

A cross-country exploration of the perceived impact of facilitated networks on green innovation capability development in the micro- firm.

Sinead Mellett BA, MSc.

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School of Business

Waterford Institute of Technology

Research supervisors: Dr. Felicity Kelliher & Prof Denis Harrington

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DECLARATION

The author hereby declares that, except where duly acknowledged, this thesis is entirely her own work.

Signed.....

Sinead Mellett
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DEDICATION

Dedicated to my beautiful wonderful daughters Órianna and Sarah

ABSTRACT

The motivation for this research originates in the current global debate on the need for a sustainable green economy. As micro-firms (those firms with less than ten employees), represent 90.8% of all businesses in Ireland (CSO, 2011) and 75% in Canada (Industry Canada, 2013), the development of their green innovation capability development is vital in pursuit of green economy goals. This thesis studies explores the perceived impact facilitated network engagement has on green innovation capability development in the micro-firm.

This study uses a interpretive multiple case, cross-country approach studying micro-firms in Ireland and Canada over a twelve month period. The proactive implementation of green innovation is influenced by the owner/manager (O/M)'s natural environment orientation (NEO) and the potential for economic gain. The findings show that facilitated networks play a role in the development of innovation capabilities and provide an additional resource that the O/M can draw from. In particular, the network allows the O/M to test new ideas, comprehend legislation and identify potential supports in pursuit of green innovation capability development within the micro-firm.

This study has academic, practitioner and policy implications as it assists in understanding the impact of inter-firm collaboration on green innovation capability development. This study offers a framework that can be used as a guideline for micro-firm support organisations including facilitated networks to assist micro-firms in reaching their green innovation goals and objectives. At a national level, government run systematic and collective marketing initiatives, which engage with enterprise and networks could help to promote the financial savings and opportunities of green innovation. In the absence of regulations, the onus is on the individual to take accountability for their own green innovation. This exploratory study provides a basis on which further research can be undertaken in the area of green innovation, facilitated networks and the micro-firm. The framework could potentially be applied in other countries and in further micro-firms to test its applicability for the development of green innovation capabilities.

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GLOSSARY

Absorptive capacity: The ability of a firm to add value, assimilate and apply new knowledge; companies need certain organisational routines and capabilities to recognise the value of new, external information, assimilate it and apply it to commercial ends (Cohen and Levinthal, 1990).

Cleantech: The umbrella term for the range of technologies, goods and services that minimize or eliminate the environmental impact of economic activity and form the basis of the corporate response to climate change (Ernst and Young, 2011).

Clusters: Groups of firms in the same industry, or in closely related industries that are in close geographical proximity to each other (Reinl, 2011).

Competence: The quality or state of being functionally adequate or having sufficient knowledge, strength and skill.

Dynamic Capability: Deeply embedded learning mechanisms in the social fabric of the firm enabling the firm to proactively anticipate environmental change (Winter, 2003).

EMERGE: Collaboration in Guelph, Canada comprised of local utilities, the City of Guelph and a diverse group of governmental and non-governmental organisations aiming to transform their city toward ‘net zero’ impact in the areas of energy, water, transportation, waste and food.

Explicit knowledge: Formal and systematic. It can be easily communicated and shared. Typically, it has been documented.

Facilitator: The facilitator actor plays an important role in forming the network, building trust, sharing resources (Besser and Miller, 2010) as well as creating knowledge and dissemination of information with members (Collin *et al.*, 2007),

maintaining the communication structures, motivating the actors and coordinating network activity.

Green firms: Firms operating in a manner demonstrating awareness of the green environment.

Green audit: The process of assessing the environmental impact of a firm, assessing their operations' compliance with applicable laws and regulations, as well as with the expectations of their various stakeholders. The green audit also serves as a means to identify opportunities to save money, enhance work quality, improve employee health and safety, reduce liabilities, and achieve other forms of business value.

Green innovation: The production of green-focused ideas, devices or methods.

Green capability development: Building an interactive process integrating green into the firm culture and value systems (Hansen, 2010).

Green economy: *“An economy that results in improved well-being and reduced inequalities over the long term, while not exposing future generations to significant environment risks and ecological scarcities... a green economy can be thought of as one which is low carbon, resource efficient and socially inclusive”* (UNEP, 2011, p.9).

Human capital: The knowledge, information, ideas, skills, and health of individuals' (Becker, 2002).

Innovation: A term used to define the implementation of a new or significantly improved product (or service), or process, a new marketing method or a new organisational method in business practices, workplace organisation or external relations (OECD, 2005).

Innovation Capability: The ability to continuously transform knowledge and ideas into new products, processes and systems for the benefit of the firm and its stakeholders (Lawson and Sampson, 2001).

Managerial capability: The human capability which develops a firm's long term competitive advantage (Barney, 1991; Penrose, 1959).

Micro-firm: The European Union (EU) defines a micro-enterprise as one that employs no more than ten full-time employees (European Commission, 2009).

Micro-firm capability: The ability of a firm to perform a coordinated task, utilizing organisational resources, for the purpose of achieving a particular end result (O'Regan and Ghobadian, 2004).

Micro-firm network: A group of firms that join together to accomplish goals that cannot be achieved in isolation. The network requires trust, voluntary active participation and communication (McAdam and McGowan, 2004).

Micro-firm facilitated network: A network set up with a facilitator for the purpose of sharing knowledge, learning and objective setting.

Network: A set of independent organisations that unite collectively to realise objectives that none of them can accomplish on their own and where the sum of the contributions from diverse firms goes above the total of the contributions from individual firms (Chisholm, 1998).

NVivo software: A software package used to facilitate the management and analysis of qualitative data.

Owner/manager (O/M): The individual owner, who establishes and manages a business with the main purpose of furthering personal goals (Jennings and Beaver, 1995).

Rio +20: Is the short name for the United Nations Conference on Sustainable Development which took place in Rio de Janeiro, Brazil in June 2012

Resources: Tangible and intangible assets linked to a firm in a semi-permanent way (Grant, 1991).

Resource Based View (RBV): The RBV of the business relates to the resources required by the business to compete and develop in the environment (Barney 1991).

Resource poverty: A term used to describe the resource poor environment that the micro-firm owner/manager operates in (Reinl, 2011).

Social capital: Resources (including knowledge) embedded in social relationships that can be leveraged by an individual to add value to their business.

Tacit Knowledge: Knowledge that is difficult to transfer from one person to another. It is personal, difficult to formalise and hard to communicate to others. It may also be difficult to capture.

Thematic analysis: An iterative approach to data analysis where themes emerge based on the researcher's initial immersion in the data and through a process of coding and reflective contemplation (Braun and Clark, 2006).

Theoretical framework: A theory grounded in academic literature which focuses the literature review and the data analysis process.

Chapter 1: Introduction

1.1 Introduction

This chapter presents the research overview before outlining the rationale for exploring the perceived impact of facilitated network engagement on green innovation capability development in the micro-firm, with a particular focus on the Canadian and Irish micro-firm environment. Specifically, this research explores green innovation capability development, applying a resource based/dynamic capability theoretical lens to study this topic in a micro-firm context. Following the research overview, the background to this research study is presented and its position in the relevant literature is outlined. Finally, the structure of the thesis is outlined and a breakdown of each chapter is provided.

1.2 Research overview

Regulations in Europe (COP 21, 2015) and North America including Canada insist that all businesses, including micro-firms fulfil the requirements of green technology and green innovation in pursuit of a sustainable green economy. Specific legal obligations under the EU Emissions Trading Scheme (ETS) requires governments to set emissions caps for various sectors, of which agriculture is the single largest contributor to the overall emissions in Ireland at 33.3% of the total. Ireland has not met its EU green objectives, lagging behind most member states in greenhouse gas emissions, and is currently paying penalties at European level as a result of breached air quality, waste management and recycling caps (ec.europa, 2017). As an independent state, Canadian policy is regulated by the Canadian Environmental Protection Act (CEPA, 1999), recently brought under the responsibility of the Environmental Enforcement Act (2010-2017). This Act has increased maximum fines, provided more order making powers and authorized the issuance of administrative monetary penalties for violations under nine different existing federal statutes dealing with environmental matters. In Canada, the largest contributor to greenhouse gas

emissions come from the oil and gas sector at 26% followed by transportation at 24% (ec.gc.ca, 2017). The non-compliance penalties in each country are likely to be passed onto businesses, including micro-firms, ultimately creating an additional cost for these firms. This in turn means that micro-firms will be penalised in kind if they are not following the policies, procedures and regulatory requirements of the green economy. As such, there is a clear business benefit in developing green innovation capabilities in these firms.

This research focuses on green innovation capability development in micro-firms, with a specific focus on the Canadian and Irish micro-firm environments. This is an important capability for micro-firms, in order for them to fulfil their environmental obligations and to participate successfully in the emerging green economy. Facilitated network supports provided at regional and national level have been shown to assist micro-firms in complying with green regulations, actions and requirements and to successfully contribute to the green economy (Kelliher and Reinl, 2014). Thus, the research aim is to explore the perceived impact of facilitated network engagement on green innovation capability development in the micro-firm. The theoretical base is built on the principles of innovation capability through the resource-based lens. By adopting such an approach, this study intends to make a contribution to resource, capability and micro-firm network theory as well through the formulation of an empirical framework on green innovation capability development in micro-firms.

1.3 Importance of the Research

This research is important for a number of reasons. Micro-firms, defined as those with less than 10 full-time employees (European Commission, 2009) represent 90.8% of all firms in Ireland (Central Statistics Office, 2011) and 75% in Canada (Industry Canada, 2013). Collectively they have a significant role to play in achieving the goals and objectives of the green economy in each studied country. Despite the perception that it is costly to pursue green initiatives, many researchers believe benefits can be gained from considering green options in firm strategies (Gibbs, 2009; Martin *et al.*, 2013; Millard, 2011; Revell and Blackburn,

2007; Robinson and Stubberud, 2013). Others state that there is a correlation between green innovation and productivity (Isaak, 2002; Lober, 1998). However, the limited resources in micro-firms may not allow them the time to research green solutions (Millard, 2011; Perera, 2008) nor the finance to fund them (Palmer, 2000; Perera, 2008). Nevertheless, the ability of micro-firms to respond to market changes is found to be beneficial for green innovation (von Høivik and Shankar, 2010). Equally, as micro-firms (when combined with SMEs) account for up to 70% of the world's industrial pollution (Hillary, 2000), assisting micro-firms to become greener would have had a major impact on the environment (Miller *et al.*, 2016; Robinson and Stubberud, 2013).

By carrying out a cross-country study, it should be possible to explore micro-firm green innovation activity at multiple levels (individual, firm, network/ industry, country) to identify the drivers and influencers of green innovation guided by owner/ managers (OMs) within the studied micro-firms. By undertaking exploratory case studies, incorporating semi-structured interviews, a green innovation capability skills audit, on-site observation and documentary review in selected Irish and Canadian micro-firms and proposing a green innovation capability framework, this research seeks to assist micro-firms in developing capabilities for green enterprise. Furthermore, supported by both OM and network facilitator interviews, the study explores whether facilitated networks have a perceived impact on green innovation capability development among the studied micro-firms and if so, how this impact can be fostered to assist micro-firms in achieving their green innovation goals.

1.4 Background to the Research Topic

There are a number of means by which to define a micro-firm, including size, turnover, number of employees and output and the criteria and limits used vary between countries and trading blocks, which presents a challenge when carrying out research on these businesses. As stated above, the European Union (EU) defines a micro-firm as one that employs no more than ten full time employees (European Commission, 2009), while in Canada, micro-firms are defined as firms

with less than five employees (Industry Canada, 2013). For equitable terms in this study, micro-firms will be defined as firms with no more than ten employees. These firms are unique in nature, due in part to their minute size and the centrality of the OM in decision making, strategy formulation and in dictating the direction of the business (Kelliher and Reinl, 2009). Micro-firm internal capabilities are limited, depending largely on generalist skills, such that the small number of employees can perform a variety of tasks within the firm (Kearney *et al.*, 2014). As a result, specialist knowledge can be limited within the firm (Kelliher and Reinl, 2009), and micro-firms tend to seek external specialist knowledge and support to develop their capabilities and supplement their limited internal resources, often through network engagement (Reinl and Kelliher, 2010).

A network is a set of independent organisations that unites collectively to realise objectives that none of them can accomplish on their own and where the sum contributions from diverse firms goes above the total of the contributions from individual firms (Chisholm, 1998). Networks are particularly valuable in rural micro-firms, as they alleviate the challenges of geographical isolation for these firms (Philipson *et al.*, 2006), and engagement can result in economic or information exchanges and new or improved relationships (Klein and Poulymonakou, 2006). However, the outcomes of a network are unpredictable (Ford and Mouzas, 2013), and these benefits are not guaranteed. Burrese and Pousette-Falk (2004) refers to it as a *marriage* as the nature of the relationship changes over time. It requires voluntary and active participation, communication and time to realise its objectives (McAdam and McGowan, 2004). For the purposes of this study, a micro-firm network is defined as a group of firms that join together to accomplish goals that cannot be achieved in isolation. Micro-firm networks can be broken down into formal, semi-formal and informal networks (Campos, 2009), however, a formal network environment (e.g. facilitated network) is the focus of this study.

A facilitated network is described as a “*network formally set up for the primary purpose of increasing knowledge*” (Bessant and Tsekouras, 2001, p.8). Facilitated networks are different to facilitated learning networks as they provide more than learning, they provide other functions including marketing, innovation

and research and development. The most common facilitated networks are those with a central facilitator, sometimes referred to as '*motors*' (Koch *et al.*, 2006) or '*boundary role persons*' (Adams, 1982; Smith and Tushman, 2005). These individuals outline the scope of the network and its direction (Collins *et al.*, 2007), and are responsible for building trust and sharing resources (Besser and Miller, 2010). The facilitator can assist with knowledge sharing, learning and objective setting (Besser and Miller, 2010). Their function is to shorten the distances (cognitive, communication, functional, geographical, organisational and social) between members (Parjanen *et al.*, 2010), so this network approach is particularly useful in rural settings. S/he is also responsible for helping to create knowledge and disseminating information with members (Collins *et al.*, 2007), maintaining the communication structures, motivating the members and coordinating network activity. A micro-firm facilitated network is therefore defined as a network set up with a central facilitator for the purpose of creating and sharing knowledge, generating learning and objective setting, motivating members and coordinating network activity, which includes innovation activities in this case.

Innovation is defined as the application of a new or improved product, service, method or process, a new method or a new structural method in business performance, work organisation or external relations (OECD, 2005). Innovation is concerned with creating, accommodating and executing new ideas, processes, products or services (Carnes and Ireland, 2013; Thompson, 1965) and is linked to positive firm outcomes, for example, success, survival and renovating (Eisenhardt, 1997; Carnes and Ireland, 2013). As an aspect of innovation, innovation capability development is defined as the ability to continuously transform knowledge and ideas into new products, processes and systems for the benefit of the firm and its stakeholders (Lawson and Sampson, 2001). In a micro-firm setting, the O/M's sociological profile – education, age, experience and gender has an impact on the internal innovation capabilities of the firm, while the attitude of the O/M also has an impact on the innovation of the employees (Bodewes and deJong, 2003). Network engagement has also been found to help exploit micro-firm innovation capability (Kearney *et al.*, 2014), wherein the OM can extend their internal resource through knowledge exchange.

Green innovation is the introduction of green-focused ideas, devices or methods (OECD, 2010). The ability of firms to make green innovation decisions has also been linked to the firm's ability to develop green capabilities and green resources (Hart, 1995; Papagiannakis *et al.*, 2014). This approach has its foundations in reinforcement learning (Sutton and Barto, 1998) and is consistent with Teece *et al.*'s (1997) dynamic capability development approach, thereby extending the concept of innovation capability development. Building green capabilities is assumed to be an interactive process that integrates green into the firm culture and value systems (Hansen, 2010), enhancing the micro-firm's contribution to the green economy. However, internal capability and resource within the micro-firm may not be sufficient to facilitate this intergration process without support. Based on this assumption, the concept of facilitated network engagement helping OMs to develop green innovation capabilities and integrate them in their micro-firm is worthy of exploration. The following section discusses the green economy context of this study, in order to highlight the importance of this research from a macro- perspective.

1.4.1 The Green Economy through a micro-firm lens

In 2008, the United Nations Environmental Programme (UNEP¹) launched the "Green Economy Initiative" proposing policy reforms and highlighting investment strategies for green sectors (United Nations, UNEP 2011). The UN's Global Compact² and the Principles of Responsible Management Education (PRME) remits have been developed to encourage businesses to be more sustainable. In Ireland, the Department of Environment, Community and Local Development (2011) outlined the important role that the green economy would have for Irish society and in consequence for Government decision making over the next decade. Emerging from such policy formulation, regulations have been

¹ The United Nations Environment Programme (UNEP) is a global environmental authority that sets the global environmental agenda, promotes the coherent implementation of the environmental dimension of sustainable development within the United Nations system and serves as an authoritative advocate for the global environment.

² The United Nations Global Compact is calling for commitments to action from the private sector to take action in support of UN goals and issues'

established that help to avert water scarcity, manage climate change, contend with pollution problems and conserve natural resources. In Canada, the green economy is described as a subset of the entire Canadian economy -it exists in parallel to the traditional economy and includes similar green activities and processes (Eco Canada, 2010) to those promoted in Ireland.

Drivers of the green economy are both global, for example climate change, and domestic, propelled by government policy, customer demands and firm reputation (Eco Canada, 2010). Davies (2013) found that the green economy required a global social contract (German advisory council on global change, WBGU, 2011) which the study pertained would support innovations for more sustainable use of resources (UNEP, 2011). Ireland has created a number of reports and initiatives on the topic over the last decade including; Ireland's energy research strategy, building Ireland's smart economy: A framework for sustainable economic renewable (2008), Ireland's National Climate Change Strategy (2007-2012), Ireland National Renewable Resource Targets for 2020, The Ocean Energy Development Programme (2008-2012), The National Energy Efficiency Action Plan³, (2009-2020), The Government's Infrastructure Investment Priorities 2010 – 2016 Framework, Green Public Procurement Opportunities. In Canada, similar programmes have been put in place, such as Partners for Climate Protection⁴ (PCP), the Green Municipal Fund⁵ (GMF) (Federation of Canadian Municipalities, 2011) the Canadian Environmental Protection Act (CEPA, 1999), and Environmental Enforcement Act (2010-2017). For the purposes of this research, the Green Economy is defined as:

“An economy that results in improved well-being and reduced inequalities over the long term, while not exposing future generations to significant environment risks and ecological scarcities... a green economy can be thought of as one which is low carbon, resource efficient and socially inclusive” (UNEP, 2011, p.9).

³ National Energy Efficiency Action Plans (NEEAPs) set out estimated energy consumption, planned energy efficiency measures and the improvements individual EU countries expect to achieve.

⁴ The Partners for Climate Protection (PCP) program is a network of Canadian municipal governments that have committed to reducing greenhouse gases (GHG) and to acting on climate change.

⁵ GMF supports initiatives that demonstrate an innovative solution or approach to a municipal environmental issue, and that can generate new lessons and models for municipalities of all sizes and types in all regions of Canada.

Ever increasing consumption levels are not sustainable, and ‘green’ thinking is part of a paradigm shift that has embedded green awareness into consumption patterns (Prothero and McDonagh, 2010). From a business perspective, the catalyst for greening commercial activities is also articulated by the European Environment Agency⁶ (2013, p.5); “... *the prevailing model of economic growth — founded on ever-increasing consumption of resources and emission of pollutants — simply cannot be sustained in a world of finite resources and ecosystem capacity*”. One of the top priorities is the move towards a sustainable green economy, and a great deal of investment has been given to support green-led enterprises (Cecere and Mazzanti, 2015). However, it is difficult to establish a single definition for ‘green’ in the business context and there has been some confusion whether the green economy means economic growth, green growth or no growth. Some view green innovation as conflicting with the firm’s economic performance and competitiveness (Yarahmadi and Higgins, 2012), while proponents see it as an opportunity (Seebode *et al.*, 2012; UNEP, 2011) for new markets and perhaps an opportunity to become a market leader (Jacobs, 2013; Porter and Van der Linde, 1995; World Bank, 2012). There may also be an opportunity to reduce the negative *externalities* of environmental degradation (Bibbee, 2012). Lorek and Spangenberg (2013) view the green growth/ green economy debate explicitly relies on a perception that promoted increasing prosperity for business, a narrower ethos than that proposed in the green economy definition (UNEP, 2011).

The introduction of green regulations made it necessary for all firms to think proactively about environmental strategies (Environment Agency, 2011; Robinson and Stubberud, 2013). Equally more knowledgeable and sophisticated consumers have contributed to stronger green awareness, and have led the demand for green goods. Volery (2002) views the production of innovative consumer goods without damaging the earth’s natural resources as both an opportunity and a need. Yet, many firms have been reluctant to go green as they equate green with expense (Alfred and Adam, 2009), a view at odds with the

⁶ The European Environment Agency provides sound, independent information on the environment for those involved in developing, adopting, implementing and evaluating environmental policy, and also the general public.

green growth model put forward by Lorek and Spangenberg (2013). These findings suggest the driver for green innovation is dependent on whether it impacts the firm's 'bottom line' (Russo and Tencati, 2009) or is demanded by consumers; each of which are reactive rather than proactive responses to the green catalyst. It is this firm level contribution to the green economy that is explored in the current study.

1.5 Research Aim and Objectives

The research aim is:

To explore the perceived impact of facilitated network engagement on green innovation capability development in the micro-firm.

There are three main objectives in this study:-

1. To undertake an analysis of perceived green innovation capability in selected Irish and Canadian micro-firms;
2. To explore the perceived impact of facilitated network engagement on the micro-firms' green innovation capability development;
3. To propose a green innovation capability framework for the micro-firm environment.

1.6 The Research Approach

This study is exploratory in nature, the adoption of a qualitative approach seeks to increase responsiveness as qualitative research is concerned with understanding the social phenomena from the participants' perspective. This research study consists of cross-country micro-firm case studies, conducted simultaneously in Ireland and Canada. Many researchers endorse the interpretive case method when studying micro-firms (Gibb, 1997; Kelliher *et al.*, 2009; Patton *et al.*, 2000; Romano, 1989), the case allows for the observation of the dynamic process that

influences green innovation capability development and helps to track the evolution of shared practice (Patton *et al.*, 2000). The multi-case approach allows for cross-case and cross-country data collection and analysis. The case study approach combines observation and semi-structured interviews as the central data collection techniques and crystallisation is reached through combining this approach with an extensive document review to yield depth (Adler and Adler, 1994). Researcher reflections are captured through a reflective diary maintained throughout the study.

1.7 Significance of the Research

This research has implications for micro-firms and facilitated networks that are engaged with the emerging green economy. The study is the first to propose a green innovation capability framework for the micro-firm environment, based on extant literature. This framework can be used by green micro-firms and network support organisations to guide micro-firms in developing capabilities that will allow them to innovate and ultimately contribute to the green economy. From an academic perspective, the findings of this research will add to the limited but growing body of knowledge and literature concerning facilitated networks and micro-firm green innovation capability development. Despite research to show the benefits of networks for innovation and to improve competitiveness (McAdam *et al.*, 2007; Tinsley and Lynch, 2001), many firms have not engaged in innovation networks (Faherty and Stephens, 2014), reinforcing the value of this study.

1.8 Thesis Structure

A research map (Figure 1) was developed to help fulfil the research aim and objectives of this study.

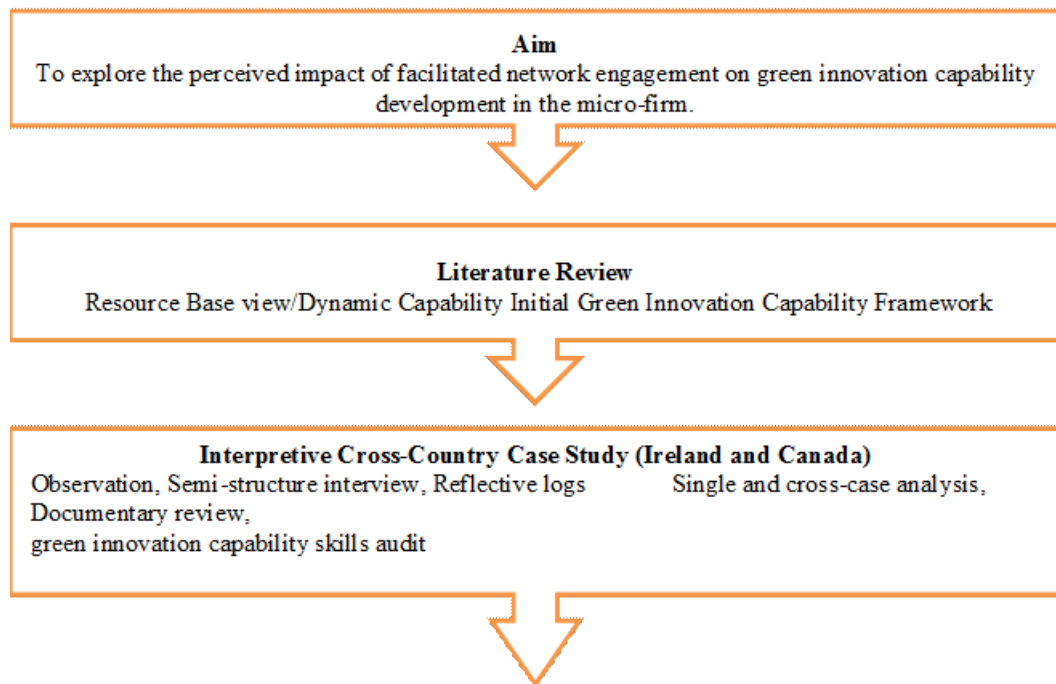


Figure 1: Research Map

The remainder of this thesis is organised into five chapters, which are structured as follows. The literature review comprises chapter two and three. Chapter two outlines the theoretical framework of the study and justifies the reasons for using resource based view/ dynamical capabilities theory to study green innovation capability development in micro-firms. Chapter three is broken down into three parts. Part one discusses the unique characteristics of the micro-firm and explores the O/M impact on environmental orientation. The micro-firm's external competitive environment is also explored in this section. Part two critically reviews micro-firm management capability development literature, focusing on the innovation process and how green innovation capability is developed. Part three critically reviews micro-firm facilitated networks as an additional knowledge resource in pursuit of capability development. The chapter concludes with a summary of the literature themes and an initial innovation capability framework for the micro-firm. The framework acts as a boundary for the research methodology. Chapter four evaluates key philosophical considerations and establishes the researcher's philosophical position. The research method adopted is assessed and justified. The process of data analysis is evaluated. Chapter five reports the empirical findings of the research. Chapter six presents a discussion of

the findings in the light of the theoretical review. From the discussion, a final framework for innovation capability development for green enterprise in the micro-firm emerges. Chapter seven presents the main research conclusions, contributions and highlights some recommendations for future research. Limitations of the current study are presented.

1.9 Conclusion

This chapter presents the research overview and provided the background and rationale for the research statement. The research aim and objectives are outlined in order to explain the nature of the study. This chapter provides an introduction to the green economy, and where the micro-firm is situated in this context. It highlights the importance of the micro-firm's participation in achieving the green goals and regulations and suggests the opportunities and benefits for micro-firms in the green economy. The chapter also defines green and green economy in the context of this study, alongside the micro-firm, green innovation and facilitated network concepts. The research map (fig. 1) and thesis structure summarise the thesis chapter by chapter. The chapter concludes with an overview of the likely contribution this research will make.

The following chapter reviews the theoretical framework underpinning this study.

Chapter 2:

Theoretical Framework

2.1 Introduction

This chapter discusses the resource based view and dynamic capabilities theory and the justification for selecting these theories as a basis on which to explore the perceived impact of facilitated network engagement on green innovation capability development in the micro-firm.

