toulouse (FRA), Campinas (BRA), Bangalore (IND), Penang (MYS), and Midrand (RSA). Despite this long list, Wieser (2002, p. 397) reflects the general view held by academics is that despite the many different high-tech clusters in a variety of countries they all share some key characteristics. Wieser (2002, p. 398) sets out these shared common characteristics:

- Geographic proximity of firms (manufacturers, suppliers, service providers), educational and research institutions, financial institutions, and business services
- Strong linkages among firms and the supporting infrastructure
- Concentration in a particular industrial sector
- Key functions within the community, self-sufficiency.

Therefore, academics tend to agree that high-tech clusters share some universal characteristics independent of other factors such as where they are located in different political-economic or cultural national contexts.

2.3.2   Describing the Cluster Model

At this stage of the literature review, understanding and recognising the elements of a cluster are important, since there are many components within the matrix of linked and networked organisations. A cluster includes a range of organisation types which include companies of all sizes that are often linked in some way (typically value adding and horizontally organised), predominantly through supply chains or networks. Often these companies cover all stages of the production process, meaning there are a number of companies in one location which operate in research and development, design, manufacture, retail and services. In addition there are a range of competing organisations within the cluster; that is, competition within the cluster in a particular 'product' market is a key feature of the cluster, as is cooperation between competitors. Therefore, clusters are characterised by companies (micro, small, medium, and large) competing and collaborating all at the same time.

Another key feature is the support organisations within a cluster. Organisations such as training organisations and higher education establishments are seen to be critical to the operation of a cluster and represent mechanisms that facilitate the entry of critical inputs into the cluster, for example in the form of skilled labour. Importantly, a cluster should be seen to represent a geographical concentration of unusually successful economic activity, coalescing around one particular field (Kuah, 2002, p. 221). Therefore, clusters can be considered as unique and particularly competitive and productive business environments, which have a close-knit geographical dimension. Engel and Del-Palacio (2011, p. 32) are helpful in this regard, setting out the common components of a 'typical' cluster:

> It typically includes start-ups; small, medium, and large corporations; universities and research centers; entrepreneurs; investors; and service providers as well as other individuals and organizations that: use entrepreneurial intensive process as a mechanism for innovation and experimentation; have heightened mobility of resources, principally people, technology, and capital; create companies with an early international perspective; and have players who have shared identities and aligned goals.

Therefore, the infrastructural support milieu, according to Kuah (2002, p. 213), "include linkages to governmental and other institutions – such as universities, think tanks, standards setting agencies, vocational training and trade association – that provide the

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essential training, education, information research, legal advice and technical support to the cluster."

Porter presented the theory of clusters in graphical form, which is known as the Porter Diamond Model, see below:
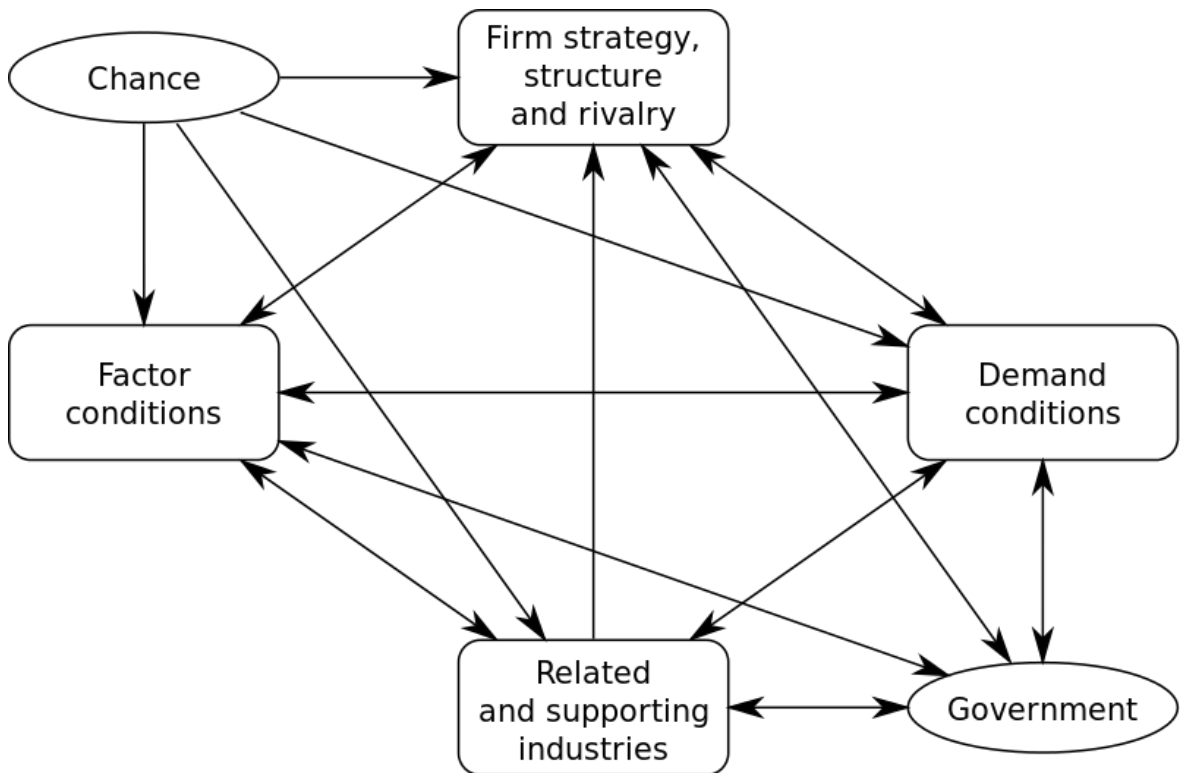
Source: http://en.wikipedia.org/wiki/Diamond_model

The basic components of the model are segmented into six categories which are embedded into the Porter diamond. Porter (2000, p. 258) set out the first four key segments that are used to analyse any cluster to identify the sources of local economic competitive advantage:

- Factor condition, also known as input conditions. These include natural, human, and capital resources; physical, administrative, information, scientific and technological infrastructure.

- Demand conditions include sophisticated and demanding local customers; unusual local demands in specialized segments that can be served globally; and customer needs that anticipate those elsewhere.

- Related and supporting industries relate to the presence of capable, locally based suppliers; and the presence of competitive related industries.

- Firm strategy, structure and rivalry, includes a local context that encourages appropriate forms of investment and sustained upgrading; and vigorous competition based on locally based rivals.

Porter (1990) also identifies two other dimensions to the diamond. These are government and chance, respectively.

- Government – is seen to be able to influence the four factors identified above, impacting on each in either positive or negative ways. Importantly, and taking into account the hierarchies of government and policy across nation states, these impacts can occur at local, regional and/or national levels. Indeed, it is possible that these government influences impact at a global level too.

- Chance – is also seen to have an important role to play in the development and sustainability of a cluster. This factor is evident in the formation of world-class clusters such as Silicon Valley and is equally clear in the failed cluster stimulation attempts which litter the globe. Importantly, chance events can be viewed as instances that occur beyond the boundaries of a firm, which limits their ability to influence any control over them. Porter (1990) argues that these influences are important because they have the potential to create discontinuities, meaning that some firms benefit by becoming competitive leaders, whereas some lose out.

These six factors, according to Porter, interact in unique ways to foster the conditions in which innovation and competitiveness is promoted.

2.3.3 Understanding Clusters and their Benefit for Innovation, Entrepreneurship and Stimulating Economic Prosperity

This section of the literature review presents key analysis of the benefit of clusters, their inherent properties, and how they operate differently to other agglomerations of businesses. The factors behind their structure and operation are described in order to shed light on how they operate as leading-edge innovators, developing regional competitive advantage, fostering the growth and birth of highly competitive firms. This section serves a practical purpose in that highlighting the key features and operational dynamics behind a high-tech cluster is the first step in understanding how they work; therefore it will provide critical understanding for latter parts of the research which will explore what has been done in Dublin and Ireland more generally and gaps or shortfalls in that intervention can be identified.

For Porter the underlying essence of a functioning cluster is high productivity, advantage gained though geographical proximity of concentration, and competition amongst firms within the cluster. With these three underlying principles in place, a cluster can evolve and develop under the velocity of activity which is self-generating and self-perpetuating. According to Pandit et al (2001, cited in Kuah, 2002) growth within the cluster increases the intensity of the agglomeration tendencies, which has a self-propelling and accelerating effect that secures ongoing success and sustainability of the cluster. Clearly there are positive feedback loops in operation within the cluster that Porter (1998) recognised as having an important impact on the amplifying effect which leads to new business formation. Kuah (2002, p. 213) exemplifies this positive feedback relationship by stating, "Agglomeration or external economies result in demand and supply conditions that are better in a cluster than in isolation and so promote the growth of incumbent firms and attract the entry of new firms." These are the conditions, according to cluster theory, which make for the entry of high numbers of highly innovative, fast-growth new firms through spinoffs and start-ups.

Clusters, according to Porter (1998, p. 79) are bounded "by the linkages and complementarities across industries and institutions that are most important to competition. Although clusters often fit within political boundaries, they may cross state or even national boundaries." Importantly then for Porter the origins of competitive advantage and innovation within the increasingly globalised economy are local, defined in the unique particularities of places (Kuah, 2002; Massey, 1984) Kuah (2002, p. 208) in his analysis of Porter's contribution points out that these local things include, "knowledge, relationships, motivation which distant rivals cannot reach." According to Porter, localness in the era of globalisation presents the solution to competitive advantage and innovation. Furthermore, there are a range of unique and identifiable benefits to local proximity as it relates to clusters. Porter (1998, p. 80) argues proximity is an important factor, enhancing firms' surveillance over markets and competitors as well as facilitating enhanced information which can be used to foster innovation. Proximity to competitors and the full value chain, according to Porter, helps to overcome what economists call information asymmetries. Firms located in clusters of companies and support institutions are able to enhance their understanding of opportunities and risks, for example. Close proximity also fosters enhanced opportunities for exchange, coordination and trust (Porter, 1998, p. 80). As Porter states the benefits of living amongst one's competitors, "Thus clusters mitigate the problems inherent in arm's-length relationships without imposing the inflexibilities of

vertical integration or the management challenges of creating and maintaining formal linkages such as networks, alliances and partnerships." Being local clearly overcomes the challenges or barriers of being spatially separated.

Clusters promote competition. This is one of their key features and benefits and without intense levels of competition clusters, it is argued, will fail (Porter, 1990). However, competition in a cluster, according to Porter (1998), sits alongside cooperation. Porter (1998, p. 80) points out, "Yet there is also cooperation, much of it vertical, involving companies in related industries and local institutions. Cooperation can coexist with competition because they occur on different dimensions and among different players."

Porter (1998, p. 80) argues that clusters directly impact on competition in three main ways. Firstly, he argues that clusters directly positively influence firm productivity within the cluster. This is critical to comparative advantage over competition beyond the cluster. Importantly, this is one area in which government can intervene in enabling improved productivity. This is amply illustrated by Porter's argument (1998, p. 80) that competition is "… strongly influenced by the quality of local business environment. Companies cannot employ advanced logistical techniques, for example, without a high quality transport infrastructure. Nor can companies effectively compete on sophisticated service without well-educated employees." Here we can see quite clearly how governments or local authorities can influence the operation of the cluster and impact on productivity by influencing supply of appropriate and adequately skilled labour through state provision in education and vocational training systems. In addition, authorities can also exercise some control over the operation of the built environment and physical infrastructure in order that firms can adopt the most productive methods of operating. This might include the physical infrastructure in the form of appropriate building supply, through planning regulations or financing the appropriate road structure or ensuring the right digital capabilities are available for companies to use, e.g. superfast broadband. Secondly, Porter (1998, p. 80) argues that clusters also drive the pace of innovation, which also impacts on productivity into the future. Thirdly, and critically for this research project, clusters are argued to stimulate the formation of new businesses which tend to be more prolific and impactful than those not operating within a cluster. The factors relating to this third issue will be discussed in more detail in section 2.4.

It is now self-evident that there are a set of benefits to being located within a high-tech cluster, over and above operating elsewhere in the economy. Firms within clusters

operate in an environment which fosters improved productivity. These influences in turn impact on the internal operation of firms and thereby improve productivity of all firms within a cluster. Furthermore, Porter (1998, p. 81) argues that being within a cluster "allows companies to operate more productively in sourcing inputs; accessing information, technology, and needed institutions, coordinating with related companies, and measuring and motivating improvement." Additionally, being located within a cluster enables firms to access a pool of labour which shares unique characteristics and is tailored to the needs of businesses within the cluster. This, Porter (1998, p.81) points out, lowers the costs firms incur when searching for and recruiting staff. It also means the firm is able to attract highly talented people with the right skills in all dimensions of the business.

Finally, and this relates to the circulation of information within a cluster, proximity also enhances communication amongst firms. Porter (1998, p. 81) asserts that the benefit associated with enhanced communication is that it,

> makes it easier for suppliers to provide ancillary or support services such as installation and debugging. Other things being equal, then, local outsourcing is a better solution than distant outsourcing, especially for advanced and specialized inputs involving embedded technology, information and service content.

The next sub-section looks at the relationship between clusters and new firm creation.

2.3.4   Clusters and New Business Formation

From the narrative presented above it is perhaps unsurprising that clusters are considered to be hot-beds for the creation of new businesses. This section investigates this issue in some detail, since understanding how clusters perpetuate the ideal conditions for new firm growth will have direct benefit to the focus of this research project: fostering a start-up ecosystem for the high-tech sector in Dublin. In fact, it has been argued that rapid firm growth and new business creation are the two key indicators of a successful cluster (Porter, 1998, cited in Kuah, 2002, p. 214). Not only that, but disproportionately high numbers of new businesses are started and grow in clusters relative to other parts of the economy (Kuah, 2002, p. 214).

Again, Porter (1998, p. 84) is useful here to summarise the key benefits clusters present in supporting new firm growth; he states,

> Individuals working within a cluster can more easily perceive gaps in products or services around which they can build businesses. Beyond that, barriers to entry are

lower than elsewhere. Needed assets, skills, inputs and staff are often readily available at the cluster location, waiting to be assembled into a new enterprise.

Beyond the individual, the infrastructure to support new businesses already exists, including a raft of financial backers, perhaps in the form of venture capitalists who understand the high-tech sector, which in turn lowers the barriers when it comes to accessing capital to finance a start-up. Engel and Del-Palacio (2011, p. 32) summarise this argument comprehensively when they state:

> Entrepreneurs and start-ups in COI [clusters of innovation] benefit from being co-located with other companies, suppliers, service providers, financial institutions, and investors specialized in or compatible with entrepreneurship. For example, law firms and other professional service providers with deep expertise in company formation and early-stage issues, such as shareholders agreements, IP [intellectual property] rights, licensing, and employment practices, are prepared to serve new firms with flexible fee structures (including start-up discounts, fee deferrals, and/or accepting equity interests in payment of fees) and service approaches (such as the practice of attending Board of Directors meetings at no charge) that enable these unproven businesses to access top professional talent.

Then there's the important factor of a 'local' enterprise culture in which entrepreneurs can operate. This perhaps less tangible factor is another enabling factor which helps support the transformation of ideas into physical products and businesses. With individuals and employees, operating in a culture which recognises enterprise and a start-up culture helps to reduce the psychological and understanding barriers to taking that step into business creation. For example, simply being embedded in an enterprising milieu enables individuals to appreciate the risks, benefits and drawbacks associated with becoming a start-up business. Knowing people who fail, understanding the basic principles of start-up and so on will help overcome inertia. Porter (1998, p. 84) points to another critical factor which promotes start-ups in clusters: "In addition, the cluster often presents a significant local market, and an entrepreneur may benefit from established relationships. All of these factors reduce the perceived risks of entry – and of exit, should the enterprise fail."

In addition, because entrepreneurs tend to be already embedded within organisations based in the cluster, future entrepreneurs are able to develop their understanding and become more educated about how to develop and manage new enterprises through a variety of means. Engel and Del-Palacio (2011, p. 32) identify three key sources of formal and informal learning and education prior to start-up, which include formal training, practical experience and informal networking. Here, government and other authorities have the opportunity to impact in this area by providing the right kind of infrastructural support. Engel and Del-Palacio (2011, p. 32) argue that "Specialized organizations exist to

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disseminate best practices, provide education for entrepreneurs and investors, and create events that foster networking, investing, and reinforcing a common set of values and practices."

2.4 Beyond the Porter Model: Cluster Theory, Globalisation and Varieties of Capitalism

This sub-section presents two additional, perhaps complementary, approaches to understanding clustering and its theories for promoting high-tech growth sectors. These theories have been selected because they propose different emphases than those put forward by the traditional Porter diamond model. The first still falls within what would be called cluster theory, but is one which focuses on the potential global dimension and interconnections between clusters of innovation. The second puts forward the varieties of capitalism approach, mainly because it is sensitive to the wider and local institutional framework and its impact on supporting or impeding the growth of high-tech sectors. What is important about this approach is that it gives analytical priority to the potential for governments and other actors to influence institutional infrastructures through, for example, policy. Therefore, it does not regard government as peripheral or inconsequential to the growth of clusters, rather they are placed more centrally within the analysis. This is particularly useful in terms of understanding how governments can impact on legislation and policy to develop successful clusters. Therefore it has practical utility when exploring what is possible in the case study of Dublin. This approach counters some of the views, often implicit or more explicit within cluster theory, that governments are at best peripheral to the development of high-performing clusters or at worst the view that is sometimes proposed that governments are best kept out of the cluster, putting forward the view that 'laissez faire' approaches are best when it comes to cluster theory (see for example Rosenburg, 2002).

Engel and Del-Palacio (2011) present an argument about cluster theories which takes account of a dimension that is typically downplayed in the standard cluster theory, that being the issue of globalisation. Engel and Del-Palacio (2011, p. 27) make the argument that clusters should not be considered as "isolated islands". The standard cluster model, the authors assert, is rather introverted and inward looking and therefore downplays wider linkages with other clusters and interrelationships with the wider global economy. Their study is innovative and takes cluster theory in new directions as they argue, it "illustrate[s] how focusing internally on a region can neglect the importance of situating an emerging cluster in a global context, and how global resources, inputs and access can accelerate

innovation and cluster development." Rather, their approach gives analytical attention to clusters and how successful high-tech clusters in particular areas connect to wider networks which potentially reach across the globe. The authors argue that these wider external linkages are used to gain access to resources, provide further access to markets that stretch out across the global economic landscape, and these factors help to speed up the process of innovation (Engel and Del-Palacio, 2011, p. 27). To summarise this approach the quotation below illustrates what is additive to the general traditional model of clusters; Engel and Del-Palacio (2011, p. 30) argue:

> We define a COI [cluster of innovation] as composed of largely intangible processes (i.e., mobility of resources, alignment of incentives, and entrepreneurial practice) as opposed to the original Porterian orientation that relies on the physical proximity of entities in the same industry. While such proximity advantages persist, we have observed that the innovation processes we emphasize pollinate across industries and indeed across regions. The definition allows for and invites the investigation of the role of the global connections between COI.

This new approach to cluster theory therefore extends the traditional Porter model in important ways to recognise the importance of analytical categories that have to date been largely ignored. The quotation above also demonstrates that thinking globally about the interconnectedness of clusters introduces new concepts and alternative analytical categories. This cluster theory approach also gives analytical credibility to policy that legitimises the actions of governments in setting policy which can take account of clusters and economies that are intimately connected to wider networks which operate supranationally and globally. Engel and Del-Palacio (2011, p. 28) point out its utility by arguing, "It can help expand the focus of economic development policy beyond regional competitive advantage to embrace the benefits of global connectivity, and it can assist in strategically targeting and prioritizing specific regions for partnership." This gives analytical credibility to another dimension to the role of government and policy in order to support cluster development and thereby new firm creation. This sub-section now moves to a second theoretical approach which provides a useful analytical framework for evaluating the benefit and efficacy of policy and the role of governments and other actors in influencing the infrastructural framework.

Varieties of capitalism allows for a clear link between the institutional context in a national economy and the impact of policies implemented by governments at a variety of spatial scales, from the level of the supranational regulation such as the European Union, the nation state, regional and local levels. The contemporary emphasis of the term 'governance' refers not just to the influence of government policies and legislation but a

wider range of interdependent actors operating to produce a unique configuration of influences which make up a unique variety of capitalism. Casper (2007, p. 8) explains the approach by stating, "Most research on models of capitalism, including the varieties of capitalism perspective, stress the importance of nongovernmental institutions, such as the orientation of financial or labor market systems." These forms of governance and the uniqueness of the national context highlight the criticality of thinking about these broader influences which can help promote or reduce the likelihood of promoting successful high-tech clusters in certain territories across the globe. The result of this is that a varieties of capitalism approach foregrounds comparative institutional research which accepts that models of capitalism differ sharply (Casper, 2007, p. 3). Casper (2007, p. 6) summarises this approach to national variation as, "contain[ing] a positive theory of why divergence in the structure of national economies continues to exist. According to the theory, divergence exists because specific national institutional frameworks create performance advantages for companies specializing in some industries, while creating obstacles in others." Put crudely, the economies within Europe can be classified into two main groups: (1) Liberal Market Economies (LMEs), such as the UK; and (2) Coordinated Market Economies (CMEs), such as Germany. Institutions can be seen to foster or impede the development of clusters, and unique circumstances will lead to the evolution of a different type of economy. It is assumed in the varieties of capitalism approach that LMEs would likely promote the development of leading-edge high-tech clusters, whereas CMEs contain a range of institutional impediments to the development of cutting-edge high technology clusters.