2.2 Resource Based View

Resources are physical, human and organisational assets that can be used to implement value creating strategies (Barney, 1986; Eisenhardt and Martin, 2000). They are described as something that is a strength or weakness of a firm (Wernerfelt, 1984), and some examples include; brand names, in-house knowledge, employment of skilled personnel, trade contacts, efficient procedures and capital (Wernerfelt, 1995). The manipulation of resources are critical in dynamic markets (Grant, 1996), so that they can be managed and exploited effectively (Carnes and Ireland, 2013; Sirmon *et al.*, 2011; Sirmon *et al.*, 2013).

The resource based view (RBV) is a theoretical framework for understanding how to achieve and sustain competitive advantage (Barney, 1991; Eisenhardt and Martin, 2000; Nelson, 1991; Penrose, 1959; Teece *et al.*, 1997). Under the RBV, long term success is the differentiation of resources from competitors (O'Donnell, 2014). While prevailing literature agrees with the principles of RBV, critics of the RBV perceive it as theoretically ambiguous, unclear and lacking in empirical grounding, managerial implications and a shortage of operational validity (Peteraf, 1993). Early development of RBV theory was somewhat vague in that it specified the necessity for VRIN resources but failed to offer instruction on how these resources could be attained, developed and sustained (Porter, 1990). This latter criticism is relevant to the current study, as an aspect of this research is to explore how resources can be attained through facilitated network engagement.

RBV brings a systematic approach to firm-level analysis by characterising the firm as a collection of resources and capabilities (Wernerfelt, 1995). Resources are also the source of a firm's capabilities (Grant, 1991). Some researchers contend that capabilities are the antecedent routines by which firms alter their resource base to generate strategies (Grant, 1996; Pisano, 1994; Eisenhardt and Martin, 2000). Here, intangible assets are the only type of assets that are a source of sustainable competitive advantage and these should be valuable, rare, inimitable and non-substitutable (VRIN) (Barney 1991; Roos and Ross, 1997). Makadok (2001) distinguishes between capabilities and resources by defining capabilities as *"a special type of resource, specifically an organisationally embedded non-transferable firm-specific resource whose purpose is to improve the productivity of the other resources possessed by the firm"* (Makadok, 2001, p. 389). This definition is applied in this study.

Resource theory posits that the underlying principle of networks is the value that can be obtained by pooling/ bundling resources. Resource bundling is a process managers use to effectively manage a firm's resources (Carnes and Ireland, 2013), it involves; converting or aligning resources for the purpose of building capabilities and creating value (Sirmon *et al.*, 2008), stabilising resources to maintain a strategy (Sirmon *et al.*, 2007), enriching resources to extend and elaborate a firm's capabilities and pioneering resources to develop and create new capabilities, with the ultimate goal of achieving innovation (Carnes and Ireland, 2013). This process enables the firm to respond to the dynamic market changes and evolving customer demands through innovation (Blommerde and Lynch, 2014; Salunke *et al.*, 2011). Firms depend on capabilities to accomplish tasks to achieve outcomes by transforming resources internally (Carnes and Ireland, 2013). In turn, the micro-firm's knowledge of the innovative resources they possess or resources that are attainable to them help them in achieving innovation capabilities (Carnes and Ireland, 2013).

Kearney *et al.*, (2014) state that micro-firm management capability develops from collaboration of managerial capability standards and resources in a process facilitated by the resource based view of a micro-firm. The assumption is that

micro-firm O/Ms have comprehensive knowledge of their resources and capabilities (Phillipson *et al.*, 2004; Greenbank, 2000) and rely on knowledge available internally and through free sources of information (Kunapatarawong and Martínez-Ros, 2014), such as friends, family, close allies, support agencies and higher education institutes to extend resource and help develop their capabilities.

2.3 Dynamic Capabilities

Prior to discussing dynamic capabilities (DC), it is of value to clarify the meaning of the word capability in regards to other relevant terms. Competency and capabilities are often linked; they both pertain to human ability. However, it is necessary to look at the difference between these words when endeavouring to develop an understanding of the organisation's ability to innovate (Vincent, 2008). Vincent (2008) differentiates between both terms: a capability is a feature, faculty or process that can be developed or improved, a competence is the quality or state of being functionally adequate or having sufficient knowledge, strength and skill. Innovation capability (e.g. a process that can be developed or improved) is the focus of the current study, although micro-firm and O/M competence may be referred to from time to time to clarify certain points.

Newbert (2007) and Liao *et al.*, (2009) emphasise capabilities rather than resources in terms of impact of firm performance and outline that the capacity to utilise resources effectively is a capability. Researchers have posited that 'dynamic capability' is a requirement to demonstrate responsiveness, an ability to flexibly innovate and coordinate and exploit internal and external resources (Teece *et al.*, 1997) as an outcome of knowledge integration (Grant, 1996). Eisenhardt and Martin (2000) criticised the dynamic capability model as being theoretically ambiguous, and argued that dynamic capabilities have common features across organisations that could be viewed as best practice. However, Ludwig and Pemberton (2011) stated that any firm operating in a dynamic environment needs to focus on competitive survival and their capabilities, and it is this perspective that is applied in the current study.

Dynamic capability is assumed to be embedded in the firm's structure (Penrose, 1959), enabling it to integrate, build and reconfigure internal and external competencies to address rapidly changing environments (Teece *et al.*, 1997). Capabilities within a firm have been described as unique, they are tangible (assets, location), intangible and inimitable assets (Chaston and Mangles, 1997; Teece *et al.*, 1997). The acquisition of capabilities may have been through learning (Collins, 1996) or through innovation (Collins, 1996). This is different from Teece *et al.*, 's (1997) view in that routines and competencies are attributable to local or regional forces that shape the firm's capabilities at early stages of development. Teece *et al.*, (1997) believes that generally routines and capabilities cannot be acquired; they need to be built.

The DC process is viewed as a process of leveraging and exploiting the firms resources and capabilities into outputs (Eisenhardt and Martin, 2000; Wang and Ahmed, 2007). RBV highlights a direct connection between the DC process and the firm's process performance (Zahra *et al.*, 2006). Zollo and Winter (2002) outline the firm routines and processes (experience accumulation, knowledge articulation, and knowledge codification) form the base of DC creation. The firm's routines are influenced by external and internal stimuli (Zollo and Winter, 2002). In the context of this study where regulatory and environmental changes require dynamic change, new routines and capabilities are required (Zollo and Winter, 2002). Zollo and Winter (2002) emphasise that learning is at the base of the DC process and guides its development. The process of sensing, learning, coordinating and integrating resources play a vital role in developing DC (Zander and Zogut, 1995). The sensing stage is connected with identifying market needs, opportunities and understanding the environment. The learning stage is related to knowledge transfer and knowledge creation to enhance existing routines in the firm. The co-ordinating stage determines the allocation and assimilation of resources. The integration stage is related to the implementation and utilisation on new knowledge by developing routines and patterns.

While process, routines, knowledge processes and learning mechanisms are sources of DC (Zollo and Winter, 2002), innovation capability developed through

network involvement is considered an antecedent to DC (Agarwal and Selen, 2009). Communication within the network is necessary to achieve innovation and learning outcomes and to facilitate knowledge transfer (Lawson and Sampson, 2001). Notably, the ability of the firm to absorb knowledge gained through participation in an external network is critical for innovation (Cohen and Levinthal, 1990) to take effect in the micro-firm.

2.4 Justification for using Resource Based View/ Dynamic Capability Theoretical Frameworks

According to Mahoney (2004) the purpose of the firm is to organise the use of its own resources including those acquired externally to the firm to produce goods or services at a profit. Similarly, other researchers view the firm as a dynamic knowledge based activity system (Nonaka and Takeuchi, 1995 and Spender, 1996). This is consistent with Penrose's (1959) view, that the firm is a pool of resources and that knowledge is the skilled process of leveraging resources that are embedded in the firm (Mahoney, 2004).

In a micro-firm context, firm performance is a function of managerial capability and the O/M is defined as a central resource for the firm (Greenbank, 2000; Kelliher and Henderson, 2006; O'Dwyer and Ryan, 2000). Kelliher and Reinl (2009) suggest a resource based view for exploring micro-firm management, with the O/M at its core. Kearney *et al.* (2014) also recommend using RBV and dynamic capability theory together when looking at innovation in the micro-firm context.

Micro-firms are unique in nature as they suffer from a lack of essential resources and therefore they need to acquire critical resources from outside (Barney *et al.*, 2001; Kelliher and Reinl, 2009) in order to sustain their business. The lack of micro-firm resources encompass a shortage of skilled labour, a lack of (access to) finance and an inability to plan for the medium and long term due to time constraints (European Commission 2011; Simpson, *et al.*, 2012; Welsh and White, 1981). While many argue that 'resource poverty' (Mäkinen 2002) affects firm performance, other factors also hamper micro-firm performance

improvement. These factors include; the O/M goals, motivation and lifestyle aspirations (Jaouen and Lasch, 2015), managerial inefficiency and undercapitalisation of assets (Boer, 1999; Cameron and Massey, 1999; Kuratho and Hodgetts, 1998). Viable micro-firms tend to start with more human capital than those that fail (Storey and Cressy, 1996) and the risk of failure is thought to be reduced due to the balanced team effect.

Taking a resource-based view, Singh *et al.* (1999) argue that the social interaction amongst micro-firms is not only an important firm resource but also a mechanism for knowledge transfer (Cross *et al.*, 2003). Furthermore, Wagner and Svensson (2014) posit that unused resources in a network should be recovered and reused by other actors in the network. However, other researchers state that firms cannot achieve a unique advantage based on resource capability alone (Gimeno Gascon *et al.*, 1997). In the context of the micro firm the O/M is the primary decision maker (Greenbank, 2000) and therefore a fundamental centre of dynamic capability development (Walsh *et al.* 2012). It is suggested that micro-firms use appropriate strategic decisions (Brush and Chaganti, 1999) to maximise the resources they do have (Penrose, 1959) in pursuit of sustainable business activity.

It is a widely held view that a micro-firm's internal capabilities and resources are insufficient for innovation to occur, as innovation goes beyond the firm boundaries. Firms need to move outside the firm to gather new information and transform the knowledge obtained for innovation purposes (Harryson *et al.*, 2008). Previous research describes how firms adapt their physical, human and firm resources in response to market changes (Eisenhardt and Martin, 2000; Teece *et al.*, 1997; Zahra *et al.*, 2006). These dynamic capabilities include the O/M's existing entrepreneurial experience, existing knowledge and firm learning to identify what resources and competencies need to be used for market changes (Winter, 2003; Zahra *et al.*, 2006 in Mezger, 2014).

Teece and Pisano (1994) states that DC theory is a subset of capabilities that allow the firm to respond to change market circumstances. The dynamic capability of micro-firms in transforming the internal and external knowledge is

described as a key factor in the firm's innovation capability development (Gebauer, Worch and Truffer, 2012; Kocuglu *et al.*, 2015). Innovation capability development is interpreted as a combination of internal and external factors which are linked to the organisations ability to continuously innovate. External factors include government regulations, environmental regulations and clusters (networks) (Terzioski, 2007). Innovation is central to DC theory (Lawson and Sampson, 2001) by integrating capabilities it allows the firm to absorb knowledge from external sources (networks) (Cohen and Levinthal, 1990).

In the context of this research RBV and DC can be extended to the network perspective. Phillipson *et al.*, (2006) argue that micro-firm O/Ms exist in a social environment, interaction with network members exposes the O/M's managerial mindset to more diverse mindsets, leading to innovation capability development (Matlay, 1999). Network engagement provides an opportunity for the O/M of the micro firm to overcome resource limitations (Lieberman-Yaconi *et al.*, 2010). Networks are key sources of innovation (Von Hippel, 1998) by widening opportunities and access to key resources. Access to external sources of usable knowledge is particularly important for micro-firms due to their limited resources (Stawasz, 2015). Sometimes the O/M is the only person in the micro-firm and therefore the primary source of knowledge (Lean, 1998). The O/M relies on knowledge available internally and through free sources of information (Kunapatarawong and Martínez-Ros, 2014), such as friends, family, close allies, support agencies and higher education institutes. The micro-firm's ability to innovate also depends on the extent of the inter-firm tacit knowledge transfer (Cavusgil *et al.*, 2003; Nonaka and Takeuchi, 1995; Stawasz, 2015). Inter-firm tacit knowledge is acquired by frequent and close collaborations (Cavusgil *et al.*, 2003; Uzzi, 1997; Zahner and Bell, 2005) which facilitate communication and exchange (Kraatz, 1998). Personal face-to-face interaction enhances the transfer of tacit knowledge in this regard (De Bresson and Walker, 1991). However, the value of the network to a micro-firm is only realised by the O/M's positive use of resources within the network (Ostgaard and Birley, 1994) and how effectively linkages are managed (Gupta and Govindarajan, 1986). At the level of the firm, it is contended that only those firms with a structure of openness (Khan and Altaf, 2015) and collaboration will enhance their absorptive capacity for innovation.

Yet, Aylward and Kelliher (2009) contend that an element of fear exists when sharing information, a key aspect in reaching network potential.

In summary the theories underlying this research are the RBV (Barney, 1991) and DC theory (Winter, 2003; Teece *et al.*, 1997) for strategic management. These theories have been used in combination for micro-firm studies by numerous researchers (Kearney *et al.*, 2014; Tu *et al.*, 2014) and present an appropriate lens through which to pursue the current research aim and objectives.

2.5 Conclusion

This chapter outlines the theoretical framework underpinning this study. The chapter justifies the reasons for using RBV/ dynamic capabilities theory to study green innovation capabilities in micro-firms. The next chapter looks at the role micro-firms play in Ireland and Canada. It discusses the unique characteristics of the micro-firm and its importance to the economy in each jurisdiction. It reviews the literature on micro-firm network engagement and its impact on management capability development. The functions of the facilitated network from both a green enterprise and network perspective are developed. Innovation in micro-firms and green innovation capabilities in networked micro-firms are studied. The chapter concludes with a summary of the literature themes and the initial innovation capability framework for, green enterprise in micro-firms.

Chapter 3: Literature Review

3.1 Introduction

Having set out the definition of a micro-firm, green innovation capability and a facilitated network in the introduction chapter and having justified the dynamic capability/ resource lens in chapter 2, this chapter explores the micro-firm and its network activities under a green innovation capability development lens. The chapter is divided into three parts. Part one discusses the unique characteristics of the micro-firm and explores the O/M natural environmental orientation (NEO) and its impact on the micro-firm's green activities. The micro-firm's external competitive environment is also explored in this section. Part two critically reviews micro-firm management capability development literature, focusing on the innovation process and how green innovation capability is developed. Part three discusses micro-firm facilitated networks as an additional knowledge resource in pursuit of capability development. The concept of network engagement and the role it plays in micro-firm green innovation capability development is also explored. A critical review of the functions of the facilitated network from both a green enterprise and network perspective is developed. This chapter concludes with a summary of the literature themes and presents a literature-informed green innovation capability framework for micro-firms.

Part 1 Micro-firm characteristics

As discussed in chapter one, for the purpose of this study, micro-firms are defined as those organisations with fewer than ten employees (EU, 2011). Penrose (1959, p.46) notes that due to the vast difference between small and large firms, “*it is hard to see the two species as the same genes – one cannot define a caterpillar and then use the same definition to describe a butterfly*”. It is generally accepted that micro-firms are unique (Welsh and White, 1981), and that they have distinctive characteristics, separate from small, or medium-sized enterprises (Kearney *et al.*, 2012). When considering such characteristics, it is suggested that these firms can be categorised by organisation structure, culture, strategy, management style and approach to decision making (Kelliher and Reinl, 2009; Welsh and White, 1981); each of which are discussed in this section. Beyond the business, micro-firms have little influence on their external environment (Kelliher, 2007), where they tend to be dependent on a small range of customers, with 73% of micro-firms concentrating on their local market (Industry Canada, 2013). As a result, external factors tend to have more impact on micro-firms (Blackburn, 2012) than other business entities.

3.1.1 Micro-firm Structure

The micro-firm organisation structure has been described as simple, flat and informal (Hannon *et al.*, 2000). Micro-firms are generally independently owned and operated (Drucker, 1985) wherein the O/M has direct control over all the resources and manages the firm at all levels (Reinl and Kelliher, 2010). Often there is little separation of ownership and control (Greenbank, 2000) and the O/M has a direct influence on employees as a result. In many cases the micro-firm has no employees and the O/M ‘is’ the business (Lean, 1998). The O/M focus is primarily on personal goals and stability (Hill and Stewart, 1999) while the O/M’s experience of past failures and lifetime management skills make micro-firms more robust and less bureaucratic, providing them with the dynamic capabilities to respond to market changes quickly (Tamayo-Torres *et al.*, 2016).

3.1.2 Micro-firm Culture

Culture comprises the norms, beliefs, behaviour and values of the people in the micro-firm that determine how the firm functions. Bodewes and deJong (2003) found that the beliefs, behaviour and values of the O/M have a significant impact on the culture of the firm. Of particular relevance to this study is Phan (2008), Richards *et al.*, (2016) and Testa *et al.*, (2015)'s studies, each of which found that the O/M's natural environmental orientation (NEO) influences the green culture of the micro-firm. Storey and Cressy (1996) suggest that the O/M's "life experience" acts as a shield against business collapse and the business is seen as a "learning experiment" by the O/M. In essence, micro-firm culture is an extension of the O/M's personality, leading to the label 'owner-led culture' in this setting (Kelliher and Reinl, 2009). It has been argued that consistent (Chesbrough, 2007), systematic and intentional processes (Thornhill, 2006) allows innovation to unfold over time and take many forms (Koput, 1997) to create an innovation culture. Thus, the O/M's NEO, alongside their innovation perspective is likely to have a significant impact on the micro-firm culture in relation to green innovation.

3.1.3 Micro-firm Strategy

The performance of the micro-firm is said to be dependent on strategy choice where the choice to adjust a strategy is reliant on the business environment and internal capabilities, objectives and the O/M's background (Roper, 1999). Formalised business planning has not been commonly used in micro-firms and less than a fifth of start-ups prepare a business plan (Duarte Alonso and Bressan, 2014). Even when created, many micro-firms consider the business plan a 'cosmetic' document to obtain financial aid (O'Dwyer and Ryan, 2000). These plans are often based on the perceptions of the O/M (Duarte Alonso and Bressan, 2014) rather than an objective assessment of the business within its environment. Of note is that many micro-firms survive less than five years (Devins *et al.*, 2005) and that many fail to survive past three years (Storey and Cressy, 1996)

acknowledging the challenges of sustainable business activity in this environment.

Micro-firms have been found to be unique when it comes to their beliefs about growth strategies, which are also directly correlated with innovation (Pett and Wolff, 2012). Greene and Brown (1997) posit that micro-firm growth strategy is a combination of the O/M's expectations and the ability to access the required resources, with a dependency on supportive economic surroundings to support growth plans (Morrison *et al.*, 2003; Reddy, 2007). However, the overriding control of the O/M as the micro-firm's strategist can lead to a constricted strategic outlook, in particular where the O/M lacks relevant capabilities, qualifications or training (Smallbone *et al.*, 2000). In addition, many micro-firms can be rigid in perspective and often lack the strategic awareness needed to grow and develop the business. McGrath and O'Toole (2013) further argue that micro-firms operate in an 'economic core' and have neither the capacity to pursue innovation nor growth strategies.

3.1.4 Management Style

Many researchers have suggested that the management style in a micro-firm setting is individual to a particular O/M and that responses to business problems are also distinct from larger firms (Reinl and Kelliher, 2008; Phillipson *et al.*, 2004; Storey and Cressy, 1996). O/Ms perform most of the operational and management functions (European Commission, 2011), including marketing, planning, production, innovation and administrative functions (Industry Canada, 2013). They have close proximity to their customers (European Commission, 2011), allowing them easy access to capturing market data and information about how the firm is functioning through observation rather than from other sources (Greenbank, 2000). Their stakeholder relationships are dynamic in nature (Hannon *et al.*, 2000) and 'transactional stakeholders' allow learning opportunities to be maximised and transactional costs to be minimised (Hannon *et al.*, 2000). However, Kaufman and Tödtling (2002) argue that a narrow focus on

their existing customers imply that the micro-firm is over dependent on these customers, to the detriment of seeking out new opportunities.

When contemplating the management style evident in micro-firms, the O/M tends to have managerial shortcomings (Jaouen and Laush, 2015), relating to both dynamic capabilities and resource (Kearney *et al.*, 2014). This is manifested where managerial capabilities tend to be developed by ‘trial and error’ (Schaper *et al.*, 2005) rather than through formal training, which can result in an inappropriate or inefficient managerial approach. Managerial limitations of this nature are argued to act as a constraint for innovation (Kaufman and Tödtling, 2002), an important aspect of the current study.

3.1.5 Decision making approach

Decision making in micro-firms is centralised on the O/M (Blackburn, 2012) with a strong internal focus on control. O/Ms are able to make faster decisions as they do not have to consult with layers of internal stakeholders (Haghighi *et al.*, 2014). As a result, they are generally faster at adopting new technologies and quicker at responding to niches in the marketplace (Kevill *et al.*, 2017). This dynamic capability is inimitable and allows them to implement innovative strategies faster than others in the market and to respond to competitive positions (Matlay, 1999) more efficiently. However, these benefits should be tempered with the reality that decision making is likely to be short term based (Storey and Cressy, 1996) and inclined to be traditional rather than growth focused (O’Dwyer and Ryan, 2000). One of the reasons O/Ms focus on short term decision making is due to the fact that many of the issues that micro-firms face are immediate (Greenbank, 2000). The O/M is generally the only person to filter the information for decision making (Burke and Jarratt, 2004) which may also restrict the rational decision process, particularly if the O/M is reluctant to change. Greenbank (2000) concurs with this view and adds that O/Ms merge information captured unofficially, through heuristics and other short cut techniques in a more impulsive approach to decision making than that of the rational decision cycle. Therefore, the O/M’s personal characteristics play an important role in micro-firm decision making

(Greenbank, 2000), leaving the micro-firm dependent on the O/M's personal orientation in relation to green innovation.

3.1.6 Micro-firm competitive environment

The micro-firm has been found to be less able to shape and guide the external environment (Kelliher, 2007) compared to its larger counterparts and is therefore dependent on internal capabilities to survive in a dominant market. Hannon *et al.*, (2000) outline that for the sustainable development of small firms they need to acquire the ability to adapt to changing business environments more quickly than their competitors. This is a management capability which many researchers believe is unique to micro-firms due to their size and closeness to the customer (Greenbank, 2000). This capability is difficult for competitors to emulate and is influenced by O/M, organisation and environmental factors (Hannon *et al.*, 2000). However, while capabilities have been found to be necessary to sustain the business, Eisenhardt and Martin (2000) do not view them as sufficient conditions for competitive advantage.

3.1.7 Micro-firm Characteristics - Literature Themes

The preceding discussion permitted the extraction of key literature themes that are plotted in Table 1.

Theme	Description	Key Authors
Micro-firm structure	Simple, flat and informal. O/M has direct control over all the resources and manages the firms at all levels.	Drucker, 1985; Greenbank, 2000; Hannon <i>et al.</i> , 2000; Hill and Stewart, 1999; Lean, 1998; Reinl and Kelliher, 2010; Tamayo-Torres <i>et al.</i> , 2016
Micro-firm culture	Dependent on the views and beliefs of O/M, culture is an extension of the owner's personality. O/Ms NEO and innovation orientation influences the micro-firm's green innovation culture	Chesbrough, 2007; Kelliher and Reinl, 2009; Koput, 1997; Storey and Cressy, 1996;
Micro-firm strategy	Predominantly one of survival; informal in nature and focused on short-term gains. Growth strategy is a combination of O/M's expectations and the ability to access the required resources.	Devins <i>et al.</i> , 2005; Duarte, Alonso and Bressan, 2014; Greene and Brown, 1997;; ; McGrath and O'Toole, 2013; Morrison <i>et al.</i> , 2003; O'Dwyer and Ryan, 2000; Pett and Wolff, 2012; Reddy, 2007; Roper, 1999; Smallbone <i>et al.</i> , 2000; Storey and Cressy, 1996
Management style	Individual; most of the operational and management functions are performed by the O/M. O/M's personal characteristics influence the approach taken.	Greenbank, 2000; Gulati and Gargiulo, 1999; Hannon <i>et al.</i> , 2000; Jaouen and Laush, 2015; Kaufman and Tödtling, 2002; Kearney <i>et al.</i> , 2014; Phillipson <i>et al.</i> , 2004; Reinl, and Kelliher 2008; Schaper <i>et al.</i> , 2005; Storey and Cressy, 1996; Todtling, 2002
Decision making approach	Short-term focused, passive, fast and centralised, resting with the O/M. Micro-firm decision making is the interaction of the individual, social and economic perspectives. O/M's personal characteristics influence the approach taken.	Blackburn, 2012; Burke and Jarratt 2004; Greenbank, 2000; Haghighi <i>et al.</i> , 2014; Kevill <i>et al.</i> , 2017; Lean, 1998; Matlay., 1999; O'Dwyer and Ryan, 2000;
Competitive environment	Micro-firm is less able to shape its competitive environment. Can adapt more quickly to changing customer needs due to size-influenced agility and closeness to market.	Eisenhardt and Martin, 2000; Greenbank, 2000; Hannon <i>et al.</i> , 2000; Kelliher and Henderson, 2006

Table 1: Micro-firm Characteristics – Literature Themes

As emphasised in the literature, micro-firms have a structure, strategy and management style that can respond quickly to market changes with the O/M performing most of the management and operational functions. The personal characteristics of the O/M determine the micro-firm culture and approach to decision making in relation to the wider business environment. Firms also differ in their resource talents and this has the potential to affect the firm

competitiveness (Barney, 1991). Specifically, micro-firms depend on capabilities to accomplish tasks to achieve outcomes by transforming resources internally (Carnes and Ireland, 2013). In turn, the micro-firm's knowledge of the innovation resources they possess or resources that are attainable to them, help them in achieving innovation capabilities (Carnes and Ireland, 2013).

As stated in Chapter 1, innovation is a process that can be used to create and add value in a firm (Carnes and Ireland, 2013). When contemplating this capability lens, Hooley and Greenley (2005) suggest management capability is a predecessor of innovation capability. Based on this premise, factors that are believed to contribute to a micro-firm's innovation capability include the O/M's desire to succeed and the background and personality traits of the O/M (Bello, 2017). The O/M's NEO and attitude towards innovation also influences their approach to and emphasis on green activities within the micro-firm. Similarly, De Mel *et al.*, (2009) claim that there is a direct correlation between the characteristics of the O/M and the firm's innovation capability. As there is also a direct correlation between O/M actions and micro-firm performance (Smith, 1999), O/M characteristics play a key role in developing innovation capability in the micro-firm. As a result, micro-firm studies tend to focus on this individual, an approach replicated in this study.

According to the EPA (2009) firms should foster an innovation-driven culture in order to reach green economy goals. However, some micro-firms due to their small size feel that they do not have an impact on the environment (Simpson *et al.*, 2004). Despite this perspective, collectively, micro-firms have a considerable impact on the environment. According to the European Commission, it is estimated that among EU countries SMEs are responsible for 64% of all industrial waste (European Commission, 2002) and 70% of the *total negative impact* of businesses on the environment (Hillary, 2000). Despite their market agility, micro-firms are believed to lag behind larger companies in terms of the green economy (Rutherford *et al.*, 2000). It is argued that this is mainly a result of resource constraints and a lack of management capabilities, which act as barriers to green innovation.