What is important about the varieties of capitalism approach in relation to this research is that the framework allows for a detailed analysis of how government and policy can impact on economic outcomes. It recognises the potential for governments to influence the institutional structure to facilitate or inhibit the emergence and sustainability of high-tech clusters. Therefore, this theory recognises the potential of industrial policies to contribute to the creation of support systems to enhance cluster development (Casper, 2007, p. 2). Casper (2007, p. 8) reinforces this view by explaining the pivotal role of the State in influencing the development of clusters; he states, "… due to the vigorous activities of governments in developing technology policies surrounding the new economy, the role of the state in directly shaping incentives within the economy should be examined." Moreover, the varieties of capitalism approach allows for a more nuanced interpretation of the political-economic and institutional structure at a local or regional level, recognising that the regulation of regional economies is interdependent with the

national economy; it is an approach that allows for local and regional differentiation in the institutional framework and therefore regional and local variation and uniqueness. The theory therefore allows for a sub-national analysis recognising regional and local differentiation. Place, and the 'local' in cluster theory, and its uniqueness is embedded within the analysis. Casper (2007, p. 8) argues, "regional economies can develop alternative patterns of economic coordination used to sustain local patterns of innovation not supported by the country's broader institutional frameworks." Varieties of capitalism, like theories of regulation and other structural analyses proposed by economic geographers and sociologists, recognise the importance of a 'geological' multi-layered analysis that recognises that processes are at work at a variety of spatial scales from the local to the supranational (Jessop and Sum, 2006; Massey 1984; Peck, 2000). All of these factors then impact on the operation of existing and emergence of new technology industries within discrete geographical territories. This analysis is critical to this research in that governments and other actors are seen to be able to exert agency over the development of the 'right conditions' that are conducive to fostering high-tech cluster development and new firm growth.

2.5   Learning from Silicon Valley

This section focuses on presenting an outstanding case study of Silicon Valley technology cluster. This outstanding example is chosen in order to understand the details of how Silicon Valley has become synonymous with business creation and to then see if this can be compared to Dublin. First however, a detailed picture of new business generation is required within Silicon Valley.

Silicon Valley has received considerable attention over the years as a high-tech cluster which has all the assets or components required to generate a sustainable leading-edge technology sector. Klepper (2010, p. 15), for example, argues that Silicon Valley should be viewed as one of the two most impressive clusters in the history of the United States. The rise to prominence of the Silicon Valley cluster, based around semiconductors, has been almost unprecedented. Klepper (2010) notes that within a period of thirty years Silicon Valley has gone from virtually nothing to becoming home to nearly 100 semiconductor firms, which include five of the industry's top 10 firms in this sector. During that period the population of the area has grown by a multiple of four and it has become a world-renowned exemplar of cluster development. What is more spectacular about this unusual case, Klepper (2010, p. 15) argues, is that this growth has occurred in a location that had no 'natural' advantage over any other location which has underpinned this

process of clustering. This factor makes Silicon Valley's global rise to prominence as an exemplar technology industry cluster even more remarkable.

Whilst many academics have attempted to 'discover' the unique origins and processes involved in the development of Silicon Valley, according to Tsai (1997, cited in Klepper, 2010, p. 15), there is little general consensus about how this location has risen to such heights. However, there has been plenty of research into the various components that have influenced the development of the cluster. Klepper (2010, p. 15) summarises these, stating, "Once semiconductor firms began to congregate in Silicon Valley after the emergence of Fairchild Semiconductor as a leader of the industry, labor pooling, technological spillovers, and a rich supplier industry stimulated further firm growth and entry of semiconductor firms in the Valley." In this list, Klepper touches on some of the key features which have impacted on Silicon Valley that have made it what it is today. Firstly, there is the key role that a few leading-edge, highly innovative firms have had over the development of this particular cluster. A small handful of innovation-leading firms have had a disproportionate impact of the development of the cluster, which has led to the germination of other high-profile market-leading organisations. This factor also relates to another key characteristic of the cluster, the role of spinoffs and new business generation. Silicon Valley has been heralded as being highly successful in germinating new businesses through a range of mechanisms. This is why the subject of this case study is particularly important and has been copied by policy makers all over the globe. It is also the reason for special interest in this literature review. Klepper (2010, p.15) argues that, "Spinoffs have been … implicated by industry insiders as key to the clustering of the industry in Silicon Valley." Even more importantly, it is the relationships between these pioneering firms and spinoffs which have received considerable academic attention. Klepper (2010, p. 15) clarifies the important relationship between pioneer business and subsequent spinoffs; he states,

> Silicon Valley …had an early exemplary performer that got the spinoff process going in their regions. Subsequently, better firms reproduced at a higher rate and their offspring were superior performers. With spinoffs not venturing far from their geographic origins, this led to a build-up of superior firms in … Silicon Valley.

Clearly, it is not the number of spinoffs that is seen to be so crucial. Rather, it is the quality of those spinoffs, and their subsequent rapid growth to become market leaders in their own right which has caused Silicon Valley to gain such considerable attention. This is exemplified by the fact that Fairchild spawned spinoffs such as Intel, National and Signetics (Klepper, 2010, p. 25). Thus, it can be seen that part of the secret of Silicon

Valley's success lies in the fact that highly innovative and entrepreneurial industry leaders were creating a large number of highly successful spinoff businesses, which in turn were becoming market leaders and at the same time producing spinoffs from those younger organisations.

This focus on spinoffs has led Klepper to identify three exemplar types of spinoff which are prevalent in Silicon Valley. These, according to Klepper (2010, p. 21), are classified as diversifiers, spinoffs and other start-ups. Klepper (2010, p.12) argued that each of the new businesses within these three main types share characteristics depending on which group they are related to. Klepper further argues that new entrants can be considered as either 1. high (H) or 2. Low (L) competence. On that basis Klepper's (2010, p. 21) typology and their characteristics can be summarised as (quoting directly):

- Diversifiers are assumed to be either high or low-competence producers in their original industry. It is assumed that for a diversifier to be an H firm in the new industry it must be an H firm in its own industry.

- Spinoffs can exploit knowledge about the new industry that their founders gained while working in the industry at their ''parent'' firm. Spinoffs are typically formed by high-level employees. Accordingly, it is assumed that for a spinoff to be an H firm, its parent (in the new industry) must be an H firm. Spinoffs are expected to inherit traits from their parents.

- Start-ups are composed of new firms founded by individuals without experience in the new industry. They are all assumed to be L firms in the new industry, reflecting their lack of organizational and industry experience.

This close genealogy of businesses in Silicon Valley is also tied up with labour and staff which researchers have identified had equally close relationships with parents and spinoffs. Staff in clusters such as Silicon Valley are incredibly mobile, this is a characteristic of the 'flexible' and contingent labour market in clusters such as this. Tracking the movement and relationships of staff between spinoffs and parent companies led researchers to discover that many entrepreneurs had moved from companies such as Fairchild to start their own spinoffs and in turn and over time had left that spinoff to create yet another enterprise. This is another key unique characteristic of highly performing clusters in the technology sector. Klepper (2010, p. 30) observes an important point, and one that is clearly present in Porter's traditional diamond model: chance. Klepper (2010, p. 31) argues that, "it would seem to be the chance entry there of these … firms that was the

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key impetus for the … clusters." Perhaps the chance location of Fairchild in Silicon Valley was the impetus behind the development of the cluster and it was purely down to chance that a superior performer had located in the area.

Silicon Valley has been successful because of a number of unique and interrelated factors (Casper, 2007; Rosenburg, 2002; Wieser, 2002). Indeed, it has become the envy of many governments and, importantly, whilst the recipe is well known, it is the way in which these elements have combined that makes Silicon Valley such a success. Casper (2007, p. 2) summarises these critical elements, stating:

> The success of Silicon Valley has led to the diffusion of a well-defined model of financing, managing, and organizing new technology firms. The model surrounds the use of venture capital to finance companies, corporate governance arrangements, employing ownership stakes in the company to generate high-powered performance incentives for managers and employees, and flexible patterns of company organisation that employ short-term employment to facilitate project-based work environments.

Rosenburg (2002, p. 2) supports this view, arguing that it is not so much the ingredients that are not well known, or understood for that matter, rather the secrets to the success of the high-tech cluster lie in the manner and order in which these ingredients were added. What these authors point out, at least implicitly, is that whilst there are many examples of governments and policy-makers attempting to replicate these conditions (see for example, Thorngate, 2004; Wadhwa, 2013), there is something which remains hidden from view, something inherently local, or something utterly unique to the particularities of place which make the recipe far less transportable or transposable to other contexts.

Furthermore, the role of universities is widely recognised as being an important component of a successful cluster, but that role and how innovative they are in producing new intellectual property (IP) and their role as engines in supporting that knowledge transfer into the market remains widely debated (Casper, 2007). In fact, some authors such as Rosenburg (2002, p. 16) claim that companies in Silicon Valley are much less innovative than is commonly understood and that the role of universities is overemphasised. Rosenburg (2002, p. 22) argues that what happened in Silicon Valley is less radical revolutionary innovation than policy makers believe, rather what is evident is the dominance of incremental progress and development which does not require universities to introduce ground-breaking IP into the marketplace. Rosenburg's (2002, p. 16) view is that companies are capable of sustaining innovation and clusters alone, as

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without the input from universities they are able to take their own research and develop as well as commercialise their own products, IP, and services.

The role of networks and flat organisational structures rather than monolithic business hierarchies has also been researched in depth and found to be a critical element of the success story (Saxanian, 1994, cited in Rosenburg, 2002). Additionally, flexibility and labour market conditions are agreed to have significant bearing on the operation of the cluster, one which links to networks between businesses, and cross-fertilisation through new business generation. Specific labour and skills issues including the role of migration of Diaspora has also been found to play a critical role (Saxenian, 1994, cited in Rosenburg). Further, firm ownership structures and their financing – through the important role played by venture capital, as well as takeovers, mergers and acquisitions – are all widely recognised as being a key part to this narrative of success (Casper, 2002; Rosenberg, 2002). Finally, the wider political-economic environment is recognised as playing its part though government intervention and policy that relates to skills training, through to setting low tax and regulatory regimes, for example (Rosenburg, 2002, p. 22).

2.6   Summary

This literature review has served a number of purposes and it sets out the theoretical terrain for the remainder of this research. The theories defined and described as well as critically evaluated have been presented as a useful theoretical window through which to view the underpinning processes, relationships and forces which lead certain locations to concentrate particular types of business activity, such as the high-tech sector. This enables the researcher to understand the mechanisms at play, which in turn enable the research to critically engage with the range of factors that interact to promote business growth and new firm germination. This includes intrinsic firm and other extrinsic factors which combine to produce geographical concentrations of highly competitive, productive businesses within a wider ecosystem in a particular territory. Without this understanding it would not be possible to evaluate how those key actors in Dublin have and have not successfully intervened to secure that city as *the* key hub for high-tech business generation in Europe. This understanding is further enhanced by a close look at one of the most successful clusters over the 20th and 21st centuries, Silicon Valley. To understand how and why Silicon Valley is such a success story will enable a comparison between that location and Dublin and allow the researcher to compare, contrast and evaluate what the key actors in Dublin have done and could do to enhance that location's prospects for securing the city as the high technology sector's new business start-up capital of Europe.

To quote Casper (2007, p. 2), "US technology clusters, such as Silicon Valley, have become engines of innovation and wealth creation, and the envy of governments around the world. Indeed, governments have poured resources into policies designed to foster clusters of similar start-up firms in their economies." This quotation demonstrates clearly what is at stake for governments and policy-makers in securing the prosperity of their economies. To get this approach right could mean securing economic prosperity not only for the city of Dublin but enhancing economic development throughout the wider Irish economy. To get it wrong, as so many authorities have done to date, means the squandering of billions of euro of taxpayers' money and failure to secure the role of Dublin in a leading-edge sector within the global economy.

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Chapter 3: Methodology

3.1   Introduction

This chapter sets out the main methodological approach which underpins this research project. In doing so, the researcher explains and justifies the approach taken, with particular reference to the alternatives that were available. In addition, the author also sets out and explains the main strengths and weaknesses associated with this approach and highlights the standard reported drawbacks associated with adopting an approach that uses secondary data to inform the analysis of these comparative case studies. There are benefits and drawbacks to all approaches to research and it is made clear that given an 'ideal world situation' the researcher would have pursued alternative and supplementary research approaches that, arguably, would have further enhanced the reliability and validity of research findings. In particular, the researcher argues that if more time were available to undertake a more in-depth project (such as a PhD) and the costs associated with undertaking a more extensive project presented no pragmatic barrier, using multiple research approaches has the potential, arguably, to enhance the reliability of data collected. Despite this caveat, this research draws on an approach that is extensively used and has a long and credible history as a research method.

As such this chapter is structured into a number of main sub-sections. Section 3.2 sets out the research approach and explains the use of secondary information. A justification and methodological explanation of this approach is also made. Academic literature on the use of secondary information is used to identify the key issues surrounding these types of information source. Important issues identified include defining what secondary information is, as well as the strengths and weaknesses associated with secondary data and information sets. Furthermore, a significant proportion of this section is dedicated to giving an account of the process of identifying sources, data collection and the different types of information gathered in order to provide the reader with an understanding of how the research was carried out. As such, and in line with case study approaches, this forms a benchmark against which readers can evaluate the validity and reliability of the accounts given and analysis provided in later chapters of the dissertation. Section 3.3 provides a short description of case study approaches and a justification is provided for the use of comparative case studies, given the nature of the research topic and the nature of what was being researched. Section 3.4 provides the researcher's reflections on the process of research and involves an identification of the limitations and drawbacks to the use of such an approach. Here, the researcher demonstrates that there are advantages and

drawbacks associated with all methods and approaches, and that in ideal situations it might be argued that more than one approach to collecting research data could be adopted. However, even these claims of 'accessing some kind of ultimate truth' through triangulation of research approaches remain highly contested, particularly if considering post-modern understanding of objectivity, truth claims and the ability of research methods to somehow reflect reality.

3.2   Research Approach: Secondary Information

This research employs a desk-based approach using secondary data and information. In addition to using secondary information as the only source of data the research adopts a comparative case study approach. This case study approach involves the comparison and evaluation of two high-tech industries located in two very different places. The first is a world-leading high-tech cluster, Silicon Valley. The second is the high-tech industry in Dublin. Secondary sources of information will be gathered and used to compare the characteristics and performance of each location as it relates to the high-tech industry. The purpose of this comparative case study approach is to use the understanding of how a world-renowned high-tech cluster – Silicon Valley – functions and taking that knowledge about how high-tech clusters operate to apply it to the experience of Dublin.

Initially, then, it is important to develop a firm understanding or definition of what secondary information is before embarking on a methodological description about the strengths and weaknesses of such an approach. As such the researcher adopts Stewart and Kamins's (1993, p. 1) definition, which is:

> Secondary information consists of sources of data and other information collected by others and archived in some form. These sources include government reports, industry studies, archived data sets, and syndicated information services as well as the traditional books and journals found in libraries. Secondary information offers relatively quick and inexpensive answers…

Importantly, Stewart and Kamins (1993, p. 3) also point out that the key distinction between secondary and primary research is that secondary research does not involve the collection of new data during the research process that did not exist prior to the research project. Thus, secondary information existed prior to the research and it was collected and analysed by others, including other researchers.

Desk-based research, which involves the identification, sourcing, reviewing, analysis, synthesis and evaluation of secondary information sources, is typically found in every

research project, usually during the initial stages (Stewart and Kamins, 1993). Often, it has been argued, secondary research and information will help to inform later stages of the research process (Stewart and Kamins, 1993). However, it is less common for desk-based research involving secondary information alone to form not only the main but also the only type of research method. Therefore, it is argued that this research project adopts an untypical approach to research. There are some important and immediate benefits to adopting such an approach, which are the availability and ubiquity of sources of secondary information available to the researcher, particularly in using digital sources and tools. Indeed timely access is one advantage and there are fewer practical difficulties relating to other primary research methods such as setting up interviews, ensuring surveys are completed by subjects; there is also little cost associated with secondary research.

3.2.1   What is Secondary Data?

Secondary data or information can come in a wide range of forms, and this is found to be the case in this research. Secondary information may include the following (not an exhaustive list): officially collected data sets from national statistics organisations (by governments); information developed by independent think tanks, government bodies, charities, and industry bodies; this is what the researcher found through the experience of undertaking extensive searches for secondary sources of information. Neither is secondary information solely developed for research purposes; there are a range of organisations and bodies that produce information or data for a wide range of purposes. Other data can include content of blogs, media reports and news items or even information produced by companies such as company accounts and annual reports.

Data or information may have been developed for a number of reasons and it is important to recognise this when reading and interpreting secondary information. In addition, the information will have been collected and often analysed already, prior to use by other researchers (Stewart and Kamins, 1993). This has important implications for evaluating inherent bias in secondary information that is already present when reading or interpreting information and reports.

Finally, it is worth pointing out that secondary information and data can come in various forms, including quantitative statistics and qualitative data. In addition, a lot of secondary information comes in the form of narrative reports of one kind or another. During this

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research an attempt was made to consider and include all types as they were all considered and evaluated on their own merits.

3.2.2   Advantages of Secondary Information

It is important to set out the advantages of using secondary information over and above primary data. Stewart and Kamins (1993, p. 5) argue that "the most significant of these advantages are related to time and cost." Therefore, it is understood that typically secondary research is, for the overwhelming majority of the time, cheaper than other methods which involve a range of approaches such as quantitative surveys, or qualitative approaches such as interviews and ethnographic approaches such as participant observation.

3.2.3   Disadvantages of Secondary Information

Despite the advantages set out above, it is important to point out that there are a number of well-recognised and widely documented drawbacks to using secondary information, particularly as a single source of information to inform the entire research process. It is important to point out that these criticisms do not make the approach less credible than others available to the researcher, rather the researcher consciously and reflexively set out the main issues that present to any researcher adopting these research techniques. There is no claim that these methods are somehow lesser in quality or offer a more partial view of the 'truth'. Rather, the researcher makes explicit these limitations to demonstrate the socially constructed and limited nature of any claims to truth.

Critically, there are difficulties involved with the interpretation of secondary information, which is a consequence of the fact that the information has been developed prior to its use in this research. It is recognised by scholars that secondary information has been developed for a specific and perhaps different purpose to that of the research project using that information. Thus, as Stewart and Kamins (1993, p. 6) point out, there are "potential problems inherent in the collection, reporting, and interpretation of secondary information. Data often are collected with a specific purpose in mind, a purpose that may produce deliberate or unintentional bias." The consequence is that the researcher needs to be careful in their interpretation of secondary data and their evaluation of what is being 'measured', why the data was collected and how it was interpreted and re-presented by authors. Furthermore, secondary data can be old data, and the researcher needs to bear this in mind when interpreting that information (Stewart and Kamins, 1993, p. 6).

3.2.4   Sources and Sourcing Secondary Information

There are a wide range of sources of secondary information and this research used many, which are listed and explained in this section. There is a wide range of types and sources of secondary information and this research used many, which are listed and explained in this section. Perhaps unsurprisingly, much of the information was sourced electronically. According to Zikmund et al (2013, p. 159) the use and availability of secondary data has "exploded with the advent of large-scale electronic sources and the web." The researcher therefore made best use of the large number of sources of information available via the Internet. These included resources available at the University's library as well as those available from or through the University's library services. The information available from the library extends well beyond academic literature, although that is what was first searched and sourced. The researcher first designed a number of search categories and used these as search criteria on the University library system, on the Internet through the Stella Search (http://stella.catalogue.tcd.ie). The Stella Search, as reported on the website, is an:

> Innovative way to find materials in the Library's collections. It functions like a search engine, so you do not need to search by title, author or subject. On the Library homepage, simply type what you are looking for in the search box on the left-hand side in the page header under Stella Search and click Search. Stella will return a list of items and using "Refine by" you can narrow down your results by format, collection, date published etc.

A wide range of academic sources were identified as evidenced in the review of literature. In addition, the researcher also used the EBSCOhost Research Databases online facility, through the University's Library[1], to follow similar searches. Beyond this, the researcher also used two search capabilities of popular search engine Google: Google Scholar[2] and the generic Google search facilities. Different parameters or search criteria and categories were used for each search function. Google scholar was used as a supplement to the Stella Search and EBSCOhost Research Databases searches, whereas the 'standard' search facility was used to source alternative types of secondary information. This information included a number of key policy reports and other reports produced by a range of stakeholders which were relevant to this research topic. This included reports such as 'Activating Dublin #bestplacetostart', for example. These reports and documents

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[1] http://web.b.ebscohost.com.elib.tcd.ie/
[2] http://scholar.google.com/)

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were equally useful to those academic outputs identified by other internet search tools identified above.

During the research process a number of specific key organisations were identified and their websites were interrogated for secondary information. One example is Invest in Ireland IDA Ireland http://www.idaireland.com/. Many more were identified but one example has been used to exemplify this process.