Part 2 Micro-firm green innovation capability development

When considering green innovation, Florida *et al.*, (2000) state that two factors in the firm, resources and capabilities, are vital in a firm's drive to adopt environmental practices. Other drivers for environmental change include environmental, economic and technological factors. Panwar *et al.*, (2016) and Leonidou *et al.*, (2015) all found that external stakeholders influence green innovation, while Sáez-Martínez *et al.*, (2016) state that it is internal stakeholders that are an important driver in green innovation, a topic explored in more detail below. As stated in section 1, the characteristics of the O/M (i.e. openness to innovation, their NEO and their awareness of employee's abilities and capabilities) and the micro-firm (i.e. willingness to change, and an ability to respond quickly to market change) play a key role in the firm's ability to foster green innovation capabilities. Taking these characteristics into account, motivation levels towards green enterprise, particularly those evident in the O/M, produce either negative or positive green outcomes (Arend, 2014). The capabilities within the micro-firm are the drivers of innovation and also determine the extent to which a firm innovates (Teece *et al.*, 1997). Notably, micro-firms that pursue green activities based on values and commitment receive more beneficial outcomes (Arend, 2014). Taking these considerations into account, research emphasises the need for micro-firms to fit into broader social and ecological systems in such a way that they contribute to sustainability (De Clercq *et al.*, 2015).

3.2 Innovation and micro-firms

Some micro-firms survive by competing in a niche market while others follow more sweeping innovations, going on to become market leaders (deJong and Marsili, 2006). From an external perspective, some researchers view innovation as the catalyst of a micro-firm's ability to survive (Carnes and Ireland, 2013), and ultimately develop and sustain competitive advantage. Other researchers suggest that operating in a competitive marketplace is a driver for innovation (Council of

Canadian Academics (CCA), 2009; Sharpe, 2010), wherein proximity to the customer is vital for micro-firm innovation and decision making relating to innovation to occur (Lieberman-Yaconi *et al.*, 2010).

Many O/Ms acknowledge the benefits of innovation and innovate where possible (Faherty and Stephens, 2014), using ad-hoc and at the same time effective innovation strategies in pursuit of business improvements. However, micro-firms also experience barriers to innovation including; lack of management motivation (Kearney *et al.*, 2014), lack of financial resources (Kaufman and Tödtling, 2002), assumptions of high cost of innovation [in particular for prototyping and intellectual property], poor information and communications technology (ICT) infrastructure and lack of manpower (Kaufman and Tödtling, 2002). Similarly, Andersson and Loof (2012) found that access to skilled labour has a more important influence for innovation in micro-firms than in larger firms. This may be partly explained by the fact that this intellectual resource may be limited among primarily generalist micro-firm employees (Kelliher and Reinl, 2009). Thus, a firm's size plays a larger role in process and organisational innovations than in product and marketing innovation (De Mel *et al.*, 2009). For example, deJong and Marsili (2006) describe the innovation patterns as more diverse in micro-firms depending on their specific needs, resources and capabilities and therefore cannot be considered a homogenous group. This results in micro-firms requiring a more diverse approach than small, medium or large firms, reflecting a need for greater insight into this domain.

Few micro-firms use methods to measure innovation, even though O/Ms are aware of the merits of this activity. The most common means for measuring innovation is the use of management accounting techniques, which can access the success criteria of product and sales growth (Faherty and Stephens, 2014). Other direct measures include customer feedback, R&D spend as a percentage of sales, the number of new products and services launched, the percentage of sales/profit/market share from innovations and the percentage of innovations meeting development schedules (Faherty and Stephens, 2014). Innovation can also be measured by product, process, marketing and organisational improvements (OECD's OSLO manual, 2005). However, Bibbee (2012) argues

that innovation is very difficult to measure because of the intangibility of its output. Some researchers found that only a small minority of firms are aware of the literature on innovation theories and models, yet innovation is important for micro-firms and is viewed as essential for survival (Baregheh *et al.*, 2012).

3.2.1 The micro-firm innovation process

Micro-firms have an important role to play in innovation (Cosh *et al.*, 1998), and their needs arise at different phases of the innovation process (Stawasz, 2015). Some researchers found that the characteristics of micro-firms – informal, flexible, open, (Pavitt *et al.*, 1987) are more suited to the dynamic innovation process than larger firms. Some researchers argue that individuals are the main agents of knowledge (Hansen, 1999) and therefore are important for the innovation process. Notably, vertical and horizontal networks with customers, suppliers (Cavusgil *et al.*, 2013) and other firms play a stronger role in the innovation process than horizontal networks with academia and government agencies (Zeng *et al.*, 2010). In particular, the benefits of involving customers in the innovation process has been well researched (Prahalad and Ramaswamy, 2004; von Hippel, 2005). Conversely, others have found no significant impact from collaboration with customers (Löf and Heshmati, 2002; Nieto and Santamaría, 2007) or suppliers (Ledwith and Coughlan, 2005).

3.2.2 Impact of human capital on innovation culture

Human capital is defined as the combined significance of the capabilities, knowledge, skills, experiences and motivation of the workforce. The role of human capital has been found to be central to human capital performance in small firm settings (Storey and Cressy, 1996). Human capital, especially the O/M's experience, education and expertise are argued to be key factors in capability development. Cross *et al.*, (2003) and Panwar *et al.*, (2016) stress that human capital for the micro-firm should incorporate a wide framework to include the stakeholders involved in the micro-firm. Similarly, Sveiby (2000) believes that all human capital inputs should be considered, while Heneman *et al.*, (2000) state

that this perspective combined with the O/M's experience and vision improves firm performance. Rauch and Frese (2000) established that a combined human capital input (HCI) perspective is more beneficial than a solely traditional O/M perspective. In contemplation of the HCI perspective, Cross *et al.*, (2003) posit that there is more human capital engagement in micro-firms than other organisations and they are better placed to involve employees in central decision making, mainly due to the existence of fewer barriers between the organisational levels in the transfer of knowledge. The innovation culture within micro-firms has therefore been built on personal relationships (Scase and Goffee, 1987) often being an extension of the O/M's personality traits (Lange *et al.*, 2000). Organisational change which may lead to innovation also follows a top down approach in the micro-firm setting (Kelliher and Henderson, 2006) as the O/M generally has direct control over any changes (Iles, 1994). As such, a propensity towards proactive change likely originates with the O/M.

Some O/Ms view employees as an important resource for innovation (Bergmann, *et al.*, 2001) and both Andries and Czarnitzki (2014) and Klaas *et al.*, (2010) argue that a positive benefit comes from using non-managerial staff in generating ideas. They also believe that using O/M's knowledge solitarily does not capture the full innovation potential of the firm. Non managerial staff comprise an important part of the firm's human capital (Grant, 1997), as they recognise opportunities and therefore are a good source of knowledge creation and innovation capabilities (Smith and Tushman, 2005). Employees can also be motivated to enhance innovation skills by incorporating them into decision making and aligning their interests with the firm's interests, which can result in the sharing of knowledge. Other researchers found that employees may not be interested in or motivated to share information as it may be seen as a way of losing power (Van Krogh, 1998), and incentives may be required to encourage tacit knowledge transfer as a result. O/Ms with prior human resource experience tend to understand the value of this resource (Klaas *et al.*, 2010) and engage their employees in generating innovation as a result. In cases where the O/M is the sole employee, this engagement can be sought through external sources. This view would also suggest a more optimal use of human capital engagement through

micro-firm network engagement (Cross *et al.*, 2003), assuming O/M willingness to engage in this process.

3.2.3 Innovation capability in a micro-firm

The higher the innovation capability, the higher the firm performance (Cavusgil *et al.*, 2003). Innovation producing capability comprises accumulated tacit knowledge which accounts for 70% of the firm's knowledge (Liu and Cui, 2012). The O/M has an existing range of tacit knowledge and experience that can be recognised and valued through capability development (Hannon *et al.*, 2000). By continuously improving tacit knowledge sharing, a firm's innovation capability also improves (Liu and Cui, 2012). Thus, tacit knowledge could be held individually through employee skills, habits and knowledge or collectively in the firm's culture and routines (Nonaka and Takeuchi, 1995) within the firm. Employee willingness to share and obtain knowledge also enables the micro-firm to improve innovation capability (Lin, 2007). Individual characteristics which influence knowledge sharing process include enjoyment in helping others, knowledge, self-efficacy and the O/M's support (Lin, 2007). Elaborating on green innovation capability, Anderson and Bateman (2000) highlight the ability to convince decision makers of the value of green innovation and the importance of sustaining employee commitment, additional aspects of an innovation culture.

3.2.4 Micro-firm green innovation catalysts

The theory of dynamic capability discussed in Section 2.3 outlined that firms need to adapt to change by adapting their existing capabilities and adding to them (Teece and Pisano, 1994). Many researchers outlined how firms build routines around the behavioural patterns which become embedded into the firm's policies, structures and processes (Seebode *et al.*, 2012). Green innovation involves new knowledge components and the micro-firm requires more absorptive capacity to manage this innovate process (Zahra and George, 2002 in Seebode *et al.*, 2012). The ability of micro-firms to respond to dynamic market changes, including in times of economic recessions has shown a quality of resilience unique to the

micro-firm's innovation capabilities. However, as micro-firms hold negligible industry power (Kelliher, 2007), change has often been forced from outside the firm, causing in a reactive approach to change which may not result in innovation activity.

According to Stahle and Hong (2002) and Leonidou *et al.*, (2015), firms need to encourage and promote innovation capabilities in order to achieve sustained competitive advantage. By adopting a culture of innovation and embedding innovation throughout their firm (Hansen, 2010), micro-firms can adapt to green regulations and demands and by default, to the requirements of the green economy more effectively and efficiently. However, the values and environmental attitudes (Klapper and Upham, 2015) of the micro-firm O/M are very important and O/Ms with positive environmental attitudes are more likely to see green innovation as an opportunity (Dibrell *et al.*, 2015). O/M attitude also has an impact on the feedback process (Papagiannakis *et al.*, 2014). As previously stated, a micro-firm's green capability depends on the *Natural Environment Orientation* (NEO) of the O/M.

NEO has been described as the choice of response by the firm to green implementation (Wartick and Clarkson, 1985). Menguc and Ozanne (2005) categorise NEOs as positive outcomes – corporate social responsibility, entrepreneurship and the firm's commitment to the environment. However, other researchers (Phan, 2008; Wartick and Clarkson, 1985) differentiate the four green outlooks as follows; resistive, reactive, accommodative or proactive. If the firm has a resistive stance, they likely opt for a low cost quick legally accepted green capability and the firm would not be motivated to spend on resources that would enhance their green capabilities. Firms that hold a reactive NEO are likely to follow what has been publicly known as an effective green solution (Sáez-Martínez *et al.*, 2016). Firms with an accommodating NEO are likely to embrace green solutions that exceed the regulatory compliance and treat 'greening' as a moral and social obligation (Abdullah *et al.*, 2016). Firms that follow the proactive NEO are environmental champions and view green capability development as an integral part of their business (Phan, 2008).

Identifying the firms NEO is the first step in identifying, building and evolving the firms' green capabilities (Phan, 2008). Phan (2008) states that firms with a reactive and resistive stance can build their green capabilities through experiential learning and this can be achieved through the acquisition of tacit knowledge in facilitated networks. Green capabilities are strengthened and sustained through gradual positive feedback outcomes initiated through regulatory demand, O/M's environmental attitudes and values and their stakeholder demands (Powell and DiMaggio, 1991). The more integrated green strategies are to the firm's business strategies (Papagiannakis *et al.*, 2014), the more positive the outcomes. However, both Papagiannakis *et al.*, (2014) and Bar (2015) warn that firms with limited resources may not have the resources to obtain feedback and therefore this feedback process may not have an impact on the micro-firm.

3.3 Knowledge transfer/green initiatives in micro-firms

According to research studies carried out by Stanovcic *et al.*, (2015) and Reinl *et al.*, (2015) knowledge transfer has been found to boost environmental innovation by providing a working environment conducive to creating, storing, sharing and applying knowledge. Most of the literature on green knowledge transfer initiatives refers to the supply chain (Hamid *et al.*, 2012; Kim *et al.*, 2011; Nielsen *et al.*, 2014). These authors argue that if the supplier and buyer are in a trustworthy (Kim *et al.*, 2011) and sustainable relationship, green knowledge transfer initiatives are more likely to take hold. Branchos *et al.*, (2007) agree that the effectiveness of green knowledge transfer initiatives include trust and sustainability but also combine motivation, learning culture, collaboration and O/M support. In contrast, Cheng *et al.*, (2008) found that trust is the pivotal factor contributing to green knowledge transfer initiatives.

Laari (2013) looked at the relationships both within and outside the firm for knowledge transfer initiatives and concluded that the firm, the economy and the environment benefit from intra firm and supply chain collaboration on green issues. Green knowledge transfer is enhanced by adopting a 'shared lens' approach incorporating a shared values framework (Porter and Kramer, 2011)

between social, economic and environmental perspectives. Dangelico and Pontrandolfo (2015), also assert that environmental collaboration has a positive impact on firm performance and in particular they emphasise the importance of sharing tacit knowledge. Networks play an important role in raising awareness of green issues and they have been positively associated with the uptake of green practices (Giudici, 2013) and green innovation (Noci and Verganti, 1999). Employees and trade unions should also be involved in government initiatives to ensure that the micro-firms have the necessary resources to engage with green initiatives (Droste et al., 2016).

3.4 Support for green innovation capability development in micro-firms

Even though innovations are the lifelines of micro-firms (Hurley *et al.*, 1998) they are perceived to be expensive, multifaceted and precarious due to changing demands and a dynamic marketplace (Cavusgil *et al.*, 2003). One means to alleviate this challenge is through resource bundling, often facilitated through mediated support. Resource bundling is a process managers use to effectively manage a firm's resources (Carnes and Ireland, 2013), it involves; converting or aligning resources for the purpose of building capabilities and creating value (Sirmon *et al.*, 2008), stabilising resources to maintain a strategy (Sirmon *et al.*, 2007), enriching resources to extend and elaborate a firm's capabilities and pioneering resources to develop and create new capabilities, with the ultimate goal of achieving innovation (Carnes and Ireland, 2013). This process enables the firm to respond to the dynamic market changes and evolving customer demands through innovation (Blommerde and Lynch, 2014).

At the time of writing, there are three agencies in Ireland and two Government agencies in Canada and each has regional offices that help to support green activity in pursuit of optimised use of environmental resource – Enterprise Ireland⁷, Sustainable Energy Authority of Ireland⁸ and the Environmental

⁷ Enterprise Ireland is the government organisation responsible for the development and growth of Irish enterprises in world markets.

Protection Agency⁹ Canadian Environmental Assessment Agency¹⁰ and Environment Canada¹¹. However, while it has been established that there is a need for business-led green innovation, it is argued that the green knowledge documentation available, rarely provides enough information to enable micro-firms to support and implement green enterprise strategies (Davies, 2013). Therefore, micro-firms perceive innovation as complex; a view supported by a number of studies that found that the innovation process needs to be simplified and the information on innovation needs to be tailored for micro-firms (Faherty and Stephens, 2014) in order for it to act as a useful resource for green innovation capability development in these organisations.

3.4.1 Building micro-firm green innovation capability

Innovation capability has been described as an enabler of green innovation capabilities (Benitez-Amado *et al.*, 2010). Green innovation or eco innovation is described as a driver of economic development (Andersen, 2012). According to Fankhauser *et al.*, (2013), one of the key challenges of competing in a green economy context has been the challenge of overcoming continual market failures. Many firms feel overburdened with existing regulations and are unlikely to engage in voluntary greening activities, although this perspective varies depending on the industry sector that micro-firm operates in. According to Hansen (2010), tools like environmental portfolio and green innovation KPIs (Key Performance Indicators) have the power to realign firms towards new markets for environmental technologies. Kelliher and Reinl (2014) propose a gradual approach to green capability development which can be established over time through trusting relationships. Kelliher and Reinl (2014) go on to outline the capabilities required for micro-firm inclusion in the green economy as the ability

⁸ The Sustainable Energy Authority of Ireland was established as Ireland's national energy authority under the Sustainable Energy Act 2002. SEAI's mission is to play a leading role in transforming Ireland into a society based on sustainable energy structures, technologies and practices.

⁹ The EPA is an independent public body established under the Environmental Protection Agency Act, 1992.

¹⁰ The Canadian Environmental Assessment Agency delivers environmental assessments and serves as the centre of expertise on this subject matter within the Government of Canada.

¹¹ The department of the Government of Canada with responsibility for coordinating environmental policies and programs as well as preserving and enhancing the natural environment and renewable resources.

for long term planning, a focus on sustainability and awareness of innovation capability enhancement that balances social inclusion and the adoption of business strategies to encourage and promote green sustainable development. Finally, developing green innovation capabilities increases the firm's market and financial performance (Gabler *et al.*, 2015), further enhancing the firm's capabilities in these areas.

It has been presumed that leveraged innovation resources result in a continuous relationship being developed between knowledge and innovation (Slater, 1997). In context, knowledge and unique knowledge (Ketata *et al.*, 2015) are described as key to innovation. Knowledge assets are accrued internally in the firm or through external sources (Camisón and Forés, 2011) and the ability of firms to identify, assimilate and analyse external knowledge is essential to building innovation capabilities (Ketata *et al.*, 2015). Some researchers argue that both the breadth and depth of external knowledge sources impact on sustainable innovation (Laursen and Salter, 2006; Ketata *et al.*, 2015) as firms need to build capabilities as they were unable to buy them (McGrath and O'Toole, 2014). Others emphasise the importance of local knowledge (Tallman *et al.*, 2004, in Tavassoli and Carbonara, 2014), variety and intensity of knowledge for innovation. In contrast, Lynskey (2004) and De Winne and Sels (2010) claim there is no relationship between O/M knowledge and innovation, although this is a relatively contrary view within the extant literature.

Drucker (1985) highlights the importance of innovation capability for firm survival. Cavusgil *et al.*, (2003) and Aragon-Correa *et al.*, (2008) each suggest that a firm with high innovation capability employs a 'learn by doing' approach. In micro-firms, innovation tends to be reactive rather than proactive (Kaufman and Tödtling, 2002), often imposed upon the micro-firm by market changes. Customers play an important role in guiding innovation (von Hippel, 1988) and collaboration plays a role in creating innovation opportunities (Moos *et al.*, 2015). Due to the proximity of their customer base micro-firms often build their innovation capability through market sensing (Merrilees and Rundle-Thiele, 2011). Similarly, the firm with the capabilities to actively gather trade intelligence is better equipped to respond to changes in the marketplace (Ignatio

et al., 2016). Lawson and Samson (2001) suggest a detailed approach to innovation capability and state that it is the ability of a firm to continuously transform knowledge and ideas into new products, processes and systems for the benefit of the firm and its stakeholders that sustains success. Lawson and Samson (2001) state that this detailed approach is feasible by following a seven step construct;

1. Vision and strategy
2. Harnessing the competence base
3. Organisational intelligence
4. Creativity and idea management
5. Organisational structures and systems
6. Culture and climate
7. Management technology

Tippman *et al.*, (2013) hold the view that capability development occurs through the formation of incremental advances that flow from previous accumulation of knowledge and learning. The central focal point in innovation has also been found to be learning (Lundvall, 1995); a social activity that involves the interaction of people (Reinl and Kelliher, 2014). As previously stated, the O/M is responsible for all functions in the micro-firm (Devine, 2012) and firm capability development is essential to enable the company to respond and cope with market changes and conditions (Beers and Gerrling-Eiff, 2013). A micro-firm characterized by a high degree of innovation is more open to sharing and transferring knowledge in achievement of long term strategic objectives, leaving it pre-disposed to network engagement and conversion of network resource into capability. A firm's innovation capability is therefore deemed to be:

“A transformational capability (Lado and Wilson, 1994; Dutta *et al.*, 2005; Wang and Ahmed, 2007) that mediates the relationship between an organisation's internal pools of innovation resources, its transfer activities (i.e. network engagement) and innovation-supportive culture and its innovation performance” (Walsh *et al.*, 2012).

Micro-firms due to their unique resource constraints, have a greater need for the development of managerial capability (MacMahon and Murphy, 1999) and also have to stretch the capabilities that they do have (Kearney *et al.*, 2014),

emphasising the need for external engagement in micro-firm environments. The O/M characteristics, educational background (Kim *et al.*, 2014) and culture as referenced in part 1 influence capability development in the micro-firm. Micro-firms can also accrue core capabilities through networks including knowledge and innovative capabilities (Lundvall, 1995).

3.5 Micro-firm Green Innovation Capability Development - Literature Themes

The literature highlighted capability development, management capability in the micro-firm setting and the role of knowledge and innovation in the micro-firm setting (Table 3).

Theme	Description	Key Authors
Innovation and micro-firms	<p>Micro-firms experience barriers to innovation.</p> <p>Micro-firms require a more diverse approach to innovation than larger firms.</p> <p>The O/M's desire to succeed and the personality and background of O/M contribute to innovation capability.</p>	Andersson and Loof, 2012; Baregheh <i>et al.</i> , 2012; Bello, 2017; Bibbee, 2012; Carnes and Ireland, 2013; deJong and Maarsili, 2006; De Mel <i>et al.</i> , 200; Faherty and Stephens, 2014; Kaufman and Todtling, 2002; Kearney <i>et al.</i> , 2014; Liberman-Yaconi <i>et al.</i> , 2010;; Sharpe, 2010;
Innovation process	<p>The characteristics of micro-firms are more suited to the dynamic innovation process, but to be effective they need structured interaction with other firms.</p> <p>There is a gap between innovation capability and a firm's intentions.</p>	Barney, 1991; Blommerde and Lynch, 2014; Carnes and Ireland, 2013;Cavusgil <i>et al.</i> , 2013; Cosh <i>et al.</i> , 1998; Faherty and Stephens, 2014; Hansen, 1999; Jensen and Schott, 2015; Kearney <i>et al.</i> , 2014; Ledwith and Coughlan, 2005; Lööf and Heshmati, 2002; McAdam <i>et al.</i> , 2007; Nieto and Santamaría, 2007; Pavitt <i>et al.</i> , 1987; Prahalad and Ramaswamy, 2004; Schumpeter, 1942; Sirmon <i>et al.</i> , 2007; Stawasz, 2015;Tinsley and Lynch, 2001; von Hippel, 2005; Zeng <i>et al.</i> , 2010
Internal innovation culture	<p>Employee willingness to share and obtain knowledge enables a firm to improve internal innovation culture, and it is suggested that employee involvement should be supported by O/M.</p> <p>Organisational change which may lead to innovation also follows a</p>	Andries and Czarnitki, 2014; Bergmann <i>et al.</i> , 2001; Cross <i>et al.</i> , 2003; Grant, 1997; Hannon <i>et al.</i> , 2000; Heneman <i>et al.</i> , 2000; Kelliher and Henderson, 2006; Klaas <i>et al.</i> , 2010; Iles, 1994; Lange <i>et al.</i> , 2000; Lin, 2007; Liu and Cui, 2012; Mintzbert and Waters, 1985; Nonaka and

	top down approach in the micro-firm setting	Takeuchi, 1995;Panwar <i>et al.</i> , 2016; Rauch and Frese, 2000; Scase and Goffee, 1987; Smith and Tushman, 2005; Storey and Cressy, 1996; Sveiby, 2000
Micro-firm green innovation	<p>Micro-firm's ability to respond quickly to dynamic market and regulatory changes is a valuable characteristic when pursuing green innovation.</p> <p>The NEO of the micro-firm O/M are very important and O/Ms with positive environmental attitudes are more likely to see green innovation as an opportunity</p>	Abdullah <i>et al.</i> , 2016;. Bar, 201; Dibrell <i>et al.</i> , 2015; Hansen, 2010; Klapper and Upham, 2015; Leonidou <i>et al.</i> ,2015; Menguc and Ozanne, 2005; Papagiannakis <i>et al.</i> , 2014; Phan, 2008; Powell and DiMaggio, 1991; Richards <i>et al.</i> ,2016; Sáez-Martínez <i>et al.</i> , 2016; Seebode <i>et al.</i> , 2012; Stahle and Hong, 2002; Teece and Pisano, 1994; Testa <i>et al.</i> , 2015; Wartick and Clarkson, 1985; Zahra and George, 2002
Knowledge transfer/green initiatives in micro-firms	<p>Green knowledge transfer initiatives have a positive impact on firm performance, the economy and the environment.</p> <p>A shared lens and learning culture among stakeholders has a positive impact on the successful transfer of green knowledge initiatives.</p>	Arend, 2014; Branchos <i>et al.</i> , 2007; Cheng <i>et al.</i> , 2008; Dangelico and Pontrandolfo, 2015; Droste <i>et al.</i> , 2016; Guidici, 2013;Hamid <i>et al.</i> ,2012; Kim <i>et al.</i> , 2011; Laari, 2013; Nielsen <i>et al.</i> , 2014; Noci and Verganti, 1999; Porter and Kramer, 2011; Reinl <i>et al.</i> , 2015; Stanovcic <i>et al.</i> , 2015;; Van Krogh, 1998
Green innovation capabilities in micro-firms	Resources alone are insufficient to create sustainable greening they needed to be leveraged and exploited through innovationcapabilities.	Benitez- Amado <i>et al.</i> , 2010; Cavusgil <i>et al.</i> , 2003; Davies, 2013; EPA, 2009; Eisenhardt and Martin, 2000; European Commission, 2002; Faherty and Stephens, 2014; Hillary, 2000; Hurley <i>et al.</i> , 1998; Rutherford <i>et al.</i> , 2000; Simpson <i>et al.</i> , 2004; Teece <i>et al.</i> , 1997

Building micro-firm green innovation capability development	<p>Micro-firm innovation is important for survival.</p> <p>The characteristics of the O/M play a vital role in transformational capability to facilitate innovation capability.</p> <p>Many firms feel overburdened with existing regulations and are unlikely to engage in voluntary greening activities.</p> <p>Acquired through learning or innovation.</p> <p>The continuous ability of the micro-firm to identify, assimilate and analyse knowledge is essential to building innovation capabilities.</p> <p>Micro-firm's ability to respond quickly to dynamic market and regulatory changes is a valuable characteristic when pursuing green innovation.</p> <p>O/M's characteristics play a key role in the transformation capability of the firm in developing innovation capability.</p>	<p>Andersen, 2012; Anderson and Bateman, 2000; Aragon-Correa et al., 2008; Bar, 2015; Camisón and Forés, 2011; Carrillo-Hermosilla et al., 2010; Cavusgil et al., 2003; DeWinne and Sels, 2010; DeMarchi, 2010; Beers and Gerrling-Eiff, 2013; Drucker, 1985; Fankhauser et al., 2013; Fielder and Deegan, 2007; Gabler et al., 2015; Hansen, 2010; Ignatio et al., 2016; Kaufman and Todtling, 2002; Kearney et al., 2014; Kelliher and Reinl, 2014; Ketata et al., 2015; Kim et al., 2014; Lawson and Sampson, 2001; Lundvall, 1995; Lynskey, 2004; MacMahon and Murphy, 1999; McGrath and O'Toole, 2014; Merrilees and Rundle-Thiele, 2011; Moos et al., 2015; Noci and Verganti, 1999; Ottman et al., 2006; Posch, 2010; Reinl and Kelliher, 2014; Schaefer et al., 2011; Tallman et al., 2004; Tippman et al., 2013; Von Hippel, 1998; Walsh et al., 2012; Yarahmadi and Higgins, 2012</p>
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Table 2: Micro-firm green innovation capability development themes

The ability of the micro-firm to adapt to market changes is more effective for the dynamic innovation process when there is structured interaction with other firms. Many researchers have stated the importance of structured interaction among firms for the innovation process to occur (Jensen and Schott, 2015; Kearney et al., 2014), such as in a networked environment. Hakansson and Ford (2002) found that managers employ judgment to cope with network paradoxes and that firms connect with networks if they need to bridge resource gaps. Stawasz (2015) suggests that the gap between internal innovation capability and a firm's intentions are a good reason for firms to use the resources that networks offer to pursue innovation in this way. Research has also shown that there is a positive link between network involvement and innovation and that the complexity of innovation processes acts as a stimulus for the growth in network numbers (Zeng et al., 2010). Here, the bundling, converting and aligning of resources assists with innovation and the creation of innovation capabilities. Resource and capability

limitations in the micro-firm context implies micro-firms can also source knowledge and information through network interaction. The internal innovation culture encouraged by the O/M helps stimulate tacit knowledge sharing and aids in achieving the full innovation producing capabilities in all micro-firm members. This building and sharing of tacit knowledge facilitates innovation, while the O/M's attitude plays a key role in building a positive internal innovation culture. A '*positive network effect*' with a match between strategic targets and network expectations creates a competitive network advantage (Stam *et al.*, 2014), as discussed in the following section.