Additionally, a number of news website and special interest online high-tech 'magazines' were interrogated and important opinion pieces, news items and other documentation was found and saved. This group included trade and professional associations as well as other stakeholder organisations which Zikmund et al (2013, p. 174) explain are valid and important sources of information. One example is Silicon Republic http://www.siliconrepublic.com/, self-described as Ireland's technology news service or the Independent online business pages, http://www.independent.ie/business. Other examples included the www.thedigitalhub.com, Dublin's dedicated website to support the high-tech cluster, digital content and technology enterprises. There are many examples of these types of website which were identified during this research but rather than providing a full list the researcher instead has provided illustrative examples above. In total 18 websites were found to be useful and provided information in one form or another, be it a government report, news item or opinion column or other report.

3.3   Comparative Case Study Approach

This secondary research process focuses on a comparative case study approach. It does so to compare a single exemplar location and high-tech business cluster, Silicon Valley, in order to take learning from one context and apply that understanding and evaluate the performance of a second case study location which forms the main focus of this investigation: the high-tech cluster or start-up hub of Dublin.

The purpose of selecting a case study approach in this instance is because of the nature of the research questions and the objects of study. For example, the research was explorative in nature, meaning that the researcher was seeking to uncover new thinking or ask questions such as 'how' and 'why' rather than some form of hypothesis testing of a general population. The inductive and explorative nature of the research question therefore lends itself to a case study approach (Yin, 2009, p. 2). Importantly, Yin (2009, p. 15) points out that a case study approach can complement internet-based research of

secondary data. Case studies also suit this project because the topic and nature of enquiry leads to the need for an in-depth level of understanding around a complex set of unique influences, processes, practices and stakeholders. It is this depth which is suitable for case study approaches (Yin, 2009: 18).

It is also important to point out that this is a comparative case study in that one location, Dublin, is being compared with the leading example of high-tech clusters, Silicon Valley. What this comparative approach seeks is to identify and explain causal relationships from evaluating the two cases and understanding how one operates in order to improve the other. The first case study, Silicon Valley, provides the analytical and empirical framework around which to compare the second case study, Dublin.

3.4   Methodological Limitations and Issues

There are a number of limitations to this approach to research. These limitations are identified from an understanding of wider research approaches that were available to the researcher at the outset of this project and through the researcher's experiences during this project.

The first limitation to be identified is the issue of triangulation. According to Flick (2006), triangulation is the term "used to refer to the observation of the research issue from (at least) two different points. This understanding of the term is used in qualitative as well as quantitative research and in the context of combining both. Triangulation is most often equated with applying different methodological approaches." The idea and practice of using triangulation is an underpinning theoretical concern which attends to the philosophical issues relating to the validity of data or information gathered during the research process. The basic principle of triangulation is that information sources should be treated with caution, particularly with regard to their truth claims. On that basis, thorough research uses a range of points of view to triangulate information. This can lead to the verification or refutation of truth claims and it is argued that as a consequence interpretation and analysis of data will in itself be more reliable. Whilst secondary information in this research project was drawn from a variety of sources including peer-reviewed academic literature, government policy documents, and news and opinion pieces, triangulation in scientific research tends to refer to the adoption and use of more than one approach to research to improve validation or enhance trust in what is being claimed. However, of critical importance there exists some academic debate about the value of triangulation in somehow offering a greater insight into reality or truth. Some post-

modern academics argue that the very notion of triangulation is premised on modernist conceptualisations of what constitutes objective knowledge and that somehow the truth or reality is 'out there' and accessible through certain methodological approaches. This argument is presented by Eyles and Smith (1988, p. 13), who argue that triangulation draws on an analogy from engineering and that in its modernist guise purports to be able to converge on a single version of reality.

In addition, and on reflection, through reading and evaluating the secondary information, the researcher became increasingly aware that despite gaining access to relatively up-to-date information there was a sense that this approach would have benefited from being supplemented through some form of contact and feedback from key actors involved in supporting Dublin to become a major start-up hub in Europe; for example, those individuals working in particularly important positions in crucial organisations. These individuals in various stakeholder organisations such as policy makers, government staff, industry representative groups, trade unions, economic development staff, and other people working 'on the ground' to deliver the vision for a start-up hub, would have provided a range of views and opinions, and identified key issues and themes around the critical dimensions which can either help or hinder business germination in Dublin. Furthermore, the first-hand views of business are lacking in the account presented in this research. These are the views of those working in corporations who would be considered as foreign direct investors and entrepreneurs who have actually embarked on starting up businesses in Dublin. Views from those working at the leading edge of innovation and enterprise would have enhanced the data bank from which to analyse the current situation, particularly that of 'on the ground'. There are a number of approaches that could have achieved this, including face-to-face interviews or business surveys, or even participation and observation in a range of meetings and other events in the Dublin high-tech cluster. Therefore, it is possible that if practical barriers were to have been overcome, mainly time and cost, it might have been possible to explore other perspectives to gain first-hand exposure to the research location and key actors involved in supporting start-ups in Dublin. This could be done through a range of research methods and approaches, each of which also have their own advantages, drawbacks and limitations.

3.5   Summary

To summarise, this comparative case study approach using secondary data is ubiquitously used in virtually every research project and approach to every research problem. Given the nature and type of research being undertaken and the practical issues

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that prohibited other approaches being used, this approach is valid and appropriate. It could be argued that without adopting this approach it would not have been possible to carry out this research project. There were two particularly significant barriers to undertaking research: time and cost. Secondary research is particularly advantageous in these circumstances as the approach is known as being economical and time efficient when compared to other primary research methods. Despite this there were some problems encountered in adopting a secondary source approach to data collection alone. These limitations and lessons learned were explained above, and it is sufficient to say that if the research were to be done again from first principles or there was more scope for other approaches to research their use would be given full consideration. In particular, the author is of the opinion that interviews with key stakeholders would have advanced the quality of the research through qualitative primary research data collection.

Chapter 4 Findings and Analysis

4.1   Introduction

This chapter presents the outcomes of the literature review in relation to the other information and data that was collected which focuses on Dublin's high-tech cluster or start-up ecosystem. To do this the chapter is subdivided into a number of sections. Section 4.2 sets out the context of the high-tech cluster from a global and European regional perspective. It demonstrates that Dublin is certainly not alone in its position as a leading European location for high-tech business start-ups and it is one amongst many cities across Europe that share the same ambition to become the pre-eminent location for new business creation in Europe. Importantly, it is clear that competition is rife, with other cities being able to attract and deploy significant sums of money to back their ambitions to support business germination ecosystems. Within this section the debate about whether policy and practice in one location can be transported or emulated in another is presented. This debate, often implicitly, runs through all sections of this chapter.

Section 4.3 narrows the focus by explaining the unique case of Ireland, and Dublin in particular. The policy and institutional context is explored as it relates to business innovation support systems. Dublin and Ireland's historical role as a prime location for foreign direct investment (FDI) provides the context for understanding contemporary policy which is aimed at supporting indigenous business growth to complement ongoing FDI. It is also shown that time, or history, plays an important role in seeding the high-tech cluster that has emerged in Dublin. Indeed, it is also seen that FDI continues to play a pivotal role in fostering and supporting the development of the high-tech cluster. Finally, in this sub-section, specific reference is made to Dublin's Digital Hub, which is a dedicated policy instrument that has been developed to facilitate the city's ambition to support cluster development in the high-tech sector. The hub acts as an umbrella organisation through partnership, and provides a coordinating function that oversees a range of investments and activities which combine to provide a well-resourced economic development support ecosystem.

Section 4.4 seeks to provide a critical analysis of the literature and evaluate the relative success and future potential for Dublin to gain the status it seeks. This is done through a comparative analysis of two clusters: Dublin and Silicon Valley. This is an effective exercise in understanding not only how highly effective clusters come into being but also how they operate. Here, direct comparisons are possible and doing so highlights some

key limitations and other issues which lead the author to argue that Dublin needs to overcome challenges to become a leading hub for high-tech start-ups in Europe.

4.2   High-tech Clusters

Given the hyperbole associated with the economic benefits of high-tech clusters, and all clusters for that matter, national or state governments across the globe have thrown the equivalent of billions of dollars at a range of interventions and a multitude of policies in an attempt to stimulate cluster development in their own back yards. This is not a particularly surprising outcome considering the media, policy and academic interest of clusters as offering such huge potential reward. However, it is important at the outset to identify that despite the apparent strength of cluster theory in being able to explain the components and characteristics of a fully functioning agglomeration of high-tech businesses and the support functions that facilitate their growth and sustainability, the message that consultants perpetuate and the policy interventions they prescribe should not be considered as a panacea to all economic development ills. Rather, and as will be demonstrated in later sections of this chapter, across the global economic landscape there are many examples of failed attempts to stimulate growth and economic rejuvenation using the 'tool kits' that cluster theorists posit. Despite this backdrop of being cautious towards the potential for cluster theory and its potential through policy implementation there are also a few success stories which demonstrate that, if done right, this set of economic development tools has the potential to transform economies, making them leaders in the field across the global economy.

The ubiquity of the desire to initiate clusters is reflected in claims by Rosenberg (2002, p. 4), who states, "By one accounting there are 105 areas around the world (including the US) that have adopted a distinct technology cluster identity." Whilst the lessons from Silicon Valley are clearly articulated and components and recipes understood, national and state governments have not attempted to implement change in an unchanging universal manner. Rather, many of those working in different localities recognise the relative differences, strengths and weaknesses of their own places and unique dimensions to their own economies. Accepting these differences, policy makers and other actors involved in the economic governance of places have approached the imitation of the Silicon Valley success story in slightly different ways, trying to carve out their own niches in the wider globalised high-tech sector. As Rosenberg (2992, p. 2) argues,

> … the Silicon Valley concept has been installed in dozens of places around the world. [However] A software house in Helsinki, Finland; a fabless-chip maker in Cambridge, England; or a fibre-optic equipment start-up in Tel Aviv, Israel, today will

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typically conduct its operations, structure its management and create its physical surroundings to resemble its peers in San Jose or Mountain View.

This is an important issue to point out at this initial stage as this demonstrates that many national and regional governments have been doing similar things to Ireland and Dublin and recognising this fact is important as governments of different places are acting as 'hostile brothers', competing with each other for a piece of the global high-tech market (Peck and Tickell, 1994). This background also demonstrates the extent and magnitude of Dublin's ambitions in attempting to secure its position as a leading location for high-tech start-ups in Europe.

Intra-European competition between cities is rife, and Dublin is one of many which are attempting to compete in this arena. For example, there are plenty of media, think-tank, industry body and academic reports into other high-profile cities within Europe, all vying to become the pre-eminent location or hub for high-tech start-ups. Other competitors in Europe and beyond, according to a recent report by CNN, include: Copenhagen, Denmark; Oulu, Finland; Zurich, Switzerland; Eindhoven, Netherlands; Stockholm, Sweden; Singapore City-State and Dublin, Ireland (http://money.cnn.com). Yet, beyond this list there are others seeking to stake their claim, including London's Silicon Roundabout (http://www.siliconroundabout.org.uk/), or Tel Aviv, which is reputed to be the second most important technology cluster beyond Silicon Valley (http://www.independent.ie); then there are international competitors such as software in India (Arora et al, 2004), all of which make up an illustrative and non-exhaustive list of key global competitors.

This section, which has focused on the ubiquity of high-tech clusters, naming only a very few, has been presented in order to place the activities in the case study city of Dublin within a wider global context. It illustrates there are a large number of locations in Europe and across the globe that are in the position to compete directly with Dublin to become the premier place for high technology start-ups in Europe and beyond. The next section focuses more on the origins of the high-tech cluster in Dublin and within that description it highlights some of the key limitations to the operation and components of that cluster in realising their ambitions to become the European leading destination for high-tech business germination.

4.3   The Case of Ireland and Dublin

Dublin and Ireland's relatively recent successful history with regard to growth in the high-tech industry has tended to be due to the policies to attract multinational corporations'

investment. Internationally owned corporations in the high-tech sector have invested in Ireland for a range of reasons but this investment has typically been in the form of a 'branch-plant economy', which is seen to exploit space and places in the structure of large multi-locational organisations (Ryan and Giblin, 2012; Massey, 1984). Multinationals in particular locate parts of their overall production processes in different places to take advantage of the unique local circumstances, which means the organisation can save money and improve productivity. Specific places come to be associated with parts of the wider overall production process. However, this means that the 'core' of the business, including decision making and research and development functions, tend to remain centred in one place, whereas 'lower order' or more routine parts of the production process are hived off and relocated elsewhere, such as Dublin. This means that Dublin would miss out on the most innovative and more complex dimensions of the production process and this has important spinoff effects on the operation of clusters and the structure of the local labour market (Massey, 1984).

The pro-inward investment policy was set by the Irish Government some decades ago and this included key incentives such as low corporation tax rates and grant incentives (Ryan and Giblin, 2012, p. 1322). Whilst proving to be a success to a certain degree this 'branch-plant' investment has had a somewhat limited impact since critically what has been observed in the first wave, such as Microsoft or IBM, and more recently with the arrival of software giants such as Google, Facebook or Twitter, has been the arrival of 'low value-added' jobs (Ryan and Giblin, 2012, p. 1322). This assertion is supported by Arora et al (2004, p. 87), who propose that these multinational companies operate the low-value-adding parts of their business from Dublin and Ireland and this includes areas such as "detailed design, coding, testing, localization and customer support (e.g. call centres)". Not only that, in addition to being low-value-adding activities, Arora et al (2004, p. 96) argue that these operations in Ireland and Dublin tend to be low-skilled parts of the overall production process, and activities preclude the utilisation, adoption and spillover of high skills, since operations focus on pursuits such as "porting of legacy projects on new platforms, disk duplication, assembling and packaging and localization". As such, whilst absorbing much of the slack in the labour market, these jobs have tended to be of lower quality than many of the jobs found in leading-edge clusters or in high-tech firm head offices, or research and development facilities and labs. This, as will be discussed in more detail later on, has had important implications for the Irish and Dublin economies respectively and impacts also on the potential for enhancing start-up and business creation.

In addition to the above, what some have seen over the relatively recent past, perhaps the last 30 years, has been a growth in FDI and the relocation of world-class brands in high-tech to Dublin; this has been paralleled by relatively weak development of the indigenous high-tech sector (White, 2004; cited in Ryan and Giblin, 2012, p. 1322). Ryan and Giblin (2012, p.1322) go on to claim that, "As a result, the sustainability of growth in the economy has always remained an issue for debate." This issue, whilst presented only briefly here, is critical, particularly when considering the best practice emerging from Silicon Valley and how that cluster operates. For the time being it is sufficient to say that there has been a lot of research into the nature of branch-plant economies and investment and the 'spillover' effects on local economies, and this research has been undertaken in a range of economic sectors, including manufacturing, engineering and services, for example. All the research points to the limited effects these kinds of lower-quality jobs have on developing and 'transfer' to economies and labour markets too, particularly those relevant to supporting complex leading-edge supply networks in the high-tech sector.

Such is the level of reliance on FDI to drive the high-tech industry in Dublin and Ireland, Forfás (2010) points out that, "In 2009, 98 per cent of exports of information, communication and computer services were from the multinational sector" (cited in Ryan and Giblin, 2012, p. 1324). The importance of FDI is reinforced by the use of an alternative measure. Bayliss (2007, p. 1265) states:

> The National Software Directorate estimates that at the end of 2005 the Irish software industry consisted of more than 900 companies, 140 of them foreign, employing 24,000 people and exporting over €23 billion worth of products and services … [However] … Of the €23 billion worth of exports in 2005, only €1.2 billion stemmed from Irish companies. FDI thus generates wages, local service provision and local corporation taxes, but profits from the sector are overwhelmingly remitted to parent companies overseas.

There are critical implications for what is being observed here, particularly for the operation of the Dublin and Irish economies. Bayliss (2007, p. 1265) goes on to argue that what the above is demonstrating is the lack of quality or connectivity in terms of supply chains/networks between FDIs and local indigenous businesses in this sector. Indeed, the next logical step to take is that a consequence of this lack of 'embeddedness' of these multinational corporations into the local economies means that that "foreign owned software companies contributes little towards either a dynamic process of innovation or an upgrading of labour force capabilities" (Roper and Grimes, 2005; cited in Bayliss, 2007, p. 1265). The implications for the indigenous economy are multiple and great. First, the

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argument is being made that historically the quality of jobs being implanted into Dublin is low, and that there is a significant weakness when it comes to linkages between FDI and indigenous businesses, which in turn means there is a limitation to the benefits of 'spillover' effects which, it would be hoped, would improve the quality (e.g. entrepreneurial, research and development capability, and skills) of the workforce. Labour markets generally are argued not to be improving because of this disconnect. All of these are key factors which will have significant impacts on the operational performance of Dublin with regard to its ambitions to become the European centre for business growth. These factors will directly and significantly inhibit Dublin's plans and their government officials' ambitions for the city. For example, what the Porter model showed in the review of literature is that factor conditions, for example the supply of appropriate skilled labour, would be required for a fully functioning leading-edge high-tech cluster to operate. Thus, Bayliss (2007, p. 1265) argues, "…the economic benefits of such ICT activity to both Dublin and Ireland remained limited."

4.3.1   Ireland's Shifting Policy: The Current Approach

As the previous section illustrated, over the past 30 years, Ireland's industrial policies have been centred on the attraction of 'mobile' multinational capital in the form of FDI, originally high-tech manufacturing firms producing computers and components (Bayliss, 2007, p. 1261). However, more recently, recognising the limitations to this approach, policy has now clearly shifted to attempt to promote indigenous business growth alongside FDI to develop a more balanced economy, one that could be argued to lead to become a 'sustainable knowledge economy'. As Bayliss (2007, p. 1261) has clearly identified, this new policy direction has been underpinned by a range of "state initiatives [which] with the substantial backing of the National Development Plan have sought to develop the ICT sector, not least by investing in research and attempting to link economic development policy to exploiting the knowledge resources of third level and other research institutions." This state-backed redirection of policy has therefore led to a reorientation of focus around indigenous ICT growth, and one which intends to utilise the 'blue skies' research and development capabilities of its university infrastructure. Clearly, there are links here to those identified in terms of the role of universities in the Silicon Valley area. Here too, the role of universities has been fundamental in sustaining that cluster and its ongoing success through high levels of intellectual property creation which has then spilled over through innovation and the creation of new businesses.

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In addition to the recognised lack of numbers of indigenous firms and the fact that the overriding majority remain small, policy makers realised that these indigenous SMEs (small and medium-sized enterprises) tended to operate in rather specific niche markets (Bayliss, 2007, p. 1265). The reason for this, according to Arora et al (2004, p. 84) is that these specialist firms tend to find niches within the high-tech markets, where entry barriers are seen to be low. The advantage is that these businesses didn't tend to compete with the larger inward investors, but neither did these businesses ever undergo high and fast growth, therefore limiting their impact on Ireland's and Dublin's economy. As such, the recent Irish Government report 'Trading and Investing in a Smart Economy' has provided a target which seeks to see an increase in exports from indigenous businesses in the ICT sector by 33 per cent by 2015 (Ryan and Giblin, 2012, p. 1324). Therefore, we can see a marked shift in central government policy and targets to help drive this growth and re-orientation of the high-tech sector. However, whilst this is national government policy, it is important to point out that the overwhelming majority of this sector is located in or around Dublin, so these policy shifts and emphases can be seen to directly impact these specific locations disproportionately when compared to other urban centres in Ireland.

There were a number of clear outcomes of this shift in policy at a national political-economic level. These outcomes led to concrete interventions which included, as Roper and Grimes (2005) point out:

> Reflecting a general policy shift from employment creation to development, support for indigenous high-tech entrepreneurship increased significantly as evidenced by major increases in levels of public and private investment in R&D, the development of business incubator facilities, improved university-industry links and increased availability of advice, support and venture capital (cited in Bayliss, 2007, p. 1266).

What is particularly interesting is that the Irish Government, in addition to taking the actions above, complemented this approach with incentivising the large multinationals to embed their businesses more deeply into the local economy through greater institutional support (Bayliss, 2007, p. 1266). Furthermore, there remains a recognition of the ability of these multinationals to promote innovation and knowledge transfer from their organisations to the Dublin high-tech cluster economy by their remaining presence in the locality. This is exemplified by Ryan and Giblin (2012, p. 1324), who argue:

> FDI embodies the latest technologies, which are transplanted to the host economy. Multinational corporations bring their own business models, international quality standards and 'ready-made' export markets. It follows that employees of MNC

subsidiaries learn international business practices and technologies which, it can be argued, enhances their entrepreneurial potential and capabilities.