Many researchers have established that there is an emergent role of networks in the pursuit of environmental innovations (De Marchi, 2010; Noci and Verganti, 1999; Posch, 2010; Schaefer *et al.*, 2011). Some reasons for these facilitated networks' proliferation have been driven by achieving appreciation from stakeholders (Ottman *et al.*, 2006); seeking a customer driven perspective; fulfilling environmental laws and regulations (Bar, 2015); seeking approval from business partners (Fielder and Deegan, 2007) and taking the opportunity to gain access to new information. Furthermore, the pooling of resources through networking helps gain competitive advantage (Carrillo-Hermosilla *et al.*, 2010), and individual firm expansion into growing green innovative markets (Yarahmadi and Higgins, 2012).

Part 3: Facilitated Network Engagement as an Innovation Resource

The purpose of this section is to explore the concept of facilitated network engagement as an innovation resource. As described in Chapter 1, a facilitated network is a “*network formally set up for the primary purpose of increasing knowledge*” (Bessant and Tsekouras, 2001, p.8), including learning, marketing functions, innovation and research and development (R&D). The function of the facilitator is to shorten the distances (cognitive, communication, functional, geographical, organisational and social) between actors in the network (Parjanen *et al.*, 2010), in pursuit of network objectives. Network capabilities have been described as the ability of a firm to manage and utilise business relationships and to capture resources (Thornton *et al.*, 2014). In the micro-firm setting, network capability is the ability of the micro-firm to orchestrate, initiate, maintain and utilise relationships to gain access to resources held by other actors in the network (Mc Grath and O’Toole, 2014; Möller and Svahn, 2003) who have complementary resources and capabilities (Gulati and Gargiulo, 1999).

Network capability takes time to develop (Parida, and Örtqvist, 2015), and can be inhibited by such things as a desire for control over decision making, a lack of knowledge sharing ability, knowledge hoarding or inhibited problem solving skills and the perception that value chain and linking resources are unnecessary (McGrath and O’Toole, 2013). The enablers of network capabilities include past experience in networks, the ability to share information and the opportunity to participate in coordinated consumer events (McGrath and O’Toole, 2013). Notably, the factors that inhibit network capabilities outweigh the enablers in a micro-firm setting (McGrath and O’Toole, 2013).

It appears that local networks are more suitable for micro-firms and also motivate them to explore new opportunities (deJong and Freel, 2010), enhancing network embeddedness over time. Thus, the value of the network consists of the content of the collaboration and the process of this interaction (O’Donnell, 2014). Liberman-Yaconi *et al.*, (2010) claim that micro-firms should engage in networks to broaden their knowledge and to move away from narrow, passive decision

making. This should result in improving the O/M's overall decision making and ultimately improve firm survival. The network communication and the behaviour or positive network effect have been found to be a greater influencing factor in creating competitive network advantage than the actual size of the network (Burrescia and Pousette-Falk, 2014). This positive network effect is dependent on a good match between strategic targets and network expectations. Proximity to the network is also found to be an important factor, however, Camagni (1991) and Kelliher *et al.*, (2014) each argue that involvement in both near and distant networks is important in order to avoid micro-firm 'lock-in' to the detriment of external relationships. It is also important to maintain a flexible interaction with a network to ensure boundaries are not created to the detriment of knowledge transfer.

Facilitated networks offer a support framework for capturing knowledge through discourse and interchange (Pikkemaat, 2008) at key stages of the development process; for reflection, for the enhancing of individual and collective competencies and to evaluate the suitability of content (Kokkonen and Tuohino, 2007). Many researchers have found that strategic intent is a key driver for joining a network (Thornton *et al.*, 2014), followed by information gathering and resource utilisation (Zaefarian *et al.*, 2011). The ability to acquire knowledge through inter-firm collaboration is also effective and efficient in pursuit of firm innovation. However, the knowledge obtained through inter-firm collaboration needs to be carefully managed in order to reap the benefits. However, from a network structure perspective achieving a beneficial position within the network is seen as crucial for exploring business opportunities (Baum *et al.*, 2013). The main reasons reported by micro-firms for not joining a network include individual characteristics of the O/M (McGrath and O'Toole, 2013), negative perceptions of sharing knowledge (Izushi, 2003) and the independent mentality of micro-firms. The assumption when joining a network is that over time the benefits will exceed the costs (Koch *et al.*, 2006), as relationships develop.

One of the vital aspects of facilitated network engagement in this study is assumed to be the encouragement and growth of green resource within the micro-firm. The benefits of network engagement include the ability to share resources,

spread risk and to gain complementary resources and these are all contributing factors for micro-firm innovation (Hanna and Walsh, 2002). However, resources alone are insufficient to create sustainable ‘greening’; specifically they need to be leveraged and exploited through capabilities in order to be effective (Eisenhardt and Martin, 2000). Thus, micro-firms need to have the capability to evaluate, select and acquire new resources and to reconfigure these capabilities in order to take advantage of the network resources (Chiayu *et al.*, 2014), and to fully absorb the benefits of the network (Kim *et al.*, 2014). Other core capabilities for networked micro-firms include; collaboration capabilities including the ability to leverage knowledge and to manage relationships (Blomqvist and Levy, 2006), communication capabilities, negotiation capabilities, conflict management capabilities and an ability to build trust.

3.6 Facilitated Network Engagement - Resource mobilisation

It is well documented that firms experience improvements in innovation when they collaborate with other firms (deJong and Marsili, 2006; Freel and Robson, 2004). Many firms have difficulty implementing innovative ideas and may need external support to transform their ideas into practice (Omerzel, 2015).

Some of the knowledge required for innovation comes from network collaboration (Purcarea *et al.*, 2013), wherein networks offer micro-firms access to resources, capabilities and markets not easily accessible for the individual firm (Carter *et al.*, 2013). Many researchers argue that facilitated networks in particular play a critical role in advancing innovations (Besser and Miller, 2010). Further, firms that engage in cooperative activities are expected to achieve higher innovation results. Therefore it is collective knowledge which creates innovation (Nonaka and Takeuchi, 1995). As such, Huggins *et al.*, (2008) posit that governments should facilitate networks to foster innovation.

The impact of network participation is emphasised as key to capability development and human capital development through mobilisation of external resources available in networks (McEvily and Marcus, 2005). By pooling their

resources micro-firms have been able to reduce the cost involved in innovation and this can in turn lead to higher performance levels (Thornton *et al.*, 2014). The inherent process of continuous cross function involvement and integrating resources internally and externally (Gubbins and Dooley, 2014) can assist O/Ms with leveraging limited resources in the micro-firm (Reinl and Kelliher, 2010). A key benefit from external engagement through facilitated networks is for information gathering where the facilitators screen the information for members (O'Donnell, 2014). By filtering information in this way, networks assist firms in cost reductions and saved time (Rusanen *et al.*, 2014). Facilitated networks also provide a platform for peer engagement (O'Donnell, 2014) and provide support and encouragement for members (Bruderl and Preisendorfer, 1998). This activity increases member motivation as well as providing endorsement for idea generation, decision making and other problem solving supports (Uzzi, 1996; O'Donnell, 2014). Another benefit of facilitated networks is the possibility for increasing customer leads and introductions to new customers which may lead to improved sales (Brown *et al.*, 1990). Facilitated networks also provide a means for gaining competitive information and new product information (Kingsley and Malecki, 2004) and this has also been achieved through customer engagement in the network (Roper and Xia, 2014), leading to innovation (Holtzman, 2014).

Often, micro-firms will only join networks by necessity or for increased sales rather than for knowledge sharing alone (McGrath and O'Toole, 2014). It has been found that networking with suppliers increases the generation of product and service innovations more than networking with customers (Tu *et al.*, 2014). However, Appiah-Adu and Singh (1998) argue that a strong customer orientation has a greater influence on the success of firms developing innovative products and services. Others find that networking with customers, suppliers and research institutes are the most significant sources of innovation for firms (Brouwer and Kleinknecht, 1996; Hyvarinen, 1990). Notably, firm development that has taken place in isolation (Doloreux and Lord-Tarte, 2013) has led to inefficiencies in the supply chain (Isaksen and Onsager, 2010). Based on the foregoing, the results achieved through network membership are greater than those achieved independently (Blommerde and Lynch, 2014).

Networks also act as an important mechanism for access to new products, new markets and innovation (Gronum *et al.*, 2012; Mottiar *et al.*, 2013; Parida *et al.*, 2016) and as a source of competitive advantage (Reinl and Kelliher, 2010; Tinsley and Lynch, 2001). Competitive network advantage is obtained by reaching a level of connection with the actors in the network that creates value for the member firms (Afuah, 2013). From a network perspective, the sharing of knowledge allows micro-firms to share the risk and increase their knowledge of innovation tools (Lin and Darnall, 2010), which in turn helps to lower transaction costs and develop external economies of scale (Erkus-Ozturk, 2009).. This can in turn improve the O/M's potential for new business development and competency development outside of the firm's individual capabilities and resource base (Gubbins and Dooley, 2014). However, the dual continuous relationship that leads to expansion of resources and sustainment of capabilities (Stahle and Hong, 2002) in networked firms require the O/M to release some of their need for independence to fully embed in the network and gain from its benefits, which can prove challenging for those who have a high need for control (Erkus-Ozturk, 2009). Difficulties may also arise where actors in the network seek short term rent at the risk of long term development of the network (Huggins, 2010).

Some researchers (Hakansson and Snehota, 2006) have stated that a firm's most important resource is its relationship with other actors in a network. However, the network itself is only a resource for the micro-firm (O'Donnell, 2014) if successfully mobilised by the O/M. The micro-firm is unable to create value just by being a member of a network; it is the O/M's positive use of resources contained in the network that creates value (O'Donnell, 2014). The O/M's need to develop specific capabilities has been stated by many researchers (Hannon *et al.*, 2000; Curran *et al.*, 1993; Blackburn, 2012). Developing specific networking capabilities helps the O/M in developing network strategy and managing uncertainties and is important for the future success of the facilitated network (Prasopoulou and Poulymenakou, 2006). The importance of specific networking capabilities emerge as they deepen the O/M's perception of other network actors' needs (Spekman *et al.*, 1998). Furthermore, firms gifted with strong capabilities tend to have a strong network position (Zaheer and Bell, 2005). Zaheer and Bell

(2005) posit that network participation also enhances internal micro-firm capabilities and therefore is an important resource for the micro-firm.

3.6.1 Impact of facilitated network engagement on green innovation capability development

A paradox exists in relation to decision making on environmental issues in that while the O/M may have an awareness regarding the green economy and may have a positive NEO, O/Ms are unable to put it into practice and implement the change (Cassells and Lewis 2011; Testa *et al.*, 2015) required to contribute fully to the green economy. Dewhurst and Thomas (2003) suggest one of the reasons for this anomaly is the O/M's feeling that it is not their responsibility to make business decisions in relation to the green economy. Instead O/Ms perceive this responsibility lies with government and regulatory bodies. However, as mentioned in the introduction, micro-firms and SMEs accounted for 70% of industrial waste and pollution (Hillary, 2000) and 64% of all industrial waste (Miller *et al.*, 2016); thus the responsibility for fulfilment of green goals partly rests with these firms. However, employing and designing effective green innovation processes is challenging (Carnes and Ireland, 2013), particularly in the resource constrained micro-firm environment. Nevertheless, some characteristics of the micro-firm are essential for green innovation to occur (Leonidou *et al.*, 2015) and facilitated networks provide an opportunity for micro-firms to join the green decision making process, in particular those that are unable to pursue the goals of the green economy in isolation (Erkus-Osturk, 2009).

From a green enterprise viewpoint, facilitated networks provide an opportunity that “*challenges and stimulates business ideas*” (Reinl and Kelliher, 2010, p.145). This is also the view of Van der Westhuizen (2016) and Rusko *et al.*, (2017) who suggest that collective innovation strategies are required for business sustainability. The 2005 World Summit outlined three pillars of sustainability – environmental, economic and social. Camarinha-Matos *et al.*, (2010) states that in order to consider these pillars as a holistic perspective of the problem, tighter collaboration with network stakeholders is required to provide a mutually beneficial synergy between network collaborators and sustainability.

Noran (2010) argues that green innovation must be driven internally and permeate all business areas in a consistent manner in order to produce cultural change within the firm and hence ensure lasting results. The function of a facilitated network from a green enterprise perspective is to assist micro-firms to move towards green technologies or green business processes (Triguero *et al.*, 2015) by providing the necessary information and additional resources for green innovation to occur (Ramus, 2002). Furthermore, involvement in networking activity is key to capturing green market opportunities and firms that do not participate in a network are put at a disadvantage when pursuing green innovation (Day and Schoemaker, 2011). This is also the view of Robinson and Stubberud (2013) who state that participating in a network can give smaller firms a competitive advantage over their larger counterparts. Given the importance of networks for innovation development in sustainable micro-firm practice, these networks would likely have significant effects on the environment (Day and Schoemaker, 2011; Robinson and Stubberud, 2013) over time.

3.7 Facilitated Innovation Networks - Literature Themes

The literature highlighted the important role facilitated networks play in the innovation process; micro-firms that engage in networks were reported to be more innovative than those that do not participate. In Table 3 the key literature themes for facilitated networks are outlined.

Theme	Description	Key authors
Facilitated Networks	Facilitated networks are an additional resource for the firm including – innovation, marketing, research and development Networks can facilitate micro-firm capability development by providing the necessary information and additional resources for green innovation to	Berraies <i>et al.</i> , 2015; Bessant and Tsekouras, 2001; Bessar and Miller, 2010; Blomqvist and Levy, 2006; Burrelscia and Pousette-Falk, 2014; Camagni, 1991; Chen <i>et al.</i> , 2015; Chiayu <i>et al.</i> , 2014; deJong and Freel, 2010; Hakansson and Ford, 2002; Huggins <i>et al.</i> , 1998; Kelliher <i>et al.</i> , 2014; Kim <i>et al.</i> , 2014; Mc Grath and O'Toole, 2014; Möller and Svahn, 2003; Nonaka and Takeuchi, 1995; O'Donnell, 2014; Omerzel, 2015; Parjanen, <i>et al.</i> , 2010; ; Parida and Örtqvist, 2015; Thornton <i>et al.</i> , 2014

	occur.	
Network engagement Resource mobilisation	<p>Facilitated networks help O/M's with leveraging resources in the micro-firm.</p> <p>Networks offer micro-firms access to resources, capabilities and markets not easily accessible for the individual firm</p> <p>A key benefit is for information gathering where the facilitators screen the information for members</p> <p>O/Ms need to develop specific networking capabilities to enhance the benefits obtained from the network.</p>	<p>Blackburn, 2012; Burke and Jarratt, 2004; Cross <i>et al.</i>, 2003; DeJong and Marsili, 2006; Ebers, 1999; Erkus-Ozturk, 2009; Freel and Robson, 2004; Gubbins and Dooley, 2014; Gulati and Gargiulo, 1999; Hakansson and Snehota, 2006; Hanna and Walsh, 2002; Hannon and Atherton, 1998; HHill and Stewart, 1999; Huggins, 2010;; Lean, 1998; Liberman-Yaconi <i>et al.</i>, 2010; Lin and Darnall, 2010; O'Donnell, 2014; Panwar <i>et al.</i>, 2016; Rauch and Frese, 2000; Sveiby, 2000; Storey and Cressy, 1996; Thornton <i>et al.</i>, 2014;</p>
Impact of network engagement on green innovation capability development	<p>Firms that do not participate in a network are put at a disadvantage when pursuing green innovation.</p> <p>Network participation enhances green innovation opportunities and the potential for competitive advantage</p>	<p>Brockington, 2012; Camarinha-Matos <i>et al.</i>, 2010; Carnes and Ireland, 2013; Cassells and Lewis, 2011; Day and Schoemaker, 2011; Dewhurst and Thomas, 2003; Erkus-Osturk, 2009; Fankhauser <i>et al.</i>, 2013; Hillary, 2000; Leonidou <i>et al.</i>, 2015; Miller <i>et al.</i>, 2016; Noran, 2010; Ramus, 2002; Reinl and Kelliher, 2010; Robinson and Stubberud, 2013; Rusko <i>et al.</i>, 2017; Testa <i>et al.</i>, 2015; Triguero <i>et al.</i>, 2015; Van der Westhuizen, 2016</p>

Table 3: Facilitated Innovation Networks – Literature Themes

When considering the themes outlined in table 4, it is important to note that micro-firms face unique resource constraints and facilitated networks aid the micro-firm in building and bundling resources and capabilities for the green economy that are not easily available within the firm. A micro-firm cannot employ all the core capabilities for innovation independently, a further catalyst for network membership. Therefore to be innovative micro-firms need to be involved in a network and to learn how to leverage the network resource within the firm. Social interaction amongst micro-firms is not only an important firm resource but also a mechanism for knowledge transfer between network members (Singh *et al.*, 1999). However, it is the O/M's use of these resources that adds value to the micro-firm rather than network engagement itself. Thus, the network

is a resource that needs to be transformed into capabilities to be of value to the micro-firm.

Micro-firm innovation has been found to be important for survival. The micro-firm's dynamic capability to respond to changes in the market quickly has been a distinctive advantage in developing green innovation capabilities; however, successful knowledge transfer between the environment and the firm need to occur for capabilities to develop. Facilitated networks play an embryonic role in building green innovation capabilities through the transfer of knowledge and the bundling of resources among network members. However, resources alone are insufficient in building capabilities. Resources need to be nurtured and exploited through green innovation capability development in interaction with network engagement. While more positive outcomes are achieved where micro-firms pursue green strategies based on values and commitment to the green economy, the drivers of green enterprise also come from customers, macro economy regulations and the potential for a financial gain.

3.8 Initial Green Innovation Capability Framework

After reviewing the literature it was clear that micro-firms played a key role in ensuring that the regulations required for the green economy are met. The dynamic capability of the O/M impact on the green innovation of the micro-firm. The facilitated network is an additional resource from which the O/M can gain utility through its green innovation capability. After developing the catalogue of key outcomes from the literature review the initial proposed green innovation capability framework was developed in Figure 2.

Within the micro-firm, employees are conceived of as human capital (Figure 2) wherein their willingness to share and obtain knowledge enables a firm to improve internal innovation culture. It is suggested that employee involvement should be supported by O/M in order to leverage this human resource. However, very often in micro-firms, the O/M 'is' the business thus knowledge transfer may be restricted in this environment if this individual does not fully embrace an innovation culture. A micro-firm's internal capabilities and resources are insufficient for innovation to occur, as innovation goes beyond the firm boundaries. Micro-firms need to move outside the firm to gather new information and transform the knowledge obtained for innovation purposes. Therefore externally-generated knowledge is a key resource as it offers the O/M the opportunity to comprehend and articulate new knowledge in interaction with network members.

A cohesive innovation outlook is central to the creation of innovation producing capabilities, amounting to a strategic resource in the micro-firm. The knowledge required for innovation is often tacit in nature, generated over a series of stakeholder interactions and can therefore be acquired internally within the micro-firm and/ or externally through facilitated network engagement. By continuously improving tacit knowledge sharing, a micro-firm's innovation capability will improve hence the perpetual spiral exhibited in figure 1. The adaptive innovation process and the continuous ability of the firm to identify, assimilate and analyse knowledge is essential to building innovation capabilities (labelled knowledge resource). Network engagement, particularly those interactions of a multi-disciplinary nature, are a vital component in accessing the resources and knowledge that micro-firms require to build green innovation capability and to create a new knowledge resource for the firm. However, merely joining a network is not sufficient to achieve enhanced capabilities; these firms also need certain network capabilities to benefit from network engagement. Networks also help to facilitate innovation capabilities by pooling/ bundling resources.

Knowledge transfer has been found to boost environmental innovation by providing a working environment conducive to creating, storing, sharing and applying knowledge. Green knowledge transfer initiatives have a positive impact

on firm performance, the economy and the environment. A shared lens and learning culture among stakeholders appears to have a positive impact on the successful transfer of green knowledge initiatives. Green innovation capabilities are strengthened and sustained through gradual positive feedback outcomes initiated through regulatory demand, O/M's environmental attitudes and values and their stakeholder demands. The more integrated green strategies are to the firm's business strategies, the more positive the outcomes. This continuous layered relationship requires a continuous communication within and between O/M micro-firm and the external environment to facilitate an adaptive innovative process and as a result become a valuable resource for continuous green innovation capability enhancement in the micro-firm.

3.9 Conclusion

This chapter looked at the unique characteristics of the micro-firm as they relate to innovation and green innovation capability development. The green economy provides many opportunities for the micro-firm. However, many micro-firms face a paradoxical challenge with respect to innovation capability development for the green economy. The literature reveals that facilitated networks are a valuable resource to micro-firms and vital for innovation, but there is a gap in the literature as to the perceived impact facilitated networks have on the green innovation capability of micro-firms.

Chapter 4:

Research Methodology

4.1 Introduction

The aim of this chapter is to consider the research philosophy and methodology that guides the reported study. The chapter examines research philosophical considerations and outlines carefully the philosophical and methodological approach adopted for this research. This chapter goes on to discuss the design of the research instruments, the sample size chosen, and the nature of the pilot survey undertaken as well as methods used to ensure research legitimisation.

4.2 Research Aim and Objectives

Research is described as a systematic investigation the nature of which is influenced by the researcher's theoretical framework (Mertens, 2005). The theoretical framework is referred to as the paradigm (Mertens, 2005) and this influences the way that knowledge is interpreted. The paradigm is described as setting down the intent, motivation and expectations of the research (MacKenzie and Knipe, 2006). By creating the paradigm to be adopted the research methodology, design and literature can be established (MacKenzie and Knipe, 2006). Thus, the paradigm orients thinking and research and guides the philosophical underpinnings and motivation for a study. This thesis presents the results from an exploratory study that contributes to the limited body of knowledge in the areas of micro-firm management and green innovation capability development.

The research aim is;

To explore the perceived impact of facilitated network engagement on green innovation capability development in the micro-firm.

The purpose of the research aim is to develop insights into people's beliefs and their lived experiences (Denscombe, 2014) in relation to the research topic. The research objectives in this study are to:

1. To undertake an analysis of perceived green innovation capability in selected Irish and Canadian micro-firms;
2. To explore the perceived impact of facilitated network engagement on the micro-firms' green innovation capability development;
3. To propose a green innovation capability framework for the micro-firm environment.

The purpose of the research objectives is to provide an indication of the goals to be achieved by the research in pursuit of the research aim.

4.3 Philosophical Perspectives

Philosophy has been described as a human and world science that represents people's viewpoints, ideologies, perspectives, and theories (Hill and McGowan, 1999). According to Burrell and Morgan (1979), all social scientists approach their research with explicit or implicit assumptions about the nature of the world and how it can be interpreted. These assumptions are based on positivist (objective) or interpretivist (subjective) approaches (Bryman and Bell, 2011). Some writers, such as Guba and Lincoln (1994) argue that questions of which paradigm to use for research are more important than questions of research methods; they posit that the paradigm identifies the basic belief system or view of the world that guides the research (Saunders *et al.*, 2007). However, both Saunders *et al.*, (2007) and Johnson and Clark (2006) agree that an important aspect in the research process is how well one can reflect and defend the chosen philosophical assumptions.

Saunders *et al.*, (2007) encourage the researcher to consider adopting a flexible approach to choosing the research approach and methods as opposed to committing rigidly to one philosophical perspective. In this research, a somewhat pragmatic approach is taken. From a pragmatic perspective, it has been argued that the most important determinant of the epistemology and ontology one adopts is the research question (Saunders *et al.*, 2007), or in this case the research aim.

Key to this process is the identification of the ontological, epistemological and human nature stance in a particular study. According to Holden and Lynch (2004) the researcher's view of ontology effects their epistemological assumption which in turn defines their view on human nature which then determines the research methodology.

Ontology	The nature of reality, how people view the world (Hill and McGowan, 1999).
Epistemology	The nature of knowledge and the nature of the relationship between researcher and subject of research (Hill and McGowan, 1999).
Human Nature	Predetermined or not.

Table 4: Summary of Philosophical Perspectives

The following sections outline the role of these assumptions when determining what way the world works and how it helps to establish the methods used to achieve research objectives. The ontology, epistemology and human nature paradigms surrounding this study are also discussed.

4.3.1 Ontology

Ontology has been referred to as what the researcher believes to be reality (Bryman and Bell, 2011). Two ontological positions are outlined as objectivism and subjectivism. Objectivism is described as a position in which social entities and their meanings are independent of social factors (Bryman, 2001), whereas subjectivism is defined as a social reality wherein social structures as well as

individuals are interconnected (Saunders *et al.*, 2007). Therefore, interaction between social actors and social entities is implied. Both objectivism and subjectivism are simplified versions of social structures and reality, which are rarely observed in their purest nature in practice (Martinez-Covarrubias, 2012) and both offer valuable insights into the research subject.

In social science, a subjectivist viewpoint is not normally used to look for external causes and regulations to explain behaviour; instead the researcher focuses on an understanding of the different meanings that people attribute to their experiences (Collis and Hussey, 2013). Subjectivists argue that the involvement of the researcher should be actively encouraged (Holden and Lynch, 2004) and their objective is to comprehend and clarify a problem in a contextual situation and the meanings individuals attach to circumstances (Easterby-Smith *et al.*, 1991).

It has been identified in the literature review (Chapter 3: Micro-firm Management Capabilities) that networks have an impact on firms and networks are important to micro-firms, in particular since they can enhance their resource base and act as an additional resource in the micro-firm. Part of the researcher's role in answering the research aim is to seek to understand the subjective reality of the O/M's context in order to be able to make sense of and understand their motives, actions and intentions in their engagement with networks and the micro-firm. As noted in Chapter 3, Section 3.1.2, the O/M had a direct impact on the micro-firm culture and on green innovation capability development in the micro-firm.

There is a distinct difference between the objectivist and subjectivist view of organisational culture. The objectivist view of culture is that culture is something the firm 'has', as opposed to the subjectivist view that the culture of the firm is something that the firm 'is' and evolves from social interaction (Smircich, 1983). Based on the literature review (Chapter 3), the subjectivist view emulates the micro-firm's limited resources and specific dynamic capabilities driven by an owner-led organisational culture which is responsive to change. In order to understand the micro-firm's resources and dynamic capabilities enablers it is important to understand the meanings attached to social phenomena of social

actors, including those mentioned in Chapter 3, Section 3.1.2; specifically, the O/M's style, views, beliefs and capability.

Having explored the ontological options, this study argues that the subjectivist approach is the one best suited to examining the perceived impact of facilitated networks on green innovation capability development in micro-firms. The subjectivist view in this study looks at the development of green innovation capabilities through the social interaction between micro-firm O/Ms and their facilitated networks. This approach views reality as being socially constructed (Saunders *et al.*, 2007), emulating the reality of the social actors in this study. For example, the O/M may place many different interpretations on the impact of the facilitated network on green innovation capability development. Therefore, the O/Ms studied in this research not only interact with their own environment as seen in the initial innovation capability framework (Figure 2, Chapter 3), but they also seek to make sense of this interaction through their interpretation of network engagement and the meanings that they draw from these interactions. Considering the research aim and objectives the ontological stance in this research is subjectivist. The following section considers the epistemological stance in this study.

4.3.2 Epistemology

Epistemology is the nature of knowledge the researcher holds about the world and the process through which that knowledge is developed (Bryman and Bell, 2011). It is related to the rationality and limits of the knowledge (Bryman, 2001) and asks the question “what it means to know?” (Scotland, 2012, p.9). In addition, as explained in Section 4.3.3 below, human nature looks at the relationship between the individual and the social environment. These assumptions have been grounded on positivist (objective) or interpretivist (subjective) approaches (Bryman and Bell, 2011).

4.3.2.1 Positivism paradigm

Positivists assume that the researcher is independent from the research and that the social world is studied according to the same principles as the natural sciences (Bryman, 2001; Saunders *et al.*, 2007). Positivism has often been referred to as scientific and reflecting a deterministic philosophy where causes determine outcomes (Creswell, 2009). Positivists aim to test a theory or describe an experience through measurement and observation in order to control and predict forces (O’Leary, 2004). The positivist view is rooted in empiricism - the idea that observation and measurement are the principals of the scientific undertaking. Positivist research commonly applies quantitative research methods of data analysis and collection, although this is not a requisite of this paradigm. Table 5 outlined the strengths and weaknesses of the positivist viewpoint.

Strengths
<ul style="list-style-type: none"> · Provides precise, quantitative, numerical data. · Useful for obtaining data that allow quantitative predictions to be made. · Testing hypotheses that are constructed before the data are collected. Can generalise research findings when the data are based on random samples of sufficient size. · The researcher may construct a situation that eliminates the confounding influence of many variables, allowing one to more credibly assess cause-and-effect relationships. · Data collection using some quantitative methods is relatively quick (e.g., telephone interviews). · Data analysis is relatively less time consuming (using statistical software). · The research results are relatively independent of the researcher (e.g., effect size, statistical significance). · It is useful for studying large numbers of people.
Weaknesses
<ul style="list-style-type: none"> · Knowledge produced may be too abstract and general for direct application to specific local situations, contexts, and individuals. · The researcher may miss out on phenomena occurring because of the focus on theory or hypothesis testing rather than on theory or hypothesis generation (called the confirmation bias). · The researcher’s theories that are used may not reflect local constituencies’ understandings.

Source: Johnson and Onwuegbuzie, (2004)

Table 5: Strengths and Weaknesses of positivist research

As shown in Table 5 the positivistic approach perceives sociology as a science that follows scientific procedures, has a testable research objective and produces evidence to prove or disprove a hypothesis. As discussed above, positivism, which emphasises an objectivist approach to studying social phenomena, uses

research methods that focus on quantitative analysis including surveys and experiments. Critics of positivist research claim that it is inadequate to fully explore social science in this way as it is artificial in nature. Proponents of this view believe that humans by nature are subjective and therefore research studying their actions and interactions should also pursue a subjective stance to capture the totality of the human experience. This gives rise to the interpretivist/constructivist paradigm.

4.3.2.2 *Interpretivist/ constructivist paradigm*

The view under this paradigm is that reality is socially constructed (Mertens, 2005) and that the interpretivist/ constructivist paradigm has the intention of understanding the world of human experience. This approach relies on the participant's view of a situation (Creswell, 2009) and appreciates that the researcher's background and experiences may influence the research. The constructivist researcher relies mainly on qualitative data collection, although this is not a requisite of this paradigm. Table 6 outlined the strengths and weaknesses of the interpretivist's view.

Strengths
<ul style="list-style-type: none"> · The data are based on the participants' own categories of meaning. · It is useful for studying a limited number of cases in depth. · It is useful for describing complex phenomena. · Provides individual case information. · Can conduct cross-case comparisons and analysis. · Provides understanding and description of people's personal experiences of phenomena (insider's viewpoint). · The researcher identifies contextual and setting factors as they relate to the phenomenon of interest. · Can determine how participants interpret "constructs". · Data are usually collected in naturalistic settings in qualitative research. · Qualitative approaches are responsive to local situations and conditions. · Qualitative data in the words and categories of participants lend themselves to exploring how and why phenomena occur.
Weaknesses
<ul style="list-style-type: none"> · Knowledge produced may not generalise to other people or other settings (i.e., findings may be unique to the relatively few people included in the research study). · It is difficult to make quantitative predictions. · It is more difficult to test hypotheses and theories. · It generally takes more time to collect the data when compared to quantitative research. · Data analysis is often time consuming. · The results are more easily influenced by the researcher's personal biases and idiosyncrasies.

Source: Johnson and Onwuegbuzie, (2004)

Table 6: Strengths and Weaknesses of Interpretivist research

As seen in Table 6 interpretivism focuses on a subjectivist approach to studying social phenomena. It uses research techniques involving qualitative analysis, including personal interviews, participant observations and focus groups.

As discussed in Section 4.3.1 the ontological stance in this research is subjectivist and the epistemological position is interpretivist. The justification for using this interpretivist approach is that it is useful for studying a limited number of cases in depth, as seen in Table 6. It assists with extracting the O/M's personal experiences which would not have been possible using the positivist approach. The interpretivist approach is also more responsive to the micro-firm's local situations and conditions and this approach is more conducive to working with micro-firms and O/Ms, as not only are micro-firms complex they are also unique (Saunders *et al.*, 2007). This approach helps answer the research aim (Burrell and Morgan, 1979).

The positivist paradigm is unsuitable in this instance as the knowledge produced may be too abstract and general for direct application to specific local situations, contexts, and individuals as outlined in Table 5. The application of the interpretive lens in micro-firm research in prior studies has shown that interaction between network members creates value by leveraging resources, enhancing capabilities and encouraging innovation (Dyer and Singh, 1998; Sundbo *et al.*, 2007). The justification for including the interpretive lens in this research study is that it provides the potential to capture richer data. The terminology used in the research aim and objectives— resource, capability, green innovation, the perceived impact of facilitated network engagement, capability development need to be discussed with O/Ms and their views and beliefs on the subjects discovered. For this study the interpretive lens is the optimum means of extracting the in depth information required to explore the nature of how participants interpret these constructs and to get an insider's view of the complex phenomena under study. Having identified the epistemological perspective the following section explores the concept of human nature.

4.3.3 Human Nature

Human nature is concerned with the relationship between the individual and the social environment (Matthews, 2009). Assumptions made about human nature inform the philosophical foundations of the research and the research design (Morgan and Smirich, 1980). Burrell and Morgan (1979) suggest that it is the difference between viewing humans as the controller and viewing humans as the controlled. The positivist/ determinists believe that humans are influenced by the nature of the environment where they are located. In contrast, subjectivists/ voluntarists maintain a voluntarist view that humans react to their environments and are therefore independent (Burrell and Morgan, 1979). Some researchers contend that human nature is both deterministic and voluntaristic, in that humans are born into an already organised society, yet societal arrangements develop and evolve through human collaboration (Holden and Lynch, 2004; Matthews, 2009). The conclusions from the literature review propose that networks are an important resource for micro-firms and facilitate the mobilisation of resources for innovation capability development. However, the perceived impact of networks and the value of the network as a resource seem to depend on the micro-firm culture and the characteristics and natural environmental orientation (NEO) of the O/M. The O/M's characteristics determine the perceived value gleaned from network engagement and interaction with other network actors. In turn, the network facilitator determines the information flow, enhancing the benefits of the network through leveraging resources and enhancing micro-firm green capabilities.

4.4 Classification and purpose of Inquiry

Before discussing the research methods adopted in this study it is valuable to consider the classification and purpose of enquiry. Robson (2002) divides the classification of purpose of enquiry into three areas – explorative, descriptive and explanatory. These are outlined below in Table 7.

Purpose of Study	Explanation of Purpose
Exploratory	<ul style="list-style-type: none"> • To find out what is happening • To seek new insights • To ask questions • To assess phenomena in a new light • To generate ideas and hypotheses for future research • Almost exclusively of flexible design
Descriptive	<ul style="list-style-type: none"> • To portray an accurate profile of persons, events, situations • Requires extensive previous knowledge of the situation
Explanatory	<ul style="list-style-type: none"> • Seeks an explanation of a situation or problem • To explain patterns relating to the phenomena being researched • To identify relationships between aspects of the phenomenon • May be of flexible and /or fixed design

Source: Robson (2002)

Table 7: Classification of Purpose of Enquiry

According to Fouche (2002), exploratory research is conducted to gain insight into a situation, phenomenon, community or individual. It seeks an explanation for a situation or problem or patterns relating to the phenomena and often utilises a creative, open, flexible approach to research, thereby aiming to find new insights into a particular area of enquiry. The current research is exploratory in nature and therefore seeks to establish causal relationships between variables (Saunders *et al.*, 2007) to try and explain the patterns associated with the phenomenon. The following section looks at qualitative and quantitative research methods to identify which would be most suitable in this study in pursuit of the research aim.

4.5 Qualitative and Quantitative Research

Research methodology is defined as a way of systematically solving the research problem (Kothari, 2004) and the nature of the research aim and objectives guide many of the research choices (Partington, 2003). Additionally, Gill and Johnson (2010) state that the research method is also determined by the philosophical assumptions underpinning the researcher's worldview. The choice of predominantly qualitative or quantitative research design is a matter of which is more appropriate to answer the research aim and objectives. The following table (Table 8) summarises the main differences between the two methods.

Quantitative approach	Qualitative approach
Measure objective facts	Construct social reality
Focus on variables	Focus on interactive process/ events
Reliability is the key	Authenticity is the key
Value free	Values present and explicit
Theory and data separate	Theory and data are fused
Independent of context	Situational constraints
Many cases/ subjects	Few cases/ subjects
Statistical analysis	Thematic analysis
Researcher is detached	Researcher is involved

Source: Neumann (2006, p. 13)

Table 8: Quantitative and Qualitative research

Quantitative research, also referred to as positivism is a scientific approach to developing knowledge, strategies and methods and interpreting results, takes an objective view of the world. Advantages of this approach include its ease of analysis and meticulous presentation of primarily numerical results. Critics of this approach claim that it oversimplifies the intricacy of real world experiences, and that it is not effective in studying multifaceted human behaviour as it is unable to capture the viewpoint of participants in their social and institutional context. The three primary types of quantitative research are; experiments, quasi-experiments and surveys, each of which are objective in nature, aim to be more conclusive and pertain to larger populations. Within this study's context, micro-firms are a diverse group and making generalisations through quantitative research is of limited value (Devine, 2012). Thus, quantitative research methods are not suitable for this study which seeks to understand particular behaviour in depth (Yin, 2009).

Qualitative research is defined as the studied application and compilation of a diversity of empirical resources (including personal experience, observation, case study, visual text, and interview) that are habitual in nature and amount to challenging moments and meanings in individual lives (Denzin and Lincoln, 1994). Qualitative research is based on the ontological assumption that reality is beyond the control of the researcher, and that the researcher may attempt to reconstruct the reality that has been observed . Myers (2000) indicates that qualitative studies are the tools used in understanding and defining the world of

human understanding (Myers, 2000). Thus, qualitative research methods are designed to help researchers understand people and the cultural and social contexts that they operate in. Smith and Stewart (2001) state that qualitative research seeks to answer the research question “what’s going on here?” while Ansbro (2009) postulate that qualitative studies are concerned with answering “What is X and how does X vary in different circumstances, and why this is?” Curran and Blackburn (2001) suggest that qualitative approaches are more suited to smaller firm research as it provides a richer understanding of the micro-firm environment (Devine, 2012; Hill and McGowan, 1999; Myers, 2000; Partington, 2002).

A criticism of qualitative research is the value of the relatively small sample sizes normally used in these studies, which are believed to be insufficient for generalising conclusions (Yin, 2009). Qualitative studies are also criticised for their lack of objectivity. Some researchers, however, state that the knowledge generated by qualitative research is significant in its own right and in providing complete and accurate information, providing the participants have an expertise about the research area (Guest *et al.*, 2006). Myers (2000) maintains that an advantage of qualitative research is the depth of understanding that can be achieved. Furthermore, since human actions are based upon beliefs, values, principles, and ideals (Hammersley and Atkinson, 1995), the study of micro-firms cannot be approached from an independent observer standpoint. It is necessary to be near the objects under study in order to explore their views and experiences and better evaluate their inner judgement and understand their subjective view of reality (Shaw and Conway, 2000). On reflection, the qualitative research approach is deemed the most appropriate method for studying micro-firms as it facilitates deeper analysis of submerged themes i.e. O/M characteristics, networking and social interaction and capability development. This depth of analysis would not be possible with quantitative methods (Gibb, 1997; Shaw and Conway, 2000).

4.6 Research Method Selection

Having identified the philosophical approach to the study, considered the overriding ontological perspective, contemplated the epistemological approach in the context of micro-firm green innovation capability development, and presented the principles of quantitative and qualitative research, the potential qualitative research methods can now be considered. Research methodology is the researcher's toolkit to investigate the phenomena (Holden and Lynch, 2004) and therefore warrants careful contemplation. The effectiveness of the selected research method depends mainly on the nature of the research and Chenail (2011) recommends using pragmatic curiosity in choosing the research method – keeping it clear, simple and coherent, as is the goal in this study. When contemplating the selection of an appropriate methodology from a subjectivist standpoint, specific criteria should be considered in light of the subjective paradigm (Table 9).

Criteria	Explanation	Outcome
Independence	The observer interacts with subject being observed	Interaction
Value Freedom	Bias as researchers are driven by own beliefs, interests, skills and values	Value laden
Causality	Aim is to try and understand what is happening	No cause and effect
Hypothetico deductive	Develop ideas from evidence; mutual simultaneous shaping of factors	No Hypothetico deductive reasoning
Operationalisation	Qualitative methods, small samples investigated in depth over time; emerging design; categories identified during research process	Operationalisation
Reductionism	Problems as a whole are better understood if totality of situation is looked	No reductionism
Generalisation	Everything is contextual, patterns identified, theories then developed for understanding	Generalisation
Research Language	Informal; evolving decisions; personal voice, use of accepted qualitative words	Research language

(Adapted from Easterby-Smith et al., 1991; Hussey and Hussey, 1997; Creswell, 1994 in Holden and Lynch, 2004)

Table 9: Summary Table: Choosing the appropriate methodology from a subjectivist perspective

Table 9 summarises the criteria for choosing the appropriate methodology from a subjectivist perspective. When contemplating these criteria, Berglund (2007) suggests that researchers should be flexible when collecting data in order to

capture the richness intrinsic in the experiences of participants, but at the same time to consider the most appropriate approach based on the research aim and objectives. Hakim (2000) suggests that the researcher should be guided by their own preferred style, although Saunders *et al.*, (2007) warn that this should not lead to a change of research aim and recommend that the chosen method should be guided by the research objectives, the extent of existing knowledge, the amount of time and other resources available, as well as the philosophical underpinnings. Hill and McGowan (1999) agree with this view from a small firm research standpoint and suggest that no research method is wholly suitable on its own. In light of the above debate, Berglund (2007) suggests that the right research method is the one that ‘fits’ the knowledge interest of the researcher and the phenomenon being explored.

Taking cognisance of insights from the literature review, it is evident that this study requires closeness between the researcher and the O/M. Pursuit of the research aim also requires that a range of experiences, attitudes, opinions and preferences of the O/M are captured. As discussed in Section 3.2.4, the O/M beliefs influence the micro-firm’s green perspective. In general, there has been very little change since Hillary (2000) studied firms and the green economy; the supports are still insufficient despite Hillary’s findings and there is a lack of awareness among some firms of the procedures and requirements relating to green regulation. As argued by Bibbee (2012) innovation is very difficult to measure because of the intangibility of its output. Additionally access to the micro-firm can be problematic (Down, 1999; Curran and Blackburn, 2001; Reinl, 2011) due to resource constraints such as time and a lack of internal capabilities. An interpretive understanding of the perceived impact of facilitated networks on green innovation capability in the micro-firm can help to uncover and analyse the meaning of the phenomenon and in doing so, pursue the research aim. Table 10 outlines the qualitative research methods applied by various researchers studying in this field.

Purpose of the research	Research method	Researcher (authors)
Micro-firm innovation and capability development (including the resource based [RBV] lens)	Qualitative; Case study approach	Andersson and Loof, 2012; Faherty and Stephens, 2014; Kearney <i>et al.</i> , 2014; Kearney, 2015; Kelliher and Reinl, 2009; O'Dwyer and Ryan, 2000; Reinl, 2011; Smith, 1999; Yaconi <i>et al.</i> , 2010
Innovation capability development through network engagement	Semi-structured interviews; Case study approach	Beers and Gerrling-Eiff, 2013; Koch <i>et al.</i> , 2006; Konsti-Laakso <i>et al.</i> , 2012
Facilitated networks and network capability	Case study approach	Giuliani, 2013; McGrath and O'Toole, 2013; Schepis <i>et al.</i> , 2014
Motivations towards environmental management, innovation and collaboration (including the RBV lens)	Qualitative	Yarahmadi and Higgins, 2012
Green innovation and green economy	Qualitative	Fankhauser <i>et al.</i> , 2013
Drivers of the green economy and the effect of networking on engagement	Case study	Gouvea <i>et al.</i> , 2013
Green innovation, networks and SMEs	Case study, interviews, observatory research	Halila, 2007; Kelliher and Reinl, 2014
Cross country study	Interpretive case study approach	Fink and Disterer, 2006; Terziovski, 2007

Table 10: Variety of methods used by various researchers

Given the variety of qualitative methods used by various researchers in Table 10 when studying resource, capabilities, innovation, green innovation and network engagement in the micro-firm environment, it is worth contemplating these methods further in the pursuit of an optimum research approach. Thus, while Hill and McGowan (1999) suggest that the best qualitative methods for researching small firms are case-study, observation, documentation and interviews, there were other qualitative research approaches – action research, ethnography, grounded theory and their potential use in this study are also evaluated in the following sections.

4.6.1 Action Research

Action research (AR) is defined as an approach used in management research where the researcher works with a firm over a matter which is of concern to them

and the intent of the firm is to take action based on the intervention (Partington, 2002). Thus, AR is about change and improvement as it provides a wealth of understanding (Reason and Rowan, 1981) about a particular problem or situation. It generally needs a significant amount of time and full contact to case sites during the study for the effects of the change to be fully observed. Due to time constraints of single-researcher study and the nature and size of micro-firms, full contact over long periods of time would have been very difficult to obtain and achieve in the current study. Furthermore, the study itself is not concerned with a particular problem. As such, AR is deemed inappropriate in this instance.

4.6.2 Ethnography

Some researchers (Creswell, 1994; Saunders *et al.*, 2009), define ethnography as interpreting the social world from the perspective of the research subject. It involves spending long periods observing people (Saunders *et al.*, 2007), coupled with talking to them about what they are doing, thinking and saying. It is designed to see how individuals understood their world (Delamont 2006). Ethnographic research seeks to obtain a holistic picture of the subjects studied by observing their everyday experiences in context (Creswell, 2009) and thus requires full access to the social actors (Saunders *et al.*, 2007) under observation. Neither the timeframe nor the research aim and objectives affiliate to this study allow for or require extensive observation in micro-firms. However, some ethnographic techniques, such as non-participant observation, are adopted into the current research design.

4.6.3 Grounded Theory

Grounded theory is used to study patterns and processes in human interactions and to understand how a group of people define their reality via their social interactions such as gestures, words, clothing (Moriarty, 2011) with the aim of building and developing theory. Grounded theory uses inductive reasoning and derives theories based on the data, an approach that is different to other models of research where the researcher chooses from existing theoretical frameworks and

then collects data to show how the theory does or does not apply to the phenomenon under study. In grounded theory, the world is viewed from multiple individual perspectives, without particular influence from the literature. For the purpose of this study grounded theory is deemed to be unsuitable as the development of a new theory is not pursued, given the RBV/ dynamic capability theory baseline. It is also at odds with the literature-informed research aim and the perspective that the O/M's own interpretations will facilitate the study (Moriarty 2011).

4.6.4 Case Study

In this study a case study is defined “*as an empirical inquiry that investigates a contemporary phenomenon within its real-life context, when the boundaries between phenomenon and context are not clearly evident, and in which multiple sources of evidence are used*” (Yin, 2009, p.18) while allowing researchers to retain the “*holistic and meaningful characteristics of real-life*” events (Yin, 2009, p.4). From an interpretive perspective, case studies are described as the study of individuals/places/structures in their natural setting, attempting to make sense of, or to interpret phenomena in terms of the meanings people bring to them (Denzin and Lincoln, 2011), such as the pursuit of O/M perspectives on green innovation capabilities in the current study. Hardie (2011) points out that case studies are “intensive”, in that they comprise more detail, richness, and completeness than other methods, which makes it beneficial in this study.

As detailed in Table 10, the case study approach has been used in previous studies that focus on micro-firms, micro-firm processes (Burke and Jarratt 2004; McCarthy 2003), sustainability (Collins *et al.*, 2007), innovation and small firms (Choudrie and Culkin, 2013), resource and capabilities in micro-firms (Hermel and Khayat, 2011) and networks (Anderson *et al.*, 1994; Morrison *et al.*, 2003). The method has also been used in innovation management (Ansbro, 2009) as it provided a rich source of data (Cross *et al.*, 2003; Fink and Disterer, 2006). It allows the examination of context and the setting of a situation (O’Leary 2004) and processes and outcomes (O’Leary 2004). For this reason, case studies are

designated as the methodology most appropriate to the exploration of green innovation capability development in the micro-firm and to produce useful results within the estimated timeframe of this study.

Of note is that while case studies can be carried out as either a single case or multiple cases (Yin, 2009), a key advantage of multiple cases has been found to be the opportunity to obtain different perspectives from different cases. Multi-case studies have been used by a number of researchers in the area of micro-firms in the past (for example: Aylward, 2012) offering credence to this approach. A cross-country approach allows for data analysis within each setting, and across settings, as well as the opportunity to identify similarities and differences between cases (Eisenhardt, 1989; Yin, 2009). This approach also offers the potential for new insights into whether cultural/ regulatory differences impact upon experiences and outcomes of green innovation capability development within the studied micro-firms.

Based on the preceding justification and in light of the research aim, a cross-country multiple case interpretive method is applied in this study. Under the case method, various research techniques are available, specifically, semi-structured interviews, observation, documentary reviews and the researcher's reflections which will be discussed in further detail below.

4.6.5 Reflective Diary

The use of the reflective diary is a useful resource for numerous reasons including - reflecting on the research process, thesis writing, research progress and idea generation (Alvesson and Sköldbberg, 2000). The reflective diary is also used as an aide memoir when constructing the interview guide setting out the goals and objectives, enabling and constraining factors, actions taken, identifying the future direction and feelings in retrospect.

4.6.6 Semi-structured interviews

Semi-structured interviews consist of several key questions that help to define the areas to be explored, but also allows the interviewer or interviewee to expand on the topic in order to pursue an idea or response in more detail. Semi-structured interviews are effective in researching micro-firms (Curran and Blackburn, 1994) as they encourage free and open answers (Johnson, 2002) and capture respondents' insights and viewpoints. Semi-structured interviews consist of several key questions that help to define the areas to be explored, but also allows the interviewer or interviewee to expand on the topic in order to pursue an idea or response in more detail. Such interviews are most effective where understanding and trust are achieved through application of the language and vocabulary of the respondent rather than of the researcher, as is the goal in this interpretive study. During the semi-structured interview it is advised not to interrupt the interviewee and to use appropriate body language to engage with the respondents. Nunkoosing (2005) suggests that the power of the interviewer rests on the ability to seek knowledge and the ability to be a privileged knower rather than an interrogator. Talking connects the external world of events to the inner world of thoughts and emotions (Nunkoosing, 2005) and in doing so, enhances the interview data.

The interview template is an instrument that can be used to ensure that none of the important issues to be discussed are left out of the conversation. The challenges of having an interview template include the need to rigidly stick to order and sequence of questions and therefore lose the flow of conversation. These challenges can be overcome by being very familiar with questions and themes and taking freedom to change the way questions were worded and the sequence of questions based on the interview flow (Yin 2009). In this study the interview template was guided by the literature themes and the initial conceptual framework was used as a boundary device. The interviews started with the O/M because they are the primary instigators of green innovation within the micro-firm. The network facilitators in each case were then interviewed, to gain their perspective on micro-firm network engagement.

4.6.7 Observation

Facilitating the observation of ongoing behaviour within the micro-firm and in interaction with the micro-firm's networks, observatory research provides a rich source of data for small business practice and theory development (Cross *et al.*, 2003; Hill *et al.*, 2002), as well as in the study of small firm dynamic capabilities and innovation (Mezger, 2014). This approach provides for in-depth analysis (Mezger, 2014; Yin, 1994) and helps to identify influencing factors (Papagiannakis *et al.*, 2014) that may not be fully articulated when interviewing O/Ms. It is regarded as a highly empirical method of data gathering (Gummesson, 2003). The guidelines recommended by Hassett and Paavilainen-Mantymäki (2013) for case study observation are utilised in this study (Table 11).

1.	Collect basic data
2.	Understanding the context of the investigate firms
	a. Collect basic environment data
	b. Collect basic data on the firm
3.	Inferring patterns of actions in strategy formation
	a. Integrating behaviour on patterns of actions
	b. Identifying periods of change and continuity
	c. Labelling the strategies
4.	Analysis of the junctures
	a. What can we learn from this case?

Table 11: Guidelines for undertaking observatory research

In this study, non-participatory observation of micro-firm O/M business and network activities offer a fuller picture of the context (micro-firm perceived capability development through network engagement) and phenomenon (green innovation) under study. Each case commenced with an on-site review where the researcher observed the O/M engaging in the day-to-day running of the business prior to the initial interview. The observations followed the flow of events, documenting behaviour, and interaction without intrusion (Adler and Adler 1994). The researcher avoided eye contact and stood/ sat away from the observed in an attempt to 'become part of the furniture' but the researcher also walked around to get a general overview of the case setting and environs. Short notes were taken while observing and after observation the findings were documented and interpreted. This non-participatory observation approach was repeated in subsequent visits to the micro-firm and in cases where the researcher had the opportunity to observe the O/M in their network environment.

4.6.8 Justification for the chosen research method

In considering the above in addition to the research aim and the application of the research objectives an interpretive case study method was deemed to be most relevant for this research. A summary of the research techniques employed to achieve the research objectives is outlined in Table 12.

Research Objective	Data collection techniques
1. To undertake an analysis of perceived green innovation capability in selected Irish and Canadian micro-firms	Semi-structured interviews, documentary review, researcher reflections, green audit.
2. To explore the perceived impact of facilitated network engagement on the micro-firms' green innovation capability development	Observations, Semi-structured interviews, documentary review, researcher reflections
3. To propose a green innovation capability framework for the micro-firm environment	Literature-led conceptual framework; refined post-research findings

Table 12: Outline of objective and method employed

The research will start with the O/M because they are the primary instigators of green innovation within the micro-firm. Each case will commence with an on-site review where the researcher will observe the O/M engaging in the day-to-day running of the business prior to the initial interview. Observations will follow the flow of events, documenting behaviour, and interaction without intrusion (Adler and Adler 1994). The researcher will avoid eye contact and sit/ stand away from the observed in an attempt to 'become part of the furniture' and will also walk around to get a general overview of the case setting and environs. Short notes will be taken while observing and after observation the findings will be documented and interpreted. This non-participatory observation approach will be repeated in subsequent visits to the micro-firm and in cases where the researcher has the opportunity to observe the O/M in their network environment.