This is a critical point in understanding that contemporary industrial policy recognises the key role these leading-edge ICT firms have in terms of stimulating and propelling growth in the sector, not just through their operations but in a range of important ways as their practices and knowledge are transferred through interactions with other indigenous and different multinationals located in Dublin. Thus, the key and dominant role of FDI remains recognised, whilst there is a move toward supporting sustainable indigenous growth alongside the original policies of attracting multinational investment. In other words, in this new policy we are not seeing a change of direction or break with the past, rather something that is additional or complementary to the current high-tech industry in Ireland around Dublin. Importantly, and whether a consequence of or despite this observable shift in government policy, some observers have seen that Dublin has already capitalised on the presence of multinationals with indigenous growth spawned from these large foreign-owned businesses. In fact, Arora et al (2004, p. 102) claim that Ireland has already started to successfully move up the value chain in high technology, capitalising on the initial investment of high-tech manufacturing and the relocation of what could be described as 'back office' functions in ICT, which is leading to growth in a specialised software sector. Indeed, they go on to report that the 'spillover' effects of these multinational giants has already impacted on the development of the cluster in ways that have been widely observed in the Silicon Valley exemplar. Arora et al (2004, p. 103) state, "Early success has catalysed future development by providing potential entrepreneurs and industry professionals with role models, rising self-confidence, easier access to capital, and declining social stigma toward failure, in addition to the obvious opportunities for learning." Here we see evidence of a range of important impacts, which include important social, cultural, financial as well as knowledge and skills dimensions that are critical to the development of a sustainable ICT cluster.

4.3.2   Dublin's Digital Hub

Having focused analysis on a higher spatial scale, that of national policy and interventions, the analysis now moves further down toward the local level to focus on concrete and observable planned interventions to support the development of the Dublin high-tech start-up hub. This plan can be viewed as a key government-sponsored, and financed, policy intervention into supporting this sector. Central government played a key role in initiating and setting up the main institutional machinery to support the development of the high-tech cluster. Bayliss (2007, p. 1267) observed that in 2003 the Irish

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Government established the Digital Hub Development Agency (DHDA) with Enterprise Ireland (Enterprise Ireland is the national development agency which is tasked with developing Irish industry). The Digital Hub's purpose and vision is described by Bayliss (2007, p. 1267):

> Stretching over a nine acre site centred upon the Guinness brewery buildings, the Digital Hub is envisaged as an industrial cluster based upon leading edge Irish and international digital media companies; a centre of excellence for knowledge, innovation and creativity, with a mix of enterprise, residential, retail, learning and civic space.

Here we see a direct intervention by policy makers, through public financial investment and public-private partnerships, to foster a specific geographically bounded area or zone within Dublin that could, in addition to contributing to urban regeneration of a de-industrialised site, become home to a hub to stimulate, incubate, and grow a world-class cluster of ICT businesses.

The Digital Hub promotes itself as the state-of-the-art campus for digital content and technology enterprises. The website claims that it was set up to "foster innovation, technological development and creativity in a supportive, entrepreneurial environment … [offering] infrastructure and support, as well as ample opportunities for collaboration, networking and knowledge-sharing" (Digital Hub, n.d). The link between digital media enterprises and entrepreneurship with research and development and education are made clear in this cluster policy (Bayliss, 2007). As such, the hub boasts each of the key components one would expect to find, such as seed funding, venture capitalist investments, large leading-edge multinationals with research and development capabilities, universities producing new blue skies intellectual property, business networking opportunities, incubator spaces, training and mentoring available, as well as state-of-the-art infrastructure, including the physical built environment. The Hub and the city is home to over 200 technology-focused start-ups which are operating out of incubators (Creative Dublin Alliance, 2013). In fact, this has led Bayliss (2007, p. 1269) to propose that "in many respects the framework conditions critical to the process of agglomeration formation appear to be present." What Bayliss is saying is that the agglomeration tendencies within Dublin are present in such a way as to expect the cluster to function well and have sufficient internal momentum to drive growth and start-ups to achieve sustainable growth. Despite all the ingredients being present, in apparently sufficient quantity, the Digital Hub project has over the first 10 years stumbled along without producing the expected performance and outcomes of a leading-edge high-tech

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cluster. Kerr (2007) argues that recent investigations by public spending committees point to a high level of waste of public funds in the Digital Hub project.

For many analysts and academics who have studied clusters and the many failed attempts to stimulate cluster development, the relative lack of Dublin's success to become Europe's leading start-up hub may not be so surprising. These analysts point to a vast array of examples where policies and interventions have failed to stimulate momentum and subsequent growth within a cluster. These authors each take their own perspective and put forward their own conclusions as to why this is the case. Some refer to Porter's original cluster formulation for an answer. Authors such as Thorngate (2004, p. 336) in his analysis of the failure of the Silicon Valley North (Ottawa, Canada) project looked to the importance of something so simple it often receives no analytical attention in theories of agglomeration, that being the importance of chance or plain and simple luck. However, the importance of the role of chance and luck are present in Porter's model and this factor has been seen to be critical in the development of Silicon Valley in a location which has been argued to present no discernible 'natural' advantages over any other in terms of understanding the underpinning factors that made that cluster work and others not (Klepper, 2010). Others such as Wadhwa (2013) have argued that it is not the role of chance or luck, rather he offers a very different interpretation, arguing it is the lack of skilled migrant labour which has stifled innovation, which led to failure. This is illustrative of an observation that there appear to be as many reasons for the low performance of a cluster as there are academics analysing them. Whilst the variables are understood, this does not explain the relative low performance of Dublin in this instance. Given the perception that Dublin's hub is still not functioning as expected, this has led Bayliss (2007, p. 1270) to claim that "the Digital Hub is perhaps best conceptualised as a 'potential/wannabe cluster' [as] important factors that can trigger a take-off and consolidation of agglomeration economies are missing."

It would be unfair to argue that the Digital Hub has been beset with problems and it is easy to forget that despite specific setbacks Dublin remains an innovative city when it comes to ICT enterprise. However, a number of key issues and drawbacks have been identified which have contributed to the relatively low performance of the Digital Hub. Bayliss (2007, p. 1270) in his analysis of the Hub's performance to date reflects on some key limitations or weaknesses to the approach to creating the digital hub:

> First, there appears to have been a failure to establish the planned links between research/education and enterprise ... A second problem that the project

experienced lies in its overambitious aims; the DHDA seems to have been trying to do too much … Thirdly, the problems encountered by the Hub illustrate also the role of luck as a critical factor in cluster development. In the case of the Hub, bad luck befell the project and momentum was lost when the dotcom bubble burst in 2000.

This quotation illustrates the key weaknesses with the practical approach to developing the Hub. Each of the three separate but important factors will have impeded Dublin's position as Europe's pre-eminent hub for ICT businesses. First it appears that the flagship research and design facility, Media Lab Europe (MLE), which was supposed to act as an anchor in the cluster, failed to produce many outputs during its residence in the Hub. Here, the evidence is clear that the hope of implanting a state-of-the-art research and development facility though investment secured by a multinational inward investor failed. On a practical level, the MLE lab, it has been argued, did not operate its leading-edge R&D from this site, which would be a critical requirement for the success of any cluster. Rather, and in addition to being beset with other problems, the corporation that owned the facility did not locate its most innovative projects at the site. Additionally, this is evidenced by the almost complete lack of IP and other academic-related outputs to come out of the Hub (Bayliss, 2007). It is argued that clusters that seek to emulate Silicon Valley require leading-edge universities and labs to produce high volumes of new intellectual property which can be commercialised to underpin a cluster (Porter, 1990). Furthermore, the €40 million property investment, announced by DHDA in March 2014, to create extra office space and student accommodation appears to be widening the range of strategic drivers for the DHDA. It has led DHDA to dilute its efforts, with a resultant overemphasis on the built infrastructure and other, arguably, peripheral issues such as social and economic inclusion, rather than concentrating essential and core activity to stimulate growth (Bayliss, 2007) or increasing competition between businesses (Porter, 1998). After all, it could be argued that the social and economic inclusion related spinoff benefits could have followed the initial economic generating activities of the cluster. Furthermore, with the loss of a key anchor business and a core component of any cluster, there has been some lack of political leadership, which has allowed the project to drift somewhat. This project would require full and consistent backing to succeed in the delivery of its agenda. All of these factors clearly impact on the question of whether Dublin can elevate itself to become the main location in Europe for ICT start-ups.

4.3.3   Best Place to Start
In addition to the Dublin Hub project, the Creative Dublin Alliance has also developed a grand plan called #bestplacetostart, which sets out the current context but also presents a

strategic vision for pushing forward an agenda that will, it is hoped, propel Dublin's ICT cluster to new heights. The ambition is to foster a thriving ecosystem around which indigenous digital start-ups can flourish. The plan sets out a vision to focus on supporting, in particular, the mobile internet, telecommunications software and digital gaming sub-sectors. In addition, the plan seeks to support particular types of start-up, those being ones that are considered to have fast growth potential and focus on technology in international markets (Creative Dublin Alliance, 2013).

The plan sets out a handful of strategic ambitions, which are summarised as:

- position Dublin as a leading global start-up centre
- attract significantly more overseas entrepreneurs to Dublin to build their businesses
- celebrate the successes with the wider business community
- encourage the wider acquisition of STEM skills to fuel our start-up tech businesses, and, ultimately
- increase the sector's growth rate, employment and economic contribution

The plan and the organisations behind it recognise the quality of the existing infrastructure and start-up ecosystem. But in order to achieve the aims above, the plan sets out some key measures of success, which are:

- help Dublin become the #1 EU hub for tech innovation, where companies will start up, scale faster, live longer and go further
- double the domestic rate of aspiration to start a business
- sustain Dublin's thriving start-up ecosystem; and
- create at a minimum 2,800 jobs and contribute €200 million p.a. to the Dublin economy.

Having set out the policy context, offered a description and analysis of the policy interventions which have accompanied the wider political-economic and institutional frameworks, what follows is an additional detailed analysis of the issues which confront Dublin in attempting to achieve its strategic ambitions. As such, the theoretical orientations of cluster theory and varieties of capitalism will be used as mechanisms through which to analyse the context in Dublin.

4.4   Learning Lessons: Comparing Dublin with Silicon Valley

This section presents some of the other issues that confront Dublin in securing itself as the pre-eminent location for technology start-ups in Europe. Initially, some key challenges are identified which were presented in the Activating Dublin Initiative (n.d) policy document. These challenges were identified during an extensive piece of policy-related research into how to support high-tech start-ups in Dublin, as demonstrated in the previous section. The first issues are set out and refer to an article from the *Harvard Business Review* prepared by Daniel Isenberg, who presented some key themes for policy makers and other economic development professionals to consider when trying facilitating the growth of a high-tech cluster. Clearly, many of these issues stated by Isenbuerd (2010) below are highly relevant to this research and also anyone interested in supporting clusters to develop in specific places:

1.   Stop emulating Silicon Valley.
2.   Shape the ecosystem around local conditions.
3.   Engage the private sector from the start.
4.   Favour the high potentials.
5.   Get a big win on board and over-celebrate the successes.
6.   Tackle cultural change head-on.
7.   Stress the roots. Easy money, more is necessarily merrier.
8.   Don't over engineer clusters; help them grow organically.
9.   Reform legal, bureaucratic and regulatory framework. Remove administrative and legal barriers to start-up formation – it's better than creating incentives to overcome these (Activating Dublin Initiative, n.d., p. 8).

The above are Isenberg's (2010) nine principles for creating a thriving entrepreneurial ecosystem. There are key lessons to be learned, including that stakeholders should stop trying to emulate the unique Silicon Valley example. Interestingly, this is exactly what this research has tried to evaluate. Whilst his advice is interesting, of course his prescriptions are up for debate. Nonetheless there is some merit in the idea of considering each place as being unique and that making policy and supporting Dublin's high-tech sector should reflect Dublin's own complex of unique advantages and weaknesses. Corroborated by the literature presented in the literature review and in this chapter, understanding locales and places as unique should be the starting point for any policy-making process. What this literature proposes is that policy makers should not follow the dangerous path of trying to replicate – or transport wholesale – what perhaps cannot be replicated, and for a number

of reasons. It also promotes the view that Dublin should be recognised as maintaining its own unique features, advantages and disadvantages and these should be recognised in policy and support for the industry.

This very point is made by academics such as Casper (2007), Massey (1984) and Rosenberg (2002), who are concerned with the notion of 'transferability' or 'transportability' of clusters and their unique conditions. This relates to much of the literature discussing the importance of recognising the uniqueness of place and how places are themselves unique products of an interplay between history, economy, space and place and these interrelated processes make for a unique and non-replicable set of patterns and circumstances, with their own set of characteristics. What is being argued in essence is that you cannot take a cluster out of one place or context and transplant it wholesale and expect it to work. There is something that is unique in the very fabric of the cluster and the national context (variety of capitalism) which conditions and reflects its uniqueness. Rosenburg (2002, p. 6) articulates this argument, stating, "like any cultural export, Silicon Valley undergoes a transformation as it is adopted outside its American homeland. Local rules, work patterns and cultural imperatives are grafted onto the original product." All of this discussion also links to Isenberg's second imperative: shape the ecosystem to local conditions. This very much fits with the varieties of capitalism argument that each national political-economic and institutional framework is unique and one must recognise that and adapt policy making to suit that unique context. Indeed, it also means that policy makers should play to a location's strengths and this is an example which has been seen in the past – see cluster development examples such as India or Tel Aviv which have developed their own approaches to supporting local cluster growth around their unique strengths and weaknesses (for a fuller explanation of these issues see Rosenberg, 2002).

The second point also relates to the notion that Dublin already has a relatively well-developed ecosystem around which a cluster can evolve. Having made that point, there are others who contest this claim and argue that despite having many of the recognisable components of a cluster in place Dublin's ICT sector is not a highly functional cluster. In fact, some have argued that it can barely claim to be a cluster at all. This is a consequence of a number of key issues, it is argued. For example, it is argued that whilst there are plenty of new business start-ups and new firm entries (two key indicators of a fully functioning cluster according to Porter's 1998 model) if one digs a little deeper there is an important series of deficiencies which is holding Dublin back. First, Dublin is not

home to any high-tech sector in particular; neither is it home to the core business operations of a truly leading high-tech business. In the words of Porter (1998), there are no key companies with a "home base" in Dublin. An example of a home base, according to Porter (1998), is Hewlett-Packard and their desktop computers and workstations in California. Importantly, a home base includes key strategically important and other activities that support core innovative processes within a business. Also Porter (1998) argues that functions like strategic development, core product and process research and development, a critical mass of the most sophisticated production or service provision, create and renew a company's product, processes and services. These leading edge businesses are considered, in the cluster model, to be the dynamos which power a cluster. A good example of this is Fairchild Semiconductors in California (Klepper, 2009). Klepper (2009) argues that it is impossible to overestimate the importance of such an innovative organisation in a cluster. These key companies produce other leading-edge spinoff businesses and other start-ups which in turn become leading-edge businesses and like the companies that create them, they create more spinoffs and other start-ups in a virtuous cycle. Dublin lacks this kind of company and furthermore it lacks companies that are truly innovative and have located their key research and development parts of the business in Dublin. Rather, these major FDI businesses are operating rather like modern day branch-plants which relocate their support and other functions to Dublin, whilst leaving the really core business in its home base (Arora et al, 2004). This fact has key knock-on effects on skills development for labour in the Dublin cluster, mobility in the form of start-ups, diversifiers and spinoffs (Arora et al, 2004; Klepper, 2009). This has led some to argue that what is observed in Dublin are small and medium-sized businesses that are not particularly innovative and operate in "low value adding activities for domestic markets" (Arora et al, 2004, p. 93). Additionally, this implies an ecosystem of technology businesses with fewer research and development activities within them that might be imagined (Arora et al, 2004, p. 85). All of these factors contribute to an ecosystem which isn't sufficiently innovative or doesn't focus on research and development which can support truly cutting-edge world-class high-tech clusters and a flourishing ecosystem of start-ups that genuinely contribute to Dublin becoming Europe's number one location for new business ventures. Whilst it might be possible to provide a full discussion of the nine points raised in the list above, space precludes that. Therefore, the author has focused on the two key issues as they relate to the literature, which are the first two points highlighted on the list: *stop emulating Silicon Valley* and *shape the ecosystem around local conditions*.

4.5   Summary

This chapter has provided an analysis of the data and information available to evaluate the potential of Ireland and Dublin in particular to achieve the ambition to become the pre-eminent start-up location for high-tech businesses in Europe. The discussion set out the range of competition from other European destinations operating in this sector and made clear a range of issues within Ireland and Dublin which could be considered as limiting factors currently impeding Dublin's ambition to be the leading start-up location in Europe. It can be seen from the literature that Dublin does indeed have a thriving technology sector in the form of FDI and indigenous start-up businesses. However, researchers have been cautious to celebrate the extent and quality of that start-up sector and the policy infrastructure that surrounds it. Authors used in this chapter have each presented a range of issues which point to a number of key limiting factors which, they argue, restrict Dublin's ability to emulate world-class clusters like Silicon Valley. Even current policy documents, while presenting the range of assets Dublin possess, also present some key debates about the city's position and genuine ability to become Europe's number one location for high-tech business germination. This is clearly illustrated in the section which reports on a direct comparison between Dublin and Silicon Valley. This section is used to show how the very origins, development processes and the nature of innovation in the two clusters are markedly different. It does, however, show that Dublin possesses many of the key characteristics associated with a fully functioning cluster, according to the Porter model. Despite this, there are clearly areas which hold the city back and it is questionable whether, because of the nature of the cluster and the activities going on within it, it will be possible to shape and direct economic development and related policy to kick-start the kind of world-leading research and development and innovation that appears to be needed to emulate the successes of Silicon Valley. This section leads us to conclude that Dublin can be seen as having a successful start-up sector in high technology and one which can be seen to possess all the right features of a successful start-up ecosystem. This positive view is mixed with others that make the author cautious in arguing Dublin will be able to realise its ambitions in becoming Europe's leading location for business start-ups, thereby emulating clusters like Silicon Valley. This will be further discussed in the conclusion which follows and this is framed within a discussion about the relative potential policy and policy interventions can have in stimulating and driving cluster development and transforming start-up ecosystems.

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5   Conclusions

Having presented the key features of the analysis and evaluation of the secondary information and compared it with the academic evidence from Silicon Valley in the previous chapter, this conclusions chapter attempts to do two key things. First, it sets out five key recommendations for policy makers on how to advance the role of Dublin in aspiring to become the pre-eminent location in Europe with regard to high-tech start-ups. Section 2.2 offers a cautionary view on the limits to policy interventions and policy instruments designed to facilitate the growth and sustainability of clusters. Here, academic discourses are drawn on to offer caution about how effective policy can be as a lever to promote the growth of start-up ecosystems. The conclusion therefore offers insights into the utility of policy and its potential effectiveness in achieving economic development aims and provides the view that policy makers and practitioners should be cautious in believing that their interventions will lead directly to successful outcomes.

5.1   Key Actions and Recommendations

Five key actions and recommendations are presented in this sub-section, each of which will enable policy makers to adapt their approach and help ensure Dublin not only sustains its position as an important European hub for high-tech business start-ups but also enhances its status into the future.

5.1.1   Recognise and Develop Policy Around Ireland and Dublin Core Strengths

This is an important lesson the academic literature has identified through analyses of failed attempts to follow the model of Silicon Valley. There are many examples of policy makers attempting to implant the Silicon Valley model in different places. These have almost always failed. It is important to recognise the unique advantages and disadvantages of Dublin and develop policy that is sensitive to this. Dublin requires its own model and pathway to development.

5.1.2   Promote Competition Within the Cluster

Porter (1990) offers critical insights into the value of policy and what makes start-up hubs work. His model teaches us that it is intra-firm competition that drives innovation and new business germination in successful clusters. Therefore, policy at the local and national level could be augmented to encourage competition and enhanced productivity, which will stimulate the high-tech ecosystem.

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5.1.3   Information or Research Insights are Key to Understanding How the Cluster Operates

This research has identified that there remains a lack of high-quality insight into the specific operations and processes associated with Dublin's start-up ecosystem. The cluster would benefit from investing in its own local business research 'observatory', which could enable stakeholders to develop specific research insights into what is working and what is not. This information could be used to develop evidence-based policies at a local level to further enhance the operation of the start-up ecosystem.

5.1.4   Attract a Big Leading-Edge High-Tech Business to Generate Spinoffs

Dublin lacks a world-leading high-tech business with its home base located in the city. Examples of successful clusters demonstrate that such a company, with all its core business functions such as research and development, can lead and generate spinoff activity and other start-ups that are world-class performers in their own right.

5.1.6 Keep Focused on Supporting the Start-up Ecosystem

The policy instruments, such as the Digital Hub, have attempted to do too much. Many policies, whilst being 'well intentioned' have failed to focus attention on creating innovation and a highly competitive business environment which will create momentum behind new business creation. By focusing on this the other spinoff benefits, which include economic inclusion and regeneration, are more likely to follow.

5.2   Limits to Policy

To conclude, the author points out that the literature on clusters and varieties of capitalism theories points to the potential limits to policy in developing a fully functioning start-up ecosystem. Policy alone will not develop a start-up ecosystem, but effective policy making can provide the right milieu for hubs to thrive and facilitate sustainable business growth. Too many economic development practitioners fall into the trap of thinking that policy has the ability to force change. Evidence suggests this is not the case. As Rosenburg (2004, p. 21) points out, policy should be seen as "catalysts but they are not the substance." This is reiterated by others like Casper (2007, p. 190), who argues that it is ultimately companies and not governments that form clusters and make them work. Therefore, policy should seek to provide the right institutional conditions around which businesses can flourish and grow. That is not to say policy has an ineffectual role, it can still impact on the development of the right labour market conditions and the factor conditions such as

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labour supply, all of which are necessary to the successful functioning of a high-tech cluster.

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