To identify green innovation capability that may already exist in the micro-firm, a green audit is used as an aspect of the interpretive interview process. Incorporating the audit into the interview process also helps to clarify questions, constructs and terminology as they appear in the interview template. It is anticipated that this approach will assist in further discussion around the topics of

the interview and in comprehending the micro-firm's green skills and green innovation capability development. Internal green innovation triggers will be considered during the initial O/M interview, supported by the green audit as a trigger mechanism for discussion around attitude, background, resource and NEO perspective of the O/M. Conversations around external triggers encompassed green awareness, regulation, market/ customer needs and demands and access to resource, which lead to discussions relating to facilitated network engagement as an external trigger to green innovation capability will follow. Internal documents referred to in the interview will be requested for review by the researcher, if made available by the micro-firm. Using non-participatory observation and semi-structured interviews in this way will provide a more detailed portrait of O/Ms in their natural setting and facilitate the in depth exploration of the situation (Devine, 2012).

Over time, the researcher will build a case profile of each micro-firm, and then confirm which networks they engage with under the auspices of green innovation. The researcher will then interview these network facilitators to gain their perspective on micro-firm network engagement. Networks have been referred to as an additional resource for the micro-firm in a move toward green technologies, green business processes and the uptake of green practices (Collins et al., 2007; Reinl and Kelliher, 2015). The network facilitator plays a key role in building trust and facilitating the sharing of resources (Besser and Miller, 2010) as well as knowledge creation and dissemination of information (Collins et al., 2007), hence this individual's perspective will be sought in addition to the micro-firm input in this study. By capturing insight from multiple sources (Yin, 2009), the researcher seeks to understand where knowledge is kept and how it is circulated within the network, and how innovation capabilities are developed and whether they are transferred back to the micro-firm. Internal documents referred to in the facilitator interviews will be requested for review by the researcher.

4.6.9 Research Objective 1: To undertake an analysis of perceived green innovation capability in selected Irish and Canadian micro-firms

Semi-structured interviews are used to gather focused, qualitative textual data from participating O/Ms as guided by the literary-informed interview template (appendix A) in interaction with the green audit. This green audit incorporates literary-informed green awareness triggers and details of the capabilities associated with green innovation (see appendix B) will be administered at the initial O/M interview. Responses to the audit will seek to gain insight into the O/M's awareness of, and attitude towards green initiatives and act as a trigger to the conversation affiliate to green innovation capability development. It may also assist in clarifying where to focus the O/M efforts in order to maximise green innovation success in the future. In this study, the green audit assesses the following skills;

- Energy management skills
- Environmental management skills
- General factors
- Personal and technical skills
- Professional skills
- Waste management skills

The ethos behind the audit is to assess the current level of green skills and knowledge in participant micro-firms in the context of the green economy. The audit enables the articulation of the green skills gap on the part of the O/M and assists in establishing which resources, additional skills and capabilities micro-firms identify as being required in order to meet the challenges of and to take advantage of the opportunities affiliate to the green economy.

4.6.10 Research Objective 2: To explore the perceived impact of facilitated network engagement on the micro-firms' green innovation capability development

To achieve this objective, the researcher uses an interpretive case study approach in micro-firms in both jurisdictions (Ireland and Canada), combining interview data from multiple sources with non-participatory observation, documentary review and researcher reflections. Semi-structured interviews with network

facilitators will be used as an ‘additional source of evidence’ (Yin, 2009) to enhance the researcher’s understanding of the context and phenomenon under study. Non-partipatory observation of the O/M in their business and network interactions helps to further clarify the context, focusing on what is done as well as said in these environments.

4.6.11 Research Objective 3: To propose a green innovation capability framework for the micro-firm environment

A literature review precedes the interpretive case study in each country in order to develop a literature-informed initial innovation capability framework (Chapter 3, Figure 2). This method is recommended by Leavy (1994) who advocates developing a literature-informed conceptual framework as a first major step in a research study. This initial framework is then used as the boundary of the research (Miles and Huberman, 1994), guiding data collection. It will then be refined based on the findings as new information became available. Equally, the framework building process advocates what further questions need to be asked in interviews in order to successfully pursue the research aim and objectives.

The following section outlines the research design, incorporating the audit trail process used in this study in pursuit of research trustworthiness (Lincoln and Guba, 1985).

4.7 Research Design

Research design is the logical sequence that connects the generated empirical data to the initial research objectives of the study and ultimately to its conclusions (Yin, 2009). Within the research design, the audit trail documents the stages of the research study and reflects the key research methodological decisions. Carcary (2009) maintains that the audit trail also encourages self-questioning and reflection; it allows the researcher to develop more in-depth research notes and explain the research decision which increases transparency and confirmability (Lincoln and Guba, 1985). Using the audit trail ethos, the research protocol

(Table 13) outlines a clear schedule of activities and timelines (Appendix C), articulating the themes to explore in each case and the subsequent data collection management and analysis plans (Yin, 2009).

Activity	Description	Timing
Research Aim	To explore the perceived impact of facilitated network engagement on green innovation capability development in the micro-firm.	
Literature Review	On-going process, initial draft completed culminating in initial framework prior to case study and reviewed upon completion of research.	Oct 14- Feb 15 concluding in initial framework. May 2017
Method	Interpretive case study <ul style="list-style-type: none"> • Observation – sporadic on-site observation • Semi-structure interviews with O/Ms & Network facilitators (Interview guides and consent forms - Appendix E and Appendix F). • Green audit completed onsite with each O/M. 	Mar 15- April 16 Continuous improvement and refinement throughout process after pilot interview and each case if necessary.
Case selection process	Purposeful non-random sampling approach, based on pre-determined criteria for case selection; micro-firm of less than 10 employees, multi-sector representation, located in Canada or Ireland. Engaged network facilitators sought subsequent to initial O/M meetings.	
Case access	Identify cases through known contacts Negotiate access	May 2015– April 2016
Research instrument	Researcher	
Boundary device	Initial framework (Miles and Huberman, 1994)	
Research technique	On-site observation Semi-structured interviews Reflective diary Documentary review	May 2015- December 2016
Data management	Endnote. NVivo, MS Word and MS Excel	

Table 13: Research Protocol

The reflective diary is used as a recording tool after each case study engagement and throughout the research process to reflect on the interviews and observations, and improvements that could be made to the interview technique and questions asked. The reflective diary also helps the researcher to reflect on each stage of the research process, thereby building their skills as a researcher. It is useful for reflection on theme generation, developing the gaps and identifying emerging themes from the case study analysis. It can be integrated throughout the study as a diary of events and a record of activities. The value of this instrument is that it helps create transparency in the research process, achieving methodological rigor and paradigmatic consistency (Ortlipp, 2008) as a result.

4.7.1 Case Study Selection Process and negotiated access

In micro-firm research, case access has been found to be problematic (Down, 1999; Curran and Blackburn, 2001; Reinl, 2011). Buchanan and Bryman (2009) suggest using a resourceful approach, and Bryant (2011) recommends exploiting known relationships. Thus, the sampling method used in this study is a purposeful non-random sampling approach, based on pre-determined criteria for case selection (Table 14) as recommended by Shaw and Conway (2000).

Case Criteria	Description
Micro-firm	Case-firms satisfy the definition of micro-firm used in this study (Shaw and Conway, 2000); less than 10 full-time employees.
Lifespan of greater than three years	Case-firms had been trading for a minimum of three years (Shaw and Conway, 2000).
Multi-sector representation	Micro-firms from various sectors (e.g. agricultural, retail, indigenous industry, service), mirrored in each country.
Facilitated network membership	Case-firms are current members of at least one facilitated network.
Network facilitator	Facilitates a network that the micro-firm participants are current members of, and facilitates green innovation activity.
Vicinity to researcher	Case-firms are located within daily travelling distance of the researcher (Shaw and Conway, 2000; Yin, 2009) in each location (Ireland and Canada).

Table 14: Pre-determined criteria for case selection

Cases were chosen such that interest in the study was “transparently observable” (Eisenhardt, 1989, p. 537). It was therefore deemed appropriate to choose cases that were known to the researcher or her contacts, an approach used in a micro-firm context by Burke and Jarratt (2004) and McCarthy (2003), among others. This approach is considered to be appropriate for exploring where the research aim is to seek a wider understanding of social processes. The selection criteria were micro-firms from various sectors (e.g. agricultural, retail, indigenous industry, service) employing less than ten employees, who had been trading for a minimum of three years, and were current or past members of a facilitated network, located within daily travelling distance of the researcher when in each country (Table 14). The industry selection was mirrored in each country. The selection criteria for the facilitated network in each country was that at least one

participant micro-firm was a member and that the network engaged with green innovation activities.

Once identified the case study protocol (appendix C) was enacted. This approach is recommended by Philliber *et al.*, (1980) to provide a research blueprint for establishing what to analyse, what data to collect, what questions to study and what data is relevant. The O/M or facilitator was first contacted by email or telephone to explain the aim and objectives of the study and then asked if they would be interested in participating. The research consent form including the terms of reference (appendix C (b)) was sent to the potential participant and a cooling off period of 2 days lapsed before the O/M or facilitator was contacted to confirm their willingness to participate. At this stage, a suitable time for a face-to-face interview (or in the case of facilitators, face-to-face or audio-visual virtual interview) was arranged. The consent form was signed prior to commencing the initial interview.

4.7.2 Data Collection Process

The data collection process is the process of collecting and evaluating information on variables of interest, in a recognised systematic manner that allows one to answer specified research objectives and evaluate outcomes. As stated previously, this study uses an interpretive case method, incorporating semi-structured interviews and interim observations carried out over a twelve month period. This approach is supported by appropriate documentary review and the researcher's own reflections recorded in a diary throughout the research study. Data was collected from four Irish micro-firms, four Canadian micro-firms and four networks across different industry sectors. The number of cases fall within the recommended number outlined by Eisenhardt (1989), Creswell (2009), Guest *et al.*, (2006) securing a comparatively manageable volume of data and a substantial empirical grounding to support theory (Papagiannakis *et al.*, 2014). As stated previously, each study commenced with an on-site review, and the O/M was observed in each case. The observation process included following the flow of events, documenting behaviour and interaction without intrusion (Adler and

Adler 1994) and taking detailed field notes as required. This process was followed by an O/M interview guided by a literature-informed template and incorporating the completion of the green audit (appendix A).

When conducting the interview the recommendations of Qu and Dumay (2011) were followed; that the interviewer be a good listener, a good planner and note taker. These skills were developed through a comprehensive generic skills programme completed by the researcher during this study. The researcher sought to keep the interview relaxed, which in turn assisted in seeing the perspective of the interviewee (Greene, 1998). Similarly, the quality of the interview was enhanced by maintaining a positive relationship with the interviewee, mitigating against interviewer bias through the researcher diary and maintaining the flow of the interviewee's story (Shensul *et al.*, 1999).

Questions pertaining to individual, social and economic contexts were planned to encourage participants to formulate their own responses (appendix A). In all micro-firm cases the O/M was the person interviewed, as s/he was the actor responsible for organisational decisions and the firm's network activity. Due to the distance involved (Ireland/ Canada) comprehensive preparation was made prior to the interview, including examination of case websites and company information to gain an understanding of the operation of each firm. The interview started with an introduction and informal conversation to make the participant feel relaxed. The objectives and topics were clearly stated and the expected length of the interview was indicated. Following the semi-structured interview the green audit took place which involved completing a questionnaire (appendix A) and a discussion around the topics ensued. The interview concluded with the next course of action to be taken, and the researcher thanked the respondent for his or her time. Interviews lasted on average 40 minutes and were digitally recorded for later transcription. Four interviews also took place with network facilitators; these interviews were via telephone, Face to face or Skype¹² (Table 15). The networks studied were those mentioned by the micro-firms (of which they were a current member). The purpose of these supporting interviews was to establish how green

¹² Skype uses P2P (peer-to-peer) technology to connect you with other users online.

knowledge was sourced/ generated and circulated within the network and among members and how were green innovation capabilities developed and transferred into the micro-firm. The underlying observations are referenced as OCC (Observation Case Canada) or OCI (Observation Case Ireland), while interview extracts are identified by the relevant O/M or their case number (see Table 15).

Case	Location	Business Focus	Staff	Length of Interview	Interview details	Length of Observation
O/M1	Canada	Recruitment	O/M	15 minutes 60 minutes 20 minutes	Initial introduction Main interview Green audit	2 hours (OCC1)
O/M2	Canada	Artist	O/M	15 minutes 55 minutes 60 minutes	Initial introduction Main interview Green audit	2 hours (OCC2)
O/M3	Canada	Farming	O/M + 8	20 minutes 62 minutes 15 minutes	Initial introduction Main interview Green audit	4 hours (OCC3)
O/M4	Canada	Hospitality	O/M + 1pt (part time)	25 minutes 25 minutes 20 minutes	Initial introduction Main interview Green audit	4 hours (OCC4)
O/M5	Ireland	Recruitment	O/M	15 minutes 49 minutes 41 minutes	Initial introduction Main interview Green audit	1 hour (OCI1)
O/M6	Ireland	Artist	O/M	43 minutes 18minutes 15 minutes	Initial Telephone Face to face x 2 Green audit	2 hours (OCI2)
O/M7	Ireland	Farming	3ft (full time) + 3pt	20 minutes 43 minutes 42 minutes	Initial introductory Main interview Green audit	2 hours (OCI3)
O/M8	Ireland	Retail	O/M+2ft	30 minutes 49 minutes 41 minutes	Initial introductory Main Interview Green audit	3 hours (OCI4)
NI1	Clare Local Enterprise Board Ireland	Micro-business; small business	facilitator	25 minutes	Telephone	N/A
NI2	Teagasc	Agriculture	Expert interview	25 minutes	Face to Face	N/A
NC1	Innovation Guelph Canada	Companies and entrepreneurs	facilitator	40 minutes	Telephone	N/A
NC2	eMerge	Micro-businesses	facilitator	60 minutes	Face to Face	N/A

Table 15: Summary table of cases and networks

Respondents were invited to verify transcripts and interview notes for accuracy (Lincoln and Guba, 1985). This approach added depth to the case data, while interviewing experts and observing network events increased scope, adequacy and appropriateness of the data (Morse *et al.*, 2002). Secondary data (Appendix G), archival documentation including marketing material, websites, newsletters

and business strategies where available was also examined. This document review was used for verification purposes and for complementing the analysis of primary data. In total, the multiple sources of data collection techniques in this case study approach included 20 hours of non-participatory observation, the maintenance of a researcher log, an extensive document review, and 798 minutes of interview data that encompassed 24 interviews with eight micro-firm O/Ms and four interviews with network facilitators collected in situ and through telephone interviews over the 12 month research period. Thus, the interpretive case approach provided a fuller picture of the context (micro-firm perceived capability development through network engagement) and phenomenon (green innovation) under study.

4.7.3 Steps to Overcome Bias

Bias is defined as a systematic deviation from the truth that distorts the results of research (Sitthi-amorn and Poshyachinda, 1993). Some of the steps they advise to ensure quality data, as applied in the current study are detailed below:

- Prolonged engagement in the field,
- Persistent observation,
- Crystallisation of methods,
- Peer debriefing (including respondent verification of transcribed interviews).

The applied interpretive case study approach used secondary data analysis (e.g. documentary review), alongside qualitative semi structured interviews, non-participatory observation and researcher reflections as complimentary data sources. Other researchers have taken a similar approach when studying micro-firms (Kearney *et al.*, 2014; Reinl and Kelliher, 2014), and in network research (Huemer, 2004).

4.7.4 Data Management

NVivo, a software tool, was used to facilitate the organisation and analysis of documentation and interview data. Data coding (Appendix D (c)) and comments were coded under the general themes uncovered in the literature review and the data was then subject to a content analysis to capture central themes, patterns and ideas within the findings through comments and expressions. Coding was undertaken for evidence of the perceived impact of inter-firm collaboration on green innovation capability development by using key words/ phrases. In combination with existing literature the patterns observed after content analysis were also used to hone the green innovation capability framework. This iterative approach acted as a support system and it facilitated a cross-case and then a cross-country comparison of the perceived impact of network engagement on green innovation capability development in micro-firms.

For the interview process, the interviews were recorded and then transcribed verbatim using MS Word and stored in NVivo, a data management software package. The approach recommended by Lapadat and Lindsay (1999) was used (recording, transcribing, coding and analysing), an ongoing process of contextualised interpretation and the continuous process of listening, re-listening, viewing and reviewing. This process of transcription carried the researcher closer to the data in order to become more familiar with the main topics that arose from the interview, and facilitated developing codes and quotations. The transcription was also sent to the respondents with an invitation to make any amendments considered necessary, facilitating a further check on the data's accuracy (Burnard *et al.*, 2008).

Following transcription, the researcher set about coding (appendix D) the data (Lapadat and Lindsay, 1999). Guest *et al.*, (2006) suggest that the number of participants individually communicating the same idea was a better gauge than the number of times a theme is stated and coded. Codes were applied to data but themes develop from the data (Guest *et al.*, 2006). Thus, patterns, similarities, themes and relationships were identified and labelled at the coding stage, which would then be analysed. In this study, the use of the NVivo software package

proved valuable in terms of sorting, reducing and managing the data collected while preserving the contextual richness of the data, an important consideration according to Sarantakos (2005). NVivo has many benefits (Creswell, 2009; Miles and Huberman, 1994; Lewis and Ritchie, 2003; Sarantakos, 2005) including adding rigour to the qualitative research (Richards and Richards, 1991). Assigning codes (code sheets are included in Appendix D). to themes enhanced the consistency of the current study's data and made it easier to store transcripts and import external data as anticipated by Gummesson (2003). It had other features including word frequency, searching, storing and linking data. It also provided structures and hierarchies of data, as well as performing certain analytical tasks. However, as outlined by Crowley *et al.*, (2002), the user was in control of the software in this instance, thus the use of software may have shaped the analysis of the data.

The analysis phase of the research process evolved through stages of decontextualisation, recontextualisation, 'thick' description and 'rich' metaphors (Hill and McGowan, 1999). Single case analysis preceded multi case analysis in each country, followed by cross country analysis. An accumulative audit trail was used to update records after analysis with each set of transcripts, while NVivo was used to establish the codes, and synthesise the data in order to provide richer data (Richards, 1999). When writing up the findings, an approach recommended by Burnard *et al.*, (2008) was used; this involved reporting the findings under the main themes using verbatim quotes to illustrate the findings. The findings are presented in individual case form divided by country, prior to incorporating network facilitator perspectives and offering a cross-country perspective. Then, a separate discussion chapter was used to discuss the findings in relation to existing research.

4.7.5 Data Saturation

Throughout the study, the researcher sought to balance the case depth against a lower number of cases, which could be added to over time in pursuit of the optimum breadth and depth of data and reviewed progress at predefined points

throughout the research process. These cycles of iteration were repeated as often as was necessary until ‘theoretical saturation’ (Eisenhardt 1989, p. 545) was achieved. Theoretical saturation occurred in this study when additional data was found to add no further explanation relating to the emergent themes (Guest et al., 2006). At this stage, there was enough information to replicate the study (Walker, 2012), and further coding produced no greater insight into the findings as presented (Guest et al., 2006). By adapting an evolutionary approach to the data as guided by the research aim, the goal was to ensure the trustworthiness of the findings (Lincoln and Guba, 1985) such that they could be applied to new situations and experiences. Retaining an interconnected relationship between theory, methodology and analysis was paramount throughout this process (Johnson, 2002), as guided by the experience of the researcher, her supervisors and the academic community.

4.7.6 Research Legitimacy

Richardson (2000) advises researchers to apply crystallising descriptions and interpretations to give the case method greater credibility and authenticity. In this study, the terms adopted are centred on the concept of trustworthiness as a criterion of how good a qualitative study is (Mathews, 2009); trustworthiness was pursued through the audit trail (Carcary, 2009) which was also a means of assuring quality of data. Other studies have used this approach in observatory research (Kelliher and Reinl, 2011; Reinl, 2011), legitimising its use in the current study. The researcher’s pursuit of trustworthiness concentrated on credibility, transferability, dependability and confirmability as recommended by Lincoln and Guba (1985) and presented in Table 16.

Trustworthiness	Stage of Research	Measures in place in present study
Credibility	Data collection Data analysis	Use case study protocol ; Use of multiple methods of data collection Peer debriefing; Participant verifying transcripts
Transferability	Data collection Data analysis	Interview protocol; Case study database Providing contextual background information; Demographics; The provision of thick description
Confirmability	Data collection Data analysis	NVIVO Audit trail
Dependability	Data collection Data analysis	Use multiple sources of evidence Reflective diary; Audit trail

Table 16: The legitimisation and authenticity of qualitative methods

Credibility has been defined as how well the research method explores what it proposes to explore (Lewis and Richie, 2003) and how well the researcher gains full access to the informants knowledge and meaning. In this study the credibility measures included using an interview template and case study protocol (see appendix C), use of multiple methods of data collection, peer debriefing and sending the transcripts to the each participant to confirm the content and make changes as deemed necessary. When writing up individual cases, a case study database was developed (appendix C) to organise and document the data in a logical manner. This database provided rich descriptive accounts of the phenomenon under investigation and allowed the participants an opportunity to discuss the topics.

According to Bryman and Bell (2011) the above approach also assists in achieving transferability. Data management tools including the qualitative software analysis tool NVivo assisted the researcher in the interpretation and analysis of results and helped the researcher to identify patterns and to analyse multiple sources of information through a single data management platform. An accumulative audit trail (Guest *et al.*, 2006; Lincoln and Guba, 1985) was also used to update records after analysis with each set of transcripts. The audit trail was also the main technique used to enable dependability (Lincoln and Guba, 1985) and confirmability of results.

Dependability is referred to as the strength and trustworthiness of the results (Devine, 2012; Hussey and Hussey, 1997; Lindolf, 1995) and is concerned with whether the study can be repeated (Kvale, 1996; Yin, 2009). As such, the researcher carefully maintained records of all processes carried out throughout the entire study (see appendices for further details) including the multiple methods of data collection (document review, semi-structured interviews, observatory case studies and the researcher's reflective diary) credibility. Dependability is further enhanced by outlining in a transparent way the procedures that led to the findings, carrying out fieldwork reliably and allowing all participants adequate time to discuss experiences, thoroughly analysing evidence and backing up interpretations, and contributing a well-adjusted viewpoint (Lewis and Ritchie, 2003). Thus, all phases of the research have been recorded and a copy of all communication transactions with participants and stakeholders has been maintained.

4.7.7 Research Ethics

During the course of this research process, attention was paid to ethical concerns. In particular, consideration was concentrated on the possible influence of this research to the case organisations; case access, interaction with the research respondents, and management and storage of collected data (Saunders *et al.*, 2007). The code of ethics for social researchers outlined by Denscombe (2014) was used as a guide in the research study. The aim of this code of ethics was to protect the interest of the participants, ensure that participation in the study is voluntary and based on consent. This code also helps to avoid deception and comply with the laws of the land.

As this research was carried out in Ireland and Canada, the research ethics of both jurisdictions were considered. The research protocol including research questions for the interviews were forwarded to a researcher based in Canada for review to ensure compliance with the country-level research ethics in that country. In Ireland, the researcher confirmed research ethics compliance with her host Higher level institute (Waterford Institute of Technology).

All efforts were made by the researcher to ensure confidentiality. Each case study was given a code name and referred to by observation case country and number (i.e. OCC1 for OC Canada 1, OCI1 for OC Ireland 1). Participation in the study was entirely voluntary and each willing participant signed and kept a copy of the consent form (appendix C (b)). The participants were informed that the interviews would be recorded at their acceptance and that they would receive a copy of the transcript of the interview, which they had authority to review and make changes if necessary. They were also advised that they could stop the interview at any time, and that they could retract from the study up to the point of data merge. The duration of the case and the likely depth of involvement of the researcher was discussed with case participants prior to their first interview, as outlined in the consent form (Appendix C). Results were presented in an aggregated format that would not identify any one person. The records of this study will be kept strictly confidential. Audio tape recordings were used for transcription purposes only and will be destroyed within three years of completion of the research study.

4.8 Conclusion

This chapter provides an overview of the research approach used in this thesis – a qualitative approach using the interpretive case method, incorporating semi-structured interviews, non-participatory observation and other complimentary data collection techniques. The objectives of the research strategies are discussed and the research philosophy detailed. The research study sought to explore the perceived impact of facilitated networks on green innovation capability development in the micro-firm. The ontological stance of the researcher – subjectivist – is identified and explained. The epistemology adopted for this study is interpretivist due to its appropriateness and applicability to the research project at hand. The methodological basis of this study is a qualitative interpretive case study. By adopting such an approach, this study is intended to make a contribution to micro-firm innovation capability development and network engagement literature, as well as helping in the formulation of a stronger empirical framework for further studies on green innovation capability

development in micro-firms. The refinement of a supporting Green Innovation Capability Framework could act as a guide for micro-firms in developing strategies that will allow them to compete effectively in the emerging green economy. The following chapter presents the primary research findings.

Chapter 5: Research Findings

5.1 Introduction

This chapter presents the findings from the study of eight micro-firm case studies, four in each studied jurisdiction (Canada [OCC1-4] and Ireland [OCI1-4]). Cases were studied in each of the following sectors; agriculture, artist and recruitment (one each in Ireland and Canada) and one case in retail (Ireland) and hospitality (Canada), a comparable sector to retail due their mutual proximity to the consumer and their similar location on the product-service continuum. Individual case studies, incorporating interview findings, researcher observations of micro-firm network activities and internal documentary evidence are presented under three literature-informed key themes; micro-firm internal and external influencers, green innovation capability development and the perceived impact of network engagement on micro-firm green innovation. Findings relating to the green audit completed by each O/M, which incorporated literary-informed green awareness triggers and details of the capabilities associated with green innovation in an attempt to gain insight into the O/M's awareness of, and attitude towards green initiatives (see appendix A) are also included in each case study.

A summary overview of each case (1-8) is outlined in Appendix C (c)), the table outlines the case location, the focus of the business, the number of employees in each micro-firm and the length of time each firm has been in business, as well as the length of each interview and how long the researcher observed each business owner/ manager (O/M) within their business and in interaction with their respective networks. Cases were selected based on the pre-established case selection criteria (Table 11) a micro-firm (less than ten full-time employees), trading for a minimum of three years, that is an existing or past member of a facilitated network, and is located within daily travelling distance of the researcher when in situ in each jurisdiction.

In addition to interviewing each O/M and observing each case within their respective networks (appendix C(c)), the researcher also conversed with network

facilitators in each jurisdiction. The purpose of speaking with the network facilitators was to identify what information if any is provided to micro-firms on green initiatives, regulation matters and general green concerns. The discussions also sought to establish if workshops/ information events were planned or had been held on green economy issues and opportunities. Four interviews took place with network facilitators (two in each jurisdiction); these interviews were via telephone or GoToMeeting (see Appendix C (c)). The interview guide used for interviewing network facilitators can be reviewed under Appendix E.

The forthcoming findings are presented in case form, divided by country prior to presenting network facilitator insights, cross-country findings. Findings from regulatory/ documentary evidence, and reflective diary notes are also presented throughout the chapter. As this is an interpretive study, other themes emerged during the analysis of the findings and these are presented throughout the chapter. The chapter concludes with a summary of the emergent themes.

5.2 Section 1: Canadian Case Findings

This section presents the four Canadian micro-firm case studies (OCC1-4), each located in the Ontario region. Twenty-two percent of the Canadian population lives in rural areas (Canada Census, 2016), which depend in the main on micro-firms for the provision of employment, goods and services to the local community. As highlighted in chapter 3, micro-firms account for 75% of all businesses in Canada (Statistics Canada Business Register, 2011), while 73% of these firms have over 60% of their market concentrated in the local community (Industry Canada, 2013). In Canada, the green economy is described as a subset of the entire Canadian economy - it exists in parallel to the traditional economy and includes similar activities and processes (Eco Canada, 2010). Comparable to Irish/ EU influencers, government policies, customer demands and firm reputation in Canada are found to be the key drivers to green economic change (Eco Canada, 2010). Micro-firms are supported by a myriad of semi-state agencies, government and sector advisers and local community stakeholders, whose offerings are often channeled through facilitated networks.

5.2.1 Case Study 1 Synopsis – Recruitment Business, Canada

Canadian case 1 (OCC1) is a recruitment business that was established in 2011. O/M1 is a qualified Recreologist (the study of human leisure behaviour) and spent most of his previous career building large volunteer based programs in children's hospitals/ units to help families to continue to thrive when faced with a child's serious illness. He made the decision to establish a recruitment business based on his experience working with the volunteers who stayed with these programs for several years while they were in university. Helping these volunteers to determine what they wanted to do after finishing their university education meant that entry into the recruitment sector was a natural progression in his career trajectory.

OCC1's clients were primarily school leavers and professionals changing career direction, as OM1 focused on those who wanted a transition in their career and life. O/M1 said it was a very small sector and therefore he needed to target his approaches differently from other organisations to show uniqueness in his offering. O/M1 found this work *'rewarding and I love what I do'* although running his own business;

'...is awfully hard, I have done a lot of different projects and I think this is the hardest I have ever undertaken. It is very rewarding and I love the work that I do but in most non-profit organisations you have specialists – finance person, marketing person, executive director, board, all these people working hopefully toward the same end who have different skills, so when you need something you can go and they will either take it on themselves, tell you how to do it, guide you'.

The resources and capabilities needed to run the business, included *'marketing and business planning and development; financial management, time management'* along with *'the administrative /secretarial functions – filing, organising and all of the office functions'*. These requirements were *'much bigger than ... ever anticipated'* by O/M1 when he first started the business. He also revealed that he had difficulty in converting ideas into actions, *'when you are on your own as a micro business you have got to do everything yourself. It is easy to get advice. The challenge I face is using the advice - moving forward on it while still working with clients....it's like two full time jobs'*. O/M1 is OCC1's only employee, requiring specialist skills in this business setting,

'Everything is so much more specialised, the social media person is not the same as the marketer, the graphic designer is not the same as website person. They are all separate... There are many people who will give you social media advice or marketing advice, but finding someone who will do the doing without charge or at a nominal cost is very difficult to find'.

In response to these requirements, O/M1 did *'work exchanges with people where they pay for our services by contributing their talents to our business instead of money'*. For example, one such client set up a web page for O/M1 in return for recruitment services. O/M1 acknowledged that *'some of the people who give me the best advice are my clients'* and that this bartering system proved helpful when trying to build and sustain the business.

Green Innovation Capability Development

O/M1's attitude towards green innovation was captured in the initial interview, prompted in part through the completion of the green innovation audit. He stated he was open to learning about green enterprise when completing the green audit, as to him *'the green economy means environmentally sustainable business that increases efficiency and reduces energy costs'*. However, he also acknowledged that he is *'really just beginning to understand sustainability'*. When asked about green innovation, O/M1 spoke about his approach to his business;

'When I think about it [green innovation] in my business, I use the bus or bicycle. I share office space, use very little paper and waste very little on any level so I guess I am contributing with our creating too much CO2'.

On observation the O/M used a laptop and a phone as the only office equipment. He believed that he didn't *'... create waste to start with'* although he amended this view in a subsequent interview; *'I produce very little waste, I have never measured it. But I don't produce much'*. When observed in his work environment, O/M1 was visibly conscious of his firm's carbon footprint and when prompted, he stated *'I am a lot more conscious now in business and personal life. I know what my [ecological] footprint is and have set goals'*. This plan fed into his intuitive green policy. Through proactive review and client feedback, he *'can look back after a year and re-evaluate if necessary'*. However, OM1 also stated that he had no cognisance of any regulations that applied to the business, despite the existence of Canadian Environmental Protection Act 1999 (CEPA) legislation relating to this industry.

OM1 believed that a key motivating factor in implementing green initiatives was the potential for a positive financial impact when *'you start to save money'*, resulting from the adoption of green innovation. These initiatives *'affect the bottom line'*, even if they *'don't affect the performance of the business'*. He rated waste management and sustainability planning skills as very important in his work environment (skills audit response), as *'you can see the difference'*. A further motivation was changing consumer preferences, as more clients became aware of the environmental impact of their actions. However, he is aware of the need to balance green initiatives with the resource challenges of operating a

micro-firm as *'you have to look after your own business needs first before you can think of green issues'*.

'It is hard when you are trying when you are up to your butt in alligators; it is hard to remember the objective is to drain the swamp. Even with the environment, it is really critical, if you are fending off all the little things it is hard to think about the environment'.

'If the person is happy in those areas they will be able to concentrate on being more environmentally aware, if they don't have a job or money to pay the bills you won't want to think about the environment – Similar to Maslow's hierarchy of needs'.

OCC1's green ethos was enhanced by technology, which had created a situation where far less paper is used in the recruitment industry, as more and more people supply their resume electronically. O/M1 found this approach adhered to his own waste perspective; he uses 'google docs' (an electronic cloud-based documentary storage device) which he found to be *'very good'* for saving paper and the Internet provided a *'good source of information'* for his business's green goals. As the majority of his clients put their resume/ Curriculum Vitae online, which can be edited online concurrently; he felt it unnecessary to print it out and stated, *'I don't own a printer as it would create/waste too much paper'*. He also used Skype to liaise with clients in order to cut down on travelling by both parties. Notably, despite the technology-enabled paperless business environment, O/M1 rated information and communication technology (ICT) and technical skills as unimportant in his skills audit response. Having discussed his green ethos as a potential advantage for his business, O/M1 mused, *'I don't promote environmental side in marketing material, something to think about'*.

Perceived Impact of Network Engagement on Green Innovation Capability

O/M1 volunteered to help with a community environmental network initiative (eMerge Guelph) and offered individual mentoring to households on reducing carbon footprint, suggesting he had a natural environmental orientation. For example, as a volunteer in the eMerge network he attended workshops on how to save money by saving energy and reducing the home's impact on the environment. As part of the case study O/M1 was observed during his network role. Part of his volunteering involved time in the eMerge office space, the office was based in a downtown shopping centre and provided information on

environmental issues relating to energy, transportation, water, waste and food. He also volunteered as a home advisor offering advice to consumers on savings on their hydro and gas bills and provided information on local rebates/incentives/programs. O/M1 believed this involvement in environmental mentoring and ongoing learning on environmental issues lead to a positive approach to internal environmental initiatives in his firm; *‘I find that volunteering with leading edge community projects is the best way to build business relationships and also great friends!’*.

O/M1 mentioned the importance of network matching and he advised that it was important to *‘select [the network] carefully. You don’t have a lot of time, you are running two businesses – the work you do, plus making business’*. He suggested selecting a network where your skill set fits the purpose of the network, and he suggested asking the question ‘are you making a good investment for both your business and the community?’ Acknowledging the benefits of network engagement, O/M1 noted *‘I grow my business by networking, tried all kind of different ways, working with other organisations is most effective, getting known through groups, word of mouth, some social media but I don’t like it’*. He also acknowledged that specialist *‘networking does occur among employment agencies regarding the people they serve who are from other countries’*, and he has *‘also worked with organisations like the Career Education Council who help high school students decide what they want to do with their career’*.

OCC1 formally engaged with three business networks - eMerge Guelph, the Canadian Positive Psychology Association (CPPA) and Innovation Guelph, where his office is based. He believed the networks’ provided him *‘with great business support, space, connections to others starting innovative business’* and he sought input from members *‘more so than family’* to gain *‘knowledge and advice’*, as;

‘Membership of network helps to be innovative; every time I work at ... (names of various local networks) I gain new ideas that I can bring into my own business and also contribute back to those organizations’.

Involvement in these networks further enhanced O/M1's innovation skills through knowledge transfer initiatives;

'One example is in my work, I have changed the interview process from what is traditionally done in interviewing volunteers for non-profit organizations by using an idea that comes from my work in career transitions. It is far more effective at finding out how to match a person's skills to the organization's needs.'

O/M1 described networking as having '*huge*' impact at a personal and business level, stating that '*running your own business can be lonely and this kind of networking energises me for my own business*'. Network involvement also helped O/M1 gain new ideas to bring into his business, particularly as a result of his shared office space at Innovation Guelph. Notably, he had a preference for '*face to face networking ... supplemented by email*', a view echoed by other respondents. Taking a wider community perspective, O/M1 stated;

'I have found that grass roots organizations like Transition Guelph (a collection of all types of interest groups and individuals around sustainability) are very helpful because of face to face contact with people from different walks of life – but who are all focused on helping Guelph to flourish. Whether you are an individual or business it doesn't matter, it is all voluntary there is not much of a hierarchy. Networking in this area is good'.

O/M1 also believed that by promoting the work of these networks, it helped him to build his business and to contribute to the wider community's wellbeing. He is an active member of eMerge Guelph, a network whose ethos '*leads the way in co-creating resilient flourishing communities [by] connecting citizens and organisations to innovative solutions to maximise resource efficiency and community well-being*' (eMerge Guelph website, 2017). The network logo is '*Live Lighter, Live Richer*' (Documentary evidence Appendix G (e)) and its ethos promotes green energy saving initiatives. By letting people know about eMerge Guelph's aims when clients were purchasing OCC1's services, O/M1 believed it showed clients that they were contributing to a healthier community. He said this was an easy way of educating people about community wellbeing. O/M1 was also a member of the CPPA. He explained that positive psychology was the scientific study of the strengths and virtues that enable individuals and communities to thrive and he suggested that positive psychology could benefit other businesses by working together to promote environmental sustainability in the community. Rather than the approach of looking at problems, positive psychology looked at

what worked and helped individuals, organizations and communities to do more. O/M1 believed that this new discipline in psychology created change faster and had potential for applications in both the business and environmental sectors. Finally, Innovation Guelph provided O/M1 with ‘*a shared [work] space*’, business support, connections and resources for learning, access to grants, collaboration and mentoring; support which O/M1 deemed ‘*tremendous, a big help*’, along with the local Enterprise Centre. In the future, O/M1 ‘*would like to know more about green initiatives*’, and believed this was a catalyst for his future network involvement.

5.2.2 Case Study 2 Synopsis – Artist, Canada

Canadian case 2 (OCC2) is an art business started in 2009, focused on creating works by applying wax and dyes on a variety of fabrics. In her previous careers, O/M2 was an architect and she had taught art at International Schools in Ethiopia, Sudan and China. Prior to becoming a self-employed artist, O/M2 also owned and operated an art gallery. When speaking about this art gallery, she stated that ‘*I was very naïve I thought I knew everything, becauseI thought I knew it all, I was way above my head, I don’t have 48 hours a day, it was too time consuming*’. The art gallery was not successful, even though she had sufficient funding, which she believed was partly due to the fact that she did not have access to the right advice,

‘I didn’t have the support of (a) network. I wish that was now, now I know the people. I had to be (a) long time in the (gallery). There was not network at the time, after that happened, I stated networking because of that’.

O/M2 felt exhausted, as she had to do everything herself, ‘*I was working all the time... to do the marketing, buy materials, pay the bills, contact the artists, it took too much time*’. She noted that she promised herself at the time that ‘*if I was doing it again I would make sure I had the network first, I don’t believe in businesses in isolation, it is social thing, and you are doing something for someone*’. O/M2 had made a lot of contacts through the gallery so after closing the business she decided to become a self-employed artist. Despite her previous experience, O/M2 stated that she again underestimated the core professional skills

and capabilities required to run her art business; *'you need leadership'*. She also acknowledged that internal resources were limited in her business as she was the only employee.

Green Innovation Capability Development

O/M2 believed her attitude and mind set was critical in influencing the green orientation culture and green innovation capability development in OCC2, *'I think all the [green] skills are important. I am achieving all the green side that I can, I don't produce waste, I know what my carbon footprint is and I set goals'*. There was also evidence in the findings that O/M2 believed that those micro-firms that pursue green activities based on values and commitment received more positive outcomes,

'The most important thing we can do if we don't go sustainable we are dead, mathematically speaking, I believe the numbers of people on this planet if we don't protect it won't last. It is the only hope'.

Even though O/M2 stated that *'I don't know what the green economy is?'* she displayed a strong NEO on observation was knowledgeable about green/sustainable issues. In the skills audit, O/M2 rated as important integrating green practices into the everyday operations of the business, although she acknowledged that this needed to be balanced with the need for profitability to remain in business,

'Key skills to remain sustainable, environmentally friendly – make money in a green way. I think – continue doing what is sustainable for the planet – not a cause, not an effect something you have, to make a profit while you are doing it'.

She had many examples of green practices,

'I got a hybrid (car), walk as much (as I can), solar panel, everything I buy is organic, I don't buy anything with packaging, and I hate the packaging, I used to pick up my own rice in the field, I don't want my rice to come in a box inside a bag ... I am not wasteful, I don't buy water, I don't buy bags, and I leave the package behind if someone offers me a package. You make the garbage, you keep it'.

O/M2 also rated waste management skills as important in the green audit, *'I put my bins out every 6 weeks, and I don't bring garbage home'* and would like the option of more sustainable packaging to be available from suppliers (Skills audit).

When contemplating her green ethos/ NEO impact on green innovation in her business, O/M2 noted that,

‘To get [green] skills, I think it would be good if the information was out there. Not on the Internet, if information was everywhere in simple words, I tried to read but it wasn’t for me. I didn’t understand it; it was all long words’.

Based on her skills audit responses, OCC2 believed in and was effective in meeting green strategy skill requirements and was in adherence to and exceeding national standards including those relating to pollution prevention. However, she also believed more government legislation was needed to further embed the ethos of the green economy in businesses like hers, *‘I don’t think the standards are high enough, they need to be higher environmentally’*. O/M2 believed that marketing is required to educate business people on environmental issues and stated that this marketing should be done through the government and the networks,

‘It is very difficult if the sustainable marketing doesn’t come from the government ... but to continue to exist you need marketing, you need to educate people, we are all swayed by what is trendy what is not trendy, you can do, this it is going to save the planet; but this is so much more [resource] - cool... its prettier, the planet is going to die, I don’t have to save planet’.

When contemplating innovation in her business setting, O/M2 believed that while *‘innovation is important’*, it is an interim tool in her work setting; *‘...but not all the time, you have the burst of innovation and then sit for a while. You can’t be innovating all the time or you would get nothing done’*.

Perceived Impact of Network Engagement on Green Innovation Capability

O/M2 acknowledged that access to and availability of outside advice was an influencing factor in network engagement, as *‘I need advice’*. She outlined the knowledge benefits obtained from network participation, as she didn’t have the time to be coming up with new business ideas all the time thus she depended on her networks to help with these business needs. O/M2 explained that when choosing which network to join, *‘they are my neighbours, because of geographical location, and the other network is 30 minutes’ drive’*. The network was the Wellington Artist Gallery, which is located nearby her business. She said in this network they were *‘all working together with the same goal, not me, me,*

me. We stick together...without them, there is no me', suggesting a close member relationship within this network. The Wellington network formally met once a month, to decide what needed to be done, and they organised events together, and made *'make change by consultation'*. Outside of the formal meetings, Wellington network members talked every day, which O/M2 found to be a great support, a source for advice and a catalyst for innovation in her own business, *'All the things we bring, we share ideas, someone in the group will know how to implement it or do something about it'*.

The O/M mentioned that *'In a non-profit network people have the same mindset, people help because they like to help, it is a different part of the brain, different personality'*, suggesting a community ethos. On observation the attitude of the O/M was one of openness and collaboration towards her networks. As part of the case observation, O/M2 was also observed volunteering at an innovation centre. This innovation centre was also a network, a space open to people, organizations and business that are working within a social innovation framework (document review). It provided the conditions for community members, practitioners and researchers, working in collaboration, to explore ideas, create and sustain new green initiatives and make discoveries for social change (document review). In tune with the Emerge ethos, O/M2 actively promoted energy saving initiatives and lead by example; she was vocal in the need for waste reduction initiatives and was focused on developing/ honing her energy management skills within OCC2.

Trust and common goals were mentioned by the O/M as very important for knowledge transfer in the network. The O/M stated that *'I had no knowledge'* about green initiatives prior to network involvement and that the network benefit is that *'we share information in my opinion'*. In this case green awareness occurred through collaboration and discussion with network members. While the network did not run courses, workshops or provide official information on green issues, the members' NEO enhanced green awareness and its application in a micro-firm environment through collaboration and informal discussions. For example the O/M discussed energy reducing techniques, like solar panels, green raw materials with other network members.

5.2.3 Case Study 3 Synopsis – Agriculture, Canada

Canadian case 3 (OCC3) is an agricultural business, specialising in horticulture. O/M3 did not come from a farming background, however she studied environmental science in University prior to completing an agricultural course in California (U.S.) and it was there that her passion for farming developed as, *‘during that time I got exposed to different water cultivations, courses and techniques’*. O/M3’s farm is *‘certified organic’* and she is committed to a sustainable approach to business activities, along with others in her sector,

‘A lot of folks coming in are starting ecological agriculture because they want to make a difference and be closer to natural eco system, to go with conventional agriculture is not an option for them’.

OCC3’s resource limitations included the quantity of work to be done by a small team and the lack of time to do it was also emphasised, *‘There is a lot to juggle so for me I am orchestrating a lot of things and to keep them going is tough’*. A lack of experience in the sector also affected O/M3’s business operations and she acknowledged the need to address this knowledge gap in her reflections, *‘... for people that don’t grow up [in farming], they need to explore and see a lot of different operations, learn from someone else’s mistakes. You don’t have a long timeline to make your own mistakes’*. O/M3 noted that she did not need to personally have all of the skills needed to run her business, instead, that she knew that she could also leverage internal human capital potential,

‘So the other piece how do you learn the business of farming and the fine tuning of you skills, if you didn’t grow up on a farm and don’t have 20 years of experience. I have a young woman working with us here, she grew up on a farm and her two uncles have their farms on the same concession, she is younger than all the interns she is 20 years ahead at age of 23, she is already thinking of the things that go across the agricultural lines, you have to think of how to make it an efficient system’.

However, finding staff, *‘that are technically savvy with logistical skills not only in the field but also with documentation, having those resources and people that can implement them, that are bright’* can be a challenge and sourcing affordable staff with the necessary skills was difficult, *‘you need really keen people, we try interview and select to get the skills we need’*. When the required skills are not

available internally, O/M3 believed that *‘going to key training to find out things is important, broadens that is a new way for evaluating farm system’*. Alternatively, there is the option to outsource the skills they did not possess, *‘A lot of skills you can hire out, someone else can do it more effectively than you e.g. book keeping can be hired out’*. O/M3 reinforced this view further, *‘Some things you can learn on the job, some can be outsourced, don’t have to be in core team. Important for business but you don’t necessarily have to do them (yourself)’*. The importance of knowledge as a resource was also reinforced when completing the green audit, *‘all [green audit] skills needed, all critical, need a lot of these things’*.

Planning was systematic and happened at particular times during the year, showing incremental improvements, *‘We do a review every Fall [Autumn], while we are still in season and it is still fresh, taking time away to evaluate and getting input from interns’*. Planning was more structured in order to maximise resources and a proactive approach was taken to prepare for the longer term, *‘Winter is very short, ... planting in March.... you have to have your goal as February ... We cannot spray slurry from September to January’* [due to environmental regulations]. In OCC3, the business strategy depended on underlying growth goals and the strategic needs of the micro-firm, *‘some are long range questions e.g. we need to change our crop rotation significantly or we need a longer crop rotation between all your fields – four years endeavour’*. O/M3 acknowledged that this planning process benefitted from observing other farms,

‘For some farms they are already a long way because they are so connected with their ecosystem. For them it is a matter of choosing different inputs or creating a longer crop rotation or mixing up their crops instead of having one crop divide the field into sections, spacing them out more’.

O/M3 reflected that it was important to pay close attention to the marketplace in order to respond to changes, as it is through *‘commercial awareness, marketing ability’* that the business can be sustained. When asked whether OCC3 promoted ‘green’ on their marketing material, O/M3 revealed they did if it made market sense, *‘It’s promoted on the marketing material, that is an easy standard, and easy to market it’*. Notably, OCC3 has a green policy [Green audit] as reflected in their documentation, alongside a strong community ethos, *‘We collaborate with*

businesses and organisations to benefit rural economies, rural life and the organic farming sector’ (Documentary evidence Appendix G(c)). O/M3’s personal ethos was rooted in ecological farming, and she rated green strategy skills from important to very important in the green audit. O/M3 also noted it was important to integrate green practices into the everyday operations of the business.

Key external influencers in promoting green activities within OCC3 include, ‘*Government regulations, federal regulations...*’ along with potential revenue generation for the business, ‘*How can I tap the sun’s energy to free energy?*’ O/M3 also believed that consumers needed to support them (organic farms) by buying local produce at the markets,

‘The things that farmers need we need consumer support for so we need to connect with local city organisations, people love local food, we need support for a lot of farms, we need to have one farm in the heart of every consumer’.

Green Innovation Capability Development

When contemplating green innovation, O/M3 believed it ‘*takes time, you have to research it sufficiently so that you are not wasting money. Some ideas, highly technical ones, take longer to develop. Others can be done immediately*’. The findings showed that O/M3 attitude was pivotal in whether green capabilities were pursued,

‘If they can make switch, make a difference and feel better that the bottom line is at least as good as it was before I can do it. The conventional farmers have been, most folks have bought into the green revolution tag which wasn’t really ecological, and a term we use here is they need an ecological conversion’.

It was also observed that while innovation was important, it was limited by the available resources, ‘*You can implement two big things a year, if you have a major staff overhaul, maybe not. You can tweak 10 things, a new tractor this year, new transporter last year*’. In terms of green innovation, O/M3 showed that employees needed to notice the ‘issue’ and ‘cause’ and then have the ability to be proactive in terms of encouraging change, so as to embed it in the innovation process in the organisation,

‘Running a business is not for people who want to be told what to do. I think in terms of green innovation I tell the interns if you can observe and respond then you can farm... soil issue, new insect, how do we manage, some are long range questions e.g. we need to change our crop rotation significantly or we need a longer crop rotation between all your fields – four years endeavour’.

Thus, while innovation was valued, the day-to-day running of the business needed to come first, *‘This is my 15th year here and it has taken this long. You have to focus on your internal organisation and make sure it is vibrant and meeting ecological goals’*. Of note is that the O/M3 was contemplating the process of measuring their green goals,

‘It is hard to compare on ecological farms because they are mixed. So they automatically have multiple enterprises going on that have synergistic effects so it’s a really tough one to measure, how do you do your measurements?’

O/M3 was aware of OCC3’s carbon footprint and what the term meant, *‘the biggest agriculture footprint is the tractor’* and knew their energy consumption levels, *‘energy is our lowest cost’*. However, he also acknowledged the challenge *‘in terms of carbon footprint and measuring that is so abstract for farmers because they are doing everything so practically’*. O/M3 went on to expand on this perspective, reinforcing the view that terminology is a challenge when communicating regulatory requirements to the business community,

‘The measurement doesn’t mean a whole lot to them (small farmers), every farm is so unique. You could say that farm has good carbon footprint and we have three different enterprises you don’t have. It is hard to compare on ecological farms because they are mixed. So they automatically have multiple enterprises going on that have synergistic effects so it’s a really tough one to measure, how do you do your measurements?’

Perceived Impact of Network Engagement on Green Innovation Capability

O/M engaged with six networks; at a national level O/M3 networks with other farming groups, EMERGE, the NFU and internationally with HEIFER international. She was actively involved in organising conferences and workshops. In 2008 OCC3 spearheaded an Environmental learning centre conference on Canadian agriculture along with other organisations (HEIFER international, ecological farmers, Canadian organic growers, ecological farmers), which was held in the locality. OCC3 also runs a program called CRAFT

[Collaborative Regional Alliance for Farmer Training] and Farm Start program, which provides incubator farms to farmers starting out.

OCC3 believed that *'rural and urban cannot be in animosity with each other'* and needed to work together to ensure organic farm survival, as *'you need social and moral support to keep going at an enterprise that barely makes money'*. Network engagement acted as a driver of idea generation for OCC3, *'I collaborate with folks like eco farmers, looking at developing training program with them and can be; farm start, local community, open doors with EMERGE'*. Conferences and training workshops also proved pivotal in transforming green information into tangible business activities that could be used in the micro-firm, *'Those conferences are quite pivotal. Farmers want practical (advice) as well as how to improve business'*. Sector representation was also valuable in promoting sustainable business activities as *'the NFU [National Farms Union] lobby with Government about policies they keep track of, these are farmers as well as advocates and at a different life stage'*. The NFU was believed to be a key actor in OCC3's external support structure as a small eco farmer,

'Strong support would be with farmers organisations. NFU is very strong on small family scale eco farms. Those are the farms in terms of productivity per acre are really high. Even if they get migrant workers they have a model that is family mediated, small enough farm that they have their feet on the ground and small enough tractor that they can take off the cap and look at the soil, not in air conditioned bubble'.

O/M3 maintained that once the core business was running efficiently then you can consider networking, *'The farm has to do a lot of its own internal work before it can look at the cross networking thing'*. The creation of new knowledge was also mentioned as a catalyst for network involvement, as was the bundling of resources,

'The folks that are interested in ecological agriculture are quite aware that they are not the big business of agri. If they are going to be green they have to do it in different ways and they need each other they can't do it on their own'.

O/M3 is actively involved in networking both locally and internationally and also runs a network for organic farmers, although *'it has no organisational structure. We get together for a few meetings in the Winter and have a field trip once a month on one of the farms, there is a workshop, and lots of opportunities for*

networking'. The local networks that O/M3 engages with include CSA [Community Shared Agriculture], EMERGE (same network as CC1 and CC2) and Everdale [a community teaching farm]. She also collaborates with local eco farmers to develop training programs and local community gardens. O/M3 valued the openness of information sharing within these local networks '*a small enough network that is informal people are open people can say what they say*'. Green knowledge transfer initiatives and green innovation capability enhancement were developed through the local network activities and the feedback transformed capabilities including process improvement, optimised crop rotation, sales and marketing collaboration and financial support. O/M3's view on networking is that,

'The farmers across the board have benefited from learning from each other, through networking and field days, now it's the new farmers and interns that go to field days... has been a huge support to a lot of farmers'.

5.2.4 Case Study 4 Synopsis – Hospitality Business, Canada

Canadian case 4 (OCC4) is a guest house which also included a self-catering basement apartment located beside a University overlooking the local golf club. O/M4 had a background in nursing prior to opening her guesthouse. She took a career break when her family were young and returned to work when the children left home about twenty years ago, working part time in a local nursing home. When the children left home O/M4 also turned the house into a Bed and Breakfast in the late 1990s.

OCC4 has no full time employees, as O/M4 is '*happy doing everything myself*'. She took on employees on an hourly basis for cleaning when needed but did not involve employees in the decision making process. The running costs of the guesthouse were low and, '*profits were steady*' and O/M4 believed '*I run business efficiently and I am frugal*'. O/M4 stated that she '*had all the resources needed*' to fulfil OCC4's strategic goals and was not interested in growing the business. If she needed advice she primarily sought it from within the family, '*...if I need more advice I ask my husband*'. O/M4 believed she was capable of

being innovative yet felt that there was no need to innovate as the hospitality business *'wasn't the only source of income'*.

Green Innovation Capability Development

O/M4 was unsure what the term 'green economy' meant and asked for an explanation, *'I'm not sure what it is, is it environmentally friendly?'* When clarified, O/M4 rated as important the integrating of green practices into the everyday operations of the business (green audit), while the external drivers of business success included financial impact of green initiatives and consumer preference. In particular, it was observed that giving the customer value and providing a quality service was important as O/M4 was focused on maintaining reputation, as *'business is mainly repeat business and by word of mouth'*. O/M4 felt that the OCC4 did not have an impact on the environment due to their small size, *'I only produce a small amount of waste'* and that her own ethos contributed to the environment, *'I am naturally green, did all the recycling'*. O/M4's perspective that there were *'no regulations'* related to this business was at odds with the existence of a number of regulations affiliate to that sector (Appendix G (f) – (l)). When this anomaly was raised by the interviewer O/M4 responded, *'I don't need to seek it [standards] out'* reinforcing her misconception that the regulations did not relate to her business.

Of note is that some green literature came through the post, *'In relation to getting information regarding the green economy it comes through the post'*, although it was unclear as to whether this information was integrated into OCC4's day-to-day operations. In relation to information sharing O/M4 said she liked to keep her business private and not share information with others outside of the business, *'I don't like to be seen looking for business...it would be like we need the money'*. O/M4 did not proactively seek green information, as she believed this was not important for the business (green audit response). O/M4 was also unaware of any green initiatives carried out by the network, although she reflected, *'I don't go looking for it'*.

Perceived Impact of Network Engagement on Green Innovation Capability

O/M4 is a member of two networks, the first of which is a local tourism network. O/M4 described herself as '*independent*' and '*did not want to be seen as looking for business*', so she decided to use this network '*for advertising the business*' at arm's length. She also joined a bigger national Bed and Breakfast network (BBCanada) with a strong online presence that organised sales and marketing campaigns and also operated an online booking system, so she could '*advertise online*'. This network had an annual membership fee. Members of the network benefitted from online learning videos such as, '*How-to videos on how to run your B&B, learn social media, book keeping, staffing*'. Participation in national promotion programmes and member presence on the network webpage detailed every aspect of OCC4's bed and breakfast, 'from bedroom, pictures, descriptions, your policies, recipes, directions, nearby attractions, testimonials' (Document review). O/M4 believed this network met her needs and business requirements. She explained that sales people from other networks contacted her when they were in the area but she wasn't interested in joining any others as, '*I have enough business*'.

Networking was also found to be beneficial from the social aspect, and as a source of value as a resource tool, business support and idea generation mechanism. '*I get ideas from other B&Bs on the wording they use to advertise their business.*' Where O/M4's skills and capabilities were lacking, for example, in web design, the network was an additional resource that provided a valuable function to the business '*the network sets up the website and makes booking easy to manage*'. Overall, O/M4 found NC1 to be a valued resource in terms of collaboration, information sharing and knowledge transfer.

5.3 Section 2: Irish Case Findings

This section presents the four Irish micro-firm case studies (OCI1-4), each located in the West of the Country. 37.3% of the population lives in rural areas (Census, 2016), where the community depends on micro-firms to provide the vast majority of employment, goods and services. As discussed in chapter 3, micro-firms account for 90.8% of businesses in Ireland (CSO, 2012), whose primary business is to service local markets. These firms are supported by a myriad of semi-state agencies, government and sector advisers and local community stakeholders, whose offerings are often channeled through facilitated networks. The Department of Environment, Community and Local Development (2011) outlined the important role that the green economy would have for Irish society and in consequence for Government decision making up to 2021, in accordance with EU policy. Emerging from such policy formulation, regulations have been established that help to avert water scarcity, manage climate change, contend with pollution problems and conserve natural resources. Enterprise Ireland has sought to encourage micro enterprise in fulfilling these requirements and their ‘Green Team’ help these firms ‘to incorporate sustainable practices into the day-to-day running of the business’, as ‘better environmental performance leads to improved resource efficiency and direct cost savings and can also increase access to customers who are increasingly demanding more environmentally friendly products and services’ (Enterprise Ireland Website, 2016).

5.3.1 Case Study 5 Synopsis – Recruitment Business Ireland

Irish case 1 (OCI1) is a training and consultancy recruitment business with a serviced office in Dublin, established in 2013. O/M5 has over 20 years’ experience in front line recruitment in Ireland and the UK covering Banking and Finance, IT and Healthcare sectors. He made the decision to establish his own business based on his desire to be independent and the perceived need for this type of service in Ireland, *‘I always wanted to do something for myself.... I also noticed a gap in the market that I felt I had the knowledge and skills to fulfil and*

it would be worthwhile'. O/M5 believed running a business was a 'lonely' occupation, *'you are working from home as opposed to working in an office; working on my own as opposed to working in a team'* and as such it was vital to have a *'passion, a love of learning and acquiring knowledge'* in order to build a successful business. However, it was also important to recognise when one needed expert advice,

'You've got to learn that pretty quickly otherwise you could go off on the wrong tangent ... and find out that you have wasted 3, 6 months of your time trying to build something that is not right. I wouldn't dream of being my own accountant, my own lawyer for example'.

The day-to-day running of the business was the responsibility of O/M5 as the sole employee. Resources were limited and time in particular was a challenge, *'You can kid yourself about how much time you spend working but when you break it down when can see how much you are doing and it is nowhere near that'*. Optimising sustainable business activity was also a dynamic process in the absence of employees, *'the thing with a single person business is what happens if... if you fall over and break your ankle, the business is scuppered until you get back on track'*. O/M5 recognised the challenges of a single-person operation and acknowledged that *'I probably need to have a second person at least to be able to contribute to that'*. A lack of internal expertise and difficulty in finding staff with suitable skills was challenging for OCI1, who acknowledged that, *'I took for granted all the help I had when I was working for others.'* O/M5 also realised that *'not having anyone to ask for advice or give advice to'* was an additional barrier to business success, a challenge that he returned too on a number of occasions in conversation,

'[Working for oneself] is completely different, obviously for me at the moment it is just a single person, but I am at the point where I will be taking on additional people. The company I left we had around 100 people with about 1000 contractors now, probably one of the biggest contractors in the West [of Ireland]. So 100 people down to 1 is a huge difference. I had prepared myself for the transition, but nothing can prepare for everything as it is completely different.'

However, O/M5 acknowledged that new staff would need to have the required expertise along with a perspective similar to his own, *'If I find someone else who*

shares the same values, shares the same expertise, has the same expectation about growing it [the business], that is the trick.'

OCI1s strategy depended on O/M5's underlying growth goals and the strategic needs of the micro-firm, *'The more I think about it, growth is what I am looking for, otherwise I will be here in the next three years doing the same sort of thing. That is probably not going to satisfy me at this stage'*. O/M5 highlighted that what was on the formal business plan may be very different to what actually happens, *'the traditional approach is that you do a business plan and it looks like a great plan, but getting the business plan implemented is much more challenging than I ever anticipated'*. The unpredictability and uncertainty in the market was also a fear expressed and this made it difficult to plan; *'I am booked up for the next 4/6 weeks. It is hard, you have the fear what if nothing else comes in after the six weeks.'* When contemplating strategy, the isolation of working in a micro-firm was evident, *'the fear of what is going to happen in the future'*. In response to these challenges, O/M5 regularly asked *'my clients for advice'* as *'it is a challenge deciding what the next step is'*, particularly in relation to business planning which he recognised as *'quite short term'* as *'there is a broad vision that changes all the time'*. Barriers to developing planning skills were also highlighted, as there was an acknowledged skills gap in this area of business development,

'No, the only sort of experience I would have had in the past with that [planning] was in putting together tenders, in the healthcare sector they would be very conscious of that. But designing my own business, it [planning] wouldn't be at the forefront'

A number of sources were used in the decision making process, providing a shared lens with stakeholders. In particular, family members were deemed a *'good sounding board and offered practical feedback'*, as *'I always find that the best person to give me advice is my wife'*. Based on the foregoing, there was an apparent willingness to leverage human capital from a variety of sources, *'the work that I do you tend to work very closely with managers and they will give me some help and advice.'* In response to what resources were required to build management capabilities in this area, O/M5 felt that,

‘... As a single person I get it (information resource) on the Internet. If I am working from home I will be at my desk at 7am, I will look at webinars that happened in America that night for example; you can play the replays in your own time.’

Green Innovation Capability Development

When seeking out business innovations, such as *‘ideas on how to market the idea, how to go about it’* O/M5 also sought advice from mentors, clients and managers as they would ‘critique’ the idea and *‘put it in a shape and form that could be marketed. There were also some very practical ideas that came from those sessions. I had my own ideas and other business models; I used the business model canvas’*. O/M5 noted that while getting advice in this way was relatively easy as he was *‘getting better at asking’*, implementing the advice was difficult due to lack of capability and resources, *‘The one thing that I didn’t comprehend how much preparation went into the training and delivering the training course’*. The findings also highlighted that a lack of internal resources mired the transformational process of training within the organisation, *‘Once I have done my three days that is about as much as I can do... I probably have not capitalised as much as I should have done and the problem is time. Three days out of five training it is hard to find time’*.

O/M5’s positive attitude towards the environment was echoed in his approach to business management and everyday operations of the business, tempered by an economic lens,

‘Yes, I would have always been like that [environmentally conscious], even working for other people. But now in particular when you have your own business you are very conscious. That has been my philosophy all along.’

‘For example when I first started every meeting I had in Dublin I would get in my car and drive to Dublin because it was what I always did. ...the train, it is amazing you can do your work and two hours later you are in the centre of Dublin. It is cheaper, greener, it was a cost and convenient issue the green side was secondary.’

In terms of external influencers O/M5 was not aware of any waste or environmental regulations that applied to the business, which is at odds with national and EU regulations relating to this sector (documentary review). A positive financial impact and consumer preference were the main external environmental influencers when contemplating the implementation of green strategies. O/M5 had previous experience which helped him develop the

resilience and management capabilities to respond effectively to these and other market needs, *'It's about being realistic, who is going to buy it, is there genuinely a market for it.You have got to be humble. The idea of entrepreneurs being vociferous and forceful, you also need some of that'*. O/M5 specified the need to develop his capabilities in order to sustain the business, noting in particular the importance of sales, marketing and finance capabilities,

'You have also got to have...Sales, in terms of asking the right questions, listening the right answers, listening is also something most people find harder, find this harder to admit to. You have got to have persistency, that you don't give up at the first sign of difficulty, the first 4/5 people that tell you no. You have also got to really like what you do, if you don't have a real grá [love] for it what's the point. I was really lucky I took the pieces I really enjoyed about the old job and turned that into a new job, having a real passion for you do, having multiple skills not multitasked. There is so much information out there you only have to look.'

O/M5 pointed to activities that could aid in OC11's development,

'But I would learn how to design a web page and you can do that easily, it's free, I can build a 4/5 page webpage in ½ hour. You learn that, you learn how to market your business in the right way effectively, you have got to learn that stuff really quickly and you have got to be able to apply it.'

However, O/M5's need to separate himself from the service he was offering in order to grow was challenging, *'you must be able to build the practice apart from one person'*, which could be linked to below anticipated growth levels evident in the firm. There was a perception that *'nothing can prepare [you] for everything as it is completely different'* in terms of market readiness, however O/M5 acknowledged that *'If I had someone who was getting out, banging the drum a lot more, showing people what I could do, obviously there would be a lot of potential to grow'*.

In the green audit O/M5 noted that environmental management skills were important but were not considered vital for the sustainability of the business (reflective diary), stating that *'we don't produce waste to start with.'* In relation to green innovation, O/M5 felt that they did not have an impact on the environment due to their small size, *'I am just one person. I don't produce waste'*. OC11 rated also quality management as important. In particular, it was observed that giving the customer value and providing a quality service was important. It was also

evident that incremental improvements were being developed in OCII in order to achieve green goals,

‘I print very little if anything, I give handouts at training but it is not a big thing. Very small in fact.’

‘I am working from home, all waste goes in to the domestic waste and I recycle what needs to be recycled. I don’t charge back any of that to the company, it hasn’t been a factor. Whether the virtual office in Dublin has anything like that they probably do, but I don’t get involved in that.’

Perceived Impact of Network Engagement on Green Innovation Capability

O/M5 was involved in two facilitated networks. The first was National Recruitment Federation (NRF), which organised breakfast meetings, an annual conference, training, workshops, advice, support, lobbying and garda¹³ vetting (Document Review). The Second was Business Network International (BNI), a business referral organisation that specialised in helping local business people meet new clients, learn valuable new marketing skills and increase sales through word of mouth marketing (Document Review). Neither of the networks provided specific information on green issues according to O/M5, however he believed that,

‘[Networking is] huge on all different levels, primarily on a personal level, for support and advice and to validate your idea –to tell you, ‘you are not mad, yes there is a market for that. [potential customers] would pay for that service. That was obviously the key piece, but also ideas on how to market the idea, how to go about it, they would also critique it, and put it in a shape and form that could be marketed’.

The transformational process of innovation capabilities also appeared to be aided by network involvement, ‘*I would share that with my mentors and they would give me advice and thoughts around it and help to shape it for the future*’. Working with different types of networks for different purposes was also found to be beneficial for building and sharing resources that are lacking in the micro-firm, as ‘*working with more people will bring more revenue in.*’ The importance of informal networks was also seen as important for discussing issues and finding out what was happening locally,

‘I do it very informally. I didn’t really use any formal networks, it was all informal workers and people I had worked with previously, my previous MD [Managing Director] - I would have approached about what I was planning on doing and they are still my

¹³ An Garda Síochána (Garda) is the national police force in the Republic of Ireland

biggest client. I call in favours from other people that I would have worked with, to ask advice. I had a lot of conversations with people in the National Recruitment Federation which is the national umbrella organisation for the recruitment industry in Ireland.'

From a local perspective, O/M5 also found that he would attend network events '*just to be seen*'. O/M5 highlighted how the network environment can be a resource in validating ideas and for providing a path to implementation, '*While I have proven in my own mind that I can do the work to an extent, there is a market, there are people who are prepared to pay for that. But now what is the next step?*' Network involvement helped with this process, '*I would have spoken to people in the organisation and told them about my plans to try and validate my idea and I would have got good feedback from that*'. O/M5 valued the knowledge contribution from the wider network membership, '*I had a lot of conversations with people in the National Recruitment Federation.*' and he relied on the network members input to transform knowledge into innovation, '*I think community helps understanding that your idea might not be the best, you might have to tweak it, and you might have to do something that you weren't necessarily considering that is a big learning point.*'

5.3.2 Case Study 6 Synopsis – Artist, Ireland

Irish case 2 (OCI2) is an art business started in 2008, and focused on painting. O/M6 was born in Spain and holds a Bachelor Degree in Fine Arts, Painting from Seville University Spain and a Higher Diploma in Teaching, with a focus on art. She now lives in the West of Ireland. She works from and rents out her art studio, which is located in the garden of her house and was built using recycled material and the labour was carried out by her husband and friends. O/M6's business included selling her art, teaching art, community art work including organising events and festivals and organising art tours to Spain. Business was volatile, with low sales in the winter months or during economic downturn (e.g. 2008-2011 in Ireland), so this combination of business activities ensured a sustainable income,

'No artists sell any more, nobody buys anymore. Paintings are being stored, you end up giving them away. I don't think even the most famous artists live off their art. It is hard if you don't have an income coming in.'

Being an O/M came with challenges, *'everything is hard'* and optimising work-life balance was a dynamic process, *'Do you want a 9-5 job? [No]. But I wish sometimes I had something regular. But that is the problem for all artists you decide do you want to do art or do you want normal wages?'* As the sole employee in OCI2, running the business was considered a 'lonely' occupation, as *'people find it hard if they are introvert but some like performing. It is hard. You need people'*. There was an underestimation of how much time each task required, *'When you are an artist you are on your own. It is very hard to get the time if you don't have your own studio. Artists don't want to work with anyone else'*. On the one hand, the flexibility of running her own studio afforded O/M6 the independence of working for oneself. However, this needed to be measured against the certainty of having regular work, as *'with the studio it is hard to see how many people are coming'*, so *'there is a thin line between when you are working and not working as an artist'*. The day-to-day running of the business was found to come first when contemplating the configuration of OCI2's business model, *'I wish I could paint and do my own things, but I rent out the studio so it is not mine anymore, it is for the classes.'*

Green Innovation Capability Development

O/M6 was open to *'learning from all corners'*, tempered with a realisation that formal training also has a value, *'I wish I could go back to college and learn other forms and look at art in a broader way'*. However, she acknowledged the challenge of fulfilling these professional development goals in unison with running a micro-firm, *'You don't have the peace of mind nor the space mentally to create'*. Limited available resource appeared to limit innovation within the business, *'I don't think I have been creating anything for the last 15 years'*, despite the fact that *'art keeps changing'* and ideally OCI2 should be evolving to meet this change. A perceived lack of financial support and funding was also found to be challenging, *'it is hard to get the funding, and all that is left is a photo or video. Performance art has much more to do with sculpture 3 dimensional'*; *'You are using your own money which we don't have... It is hard if you don't have an income coming in'*. Thus, access to and availability of resources was an influencing factor in supporting innovation capability

development in OCI2, as *'it takes a long time to put together an exhibition. It is possible to join other artists, but there is no space locally to run it.'*

In terms of environmental influencers, the green economy was a new term, *'I'm not sure what you mean by that?'* O/M6 was not aware of any regulations that impacted the business, a view that was at odds with existing Irish and EU legislation relevant to micro-firm operations. In the green audit O/M6 believed that energy/ green skills were not important, as they *'produce very little waste'*. Of note is that O/M6 was visibly environmentally conscious in her business operations, the studio was built using recycled materials and the products and art pieces used from festival floats and animation shows were also produced using recyclable material. While these activities pointed to a natural environment orientation, external drivers for green policy adoption also included positive financial impact and consumer preferences.

When contemplating the sustainability of her business and in particular, green innovation activities, O/M6 spoke of the challenges of being an artist, a business person and a mother,

'So I don't have the time or the space, with family commitments. You need a lot of space in your own head and you don't have that when you have a family. I talk to other artists and it is the same for everybody. When the children come and you have a family life, the art goes out the window'.

O/M6 viewed business development as *'long term'* but the unpredictability and uncertainty of the art market was a source of 'fear' within OCI2, and this *'made it difficult to plan'*. While O/M6 rated business development as average (green audit), on observation, marketing was primary through word of mouth and also through engagement with the facilitated networks.

Perceived Impact of Network Engagement on Green Innovation Capability

OCI2 was a member of network set up by the Irish Art Council, which is part of the local County Council in Ireland. The network provides a space for artists to meet and collaborate and offers help with funding, resources, and innovation

projects. It works with artists of all disciplines (painters, musicians, dancers, writers, actors etc.) and communities throughout the county on a variety of programmes and projects. They carry information on local, national and international events and opportunities on their Facebook page and Twitter (document review). OCI2 found this network involvement proved beneficial in building and sharing resources and transforming knowledge into innovation, *'I am creating an idea for the 1916 Rising, I have fantastic musicians and other artists'*. O/M6 gave another example to explain the value of network engagement to her and her business,

‘When I started doing crocodile project I wasn’t sure if it would work, my friends and family said it would. But I met another person and asked his advice, he sat down and it started from there... We were able to get funding. Collaboration is very important.’

Human engagement through network activity was also highlighted as important for building the business, *'It is good for meeting people, it is helpful for coming up with new ideas and meeting other artists'*. O/M6 perceived the networks to be the only resource for idea generation and innovation capability enhancement,

‘...there is a local meeting coming up looking for new ideas for 1916 celebration so I will go along to that and try that way. Documentation is vital, a little demo of what I would like to do.’

The transformation process of green innovation enhancement was observed in the use of recycled material for producing products, props and artistic reproductions in collaboration with other artists in network supported art projects and festivals.

5.3.3 Case Study 7 Synopsis – Agriculture, Ireland

Irish case 3 (OCI3) is a farm in the South West of Ireland, specialising in dairy farming. The son of a farmer, O/M7 *'started off in banking, I studied in economics and law'* before returning to the family firm, after which he *'did a farm management course'*. The farm operation had three full time and three part time employees as well as O/M7 and there was a strong focus on employee development and motivating staff to manage and develop their own capabilities,

‘With regard to staff we give them time off, we give them beef when we kill animals, firewood, they can use the machinery for their own use on their own farms. I have a policy if you look after the staff they will look after you. It incentivises them to work’.

The relatively high costs associated with running the micro-firm was a challenge for optimised business development, *‘the water rates, and insurance, all that is through the roof’*. O/M7 also believed that there should be greater support from funding sources for small firm operations, *‘Banks should be more appreciative of what farmers are doing, the co-ops, Kerrygold, they have tough credit systems which makes it hard for farmers. The targets may be difficult to achieve’*.

Green Innovation Capability Development

O/M7 rated it ‘important’ to integrate green practices into the everyday operations of the business (green audit). He also rated all green strategy skills as of average importance including green auditing, government policy, and sources of funding support, quality management and developing a green policy. The external drivers for green innovation in OCI3 included fulfilling regulations, positive financial impact and consumer preference. O/M7 was aware of the regulations relevant to the industry sector and rated green strategy skills and waste management skills as important to very important in the green audit. He knew exactly how much waste was produced by the farm and had also come up with innovative ways of treating the waste according to regulations,

‘We produce 2 ½ million litres of slurry every year which goes into a lagoon into a tank and is then spread on the land. We cannot spray slurry from September to January in this part of the country’.

Regulations also improved the micro-firms absorptive capacity and green innovation capability development in OCI3,

‘All the plastic is put in on spot and we pay to dispose of it. If we use chemical sprays they also have to be disposed of properly. There are environmental regulations across Europe, if you don’t follow it you are penalised’.

However, O/M7 felt crippled by existing regulations, believing there was no compensation for an organisation’s size in terms of regulatory requirements. O/M7 noted the difficulties in finding information in simple/ accessible language

that they could understand, *‘most farmers, in particular small farmers don’t understand the terminology or understand what they need to do’*.

O/M7’s environmental orientation was conducive to the application of green methods in OCI3, *‘We don’t use GM foods other countries do, we don’t use hormones. The natural method is the best; the hormones speed up the process’* and he was open to learning, *‘if you have an open mind you can learn anything’*. However, green innovation was perceived as a cost by O/M7 and this was an influencing factor in the application of green initiatives in OCI3, *‘we have looked at solar panels but it isn’t economically viable for us, everything has to have an economic benefit for me to do it’*. O/M7 also believed that there was potential for support organisations to promote more ‘green’ or energy efficient approaches in micro-enterprise (Appendix G (k)),

‘We do our part but, the County Council¹⁴ doesn’t do their part. All the water is flowing into the rivers and they have no filtration systems in place. We sew to reap and we look after the environment and give something back’.

Frequent engagement with external knowledge resources, particularly in relation to network engagement helped generate ideas and ultimately capability enhancement, *‘I have a pond filtration system the size of Croke Park [one of Ireland’s national Sports arenas]’*. Knowledge transfer and social interaction also improved the absorptive capacity in the innovation process of OCI3, *‘We got the idea in Germany, it is a system of a group of lakes that the water passes through’*.

Perceived Impact of Network Engagement on Green Innovation Capability

OCI3 was a member of a number of different networks and forums, including Teagasc, Bord Bia and Glanbia (see appendix H for an overview of these networks). The networks regularly organised training, marketing workshops, provided online and paper based information resources, and offered green innovation, knowledge transfer and mentoring supports, *‘Teagasc regulate and facilitate the forums’*. The benefits of being a part of a network and the value of the network as an additional resource for OCI3 was echoed in the findings and

¹⁴ A county council is the elected administrative body governing an area known as a county.

internal documentary evidence, *‘they do everything. They organise training, mentoring, advice ... One group focuses on farm management other on grass management’*. O/M7 described network engagement as a *‘huge’* influencing factor for survival, growth and support for the firm, *‘Glanbia do the marketing, but you have to be a member’*. Networking was also found to be beneficial from the social aspect, and as a knowledge source and idea generation mechanism. Structured social interaction was believed to be vital for capability development and knowledge transfer initiatives in OCI3,

‘I have 4/5 farmers that I talk to every week. We talk about the macro economic issues, what’s happening in China, Ukraine, and Tunisia. How it is going to impact on us. Same as banks, ECB [European Central Bank], the economy is not doing as well as it should’.

The agriculture networks were proactive in organising and delivery green innovation workshops, and in helping farm businesses to meet environmental regulations (document review Appendix G (c), (d).) *‘Glanbia email us with a monthly bulletin of what is going on, Teagasc do the same thing. It is not obligatory to get the emails’*. There was general recognition that *‘[micro farmers] find administration very difficult and the regulations are killing it’*, reinforcing the value of the network in helping these micro-firms fulfil their regulatory requirements. The networks also provided information on funding, resources and information relating to green initiatives. OCI3 also helped to educate other network members on waste reduction initiatives in order to meet energy regulations,

‘I also help other farmers, with finance and grassland management. They are not in the group; they are in a different part of the country. I do this voluntarily and feel I am giving something back. Teagasc¹² would have been trying to explain it to them for the past 20 years. I could explain it to them in 20 minutes. Farmers find administration very difficult’.

5.3.4 Case Study 8 Synopsis – Retail Business, Ireland

Established in 1990, OCI4 is a retail discount business in the North West of Ireland. O/M8 had a second level education with previous experience in the retail sector through a family business before establishing his own firm. He employed two full time employees, and he believed that, *‘[the] challenge is to keep the staff*

happy'. O/M8 expressed concern about recruiting appropriate staff in a competitive employment market and that even when sourced, *'it is hard to get staff you can trust'*. O/M8 noted that customers need to be assured that they would receive the same service whether it was the O/M or any other member of staff providing the service, but that, *'it is very hard to get staff with initiative'*.

O/M8 professional approach presented a mix of experience, adaptability and initiative traits in relation to business activities as well as an action-oriented approach to learning, *'I learned it on the job, my dad would be very personable, very shrewd, clever, and he passed that on to us'*. When contemplating the capabilities needed to sustain OCI4, O/M8 was of the view that, *'buying and selling at the right price is very important, a charming personality'*. Building and maintaining reputation was also an important capability to the micro-firm, *'We have been in business a long time and we have a good name, we are a good payer and we are known as a good business'*. Customer satisfaction also featured strongly as a catalyst for change, and his motivation was, *'keeping customers happy'*. Indeed the advantage of the micro-firm's small size was highlighted as a valuable asset, especially given the proximity of O/M8 to his customers,

'... looking after your customers well, by being there yourself and keeping a good handle on the business is the most important thing. We look after our customers well and we keep the shop well stocked. When customers come into my shop looking for 1 thing they leave with 12'.

OCI4 were not concerned with growing the business. Planning in OCI4 appeared to be somewhat informal and O/M8 displayed the inherent dynamic capability to rapidly respond to change, based on evolving customer needs. Equally OCI4 showed that they were proactive in gathering strategic intelligence, using employee involvement initiatives, *'if the customer asks for something we write it down'*. O/M8 also involved employees in the decision making process and found them to be a good source of innovation. He reinforced the importance of leveraging human capital in this way and that having the employee as a resource in the micro-firm depended on their own initiative, *'they generally will do what you ask them for example if I ask to tidy a shelf they will do that but they don't have the initiative to sweep the floor or do something extra'*.

Green Innovation Capability Development

When discussing the concept of the environmentally friendly business activities, O/M8 mused, *'I am ashamed to say this but I would not be aware of any green issues'*, although he said he would like to know more if it impacted on the *'bottom line'*. He was of the impression that green regulations were not a factor in the business, *'There are no regulations regarding waste management that I am aware of. That's probably why I am not aware of them'*, despite the existence of relevant EU and Irish regulations pertinent to that industry (document review) and specifically relating to the packaging referred to by O/M8 in conversation, *'I would have a lot of boxes, packaging'*.

O/M8 rated green skills as 'unimportant' and believed they did not need to be integrated into the everyday running of the business (green audit), noting, *'I presume the local council might [offer green data], but I am not aware of it'*. When asked about how much waste was produced by OCI4, O/M8 stated, *'I would not know how much waste I produce. I would have a lot of cardboard that would be my biggest waste'*. In this case, O/M8 believed that green innovation *'would not be a factor in the business'*, although in later conversations, he amended this view to state that *'green innovation is important to me if it saves me money, if it doesn't it isn't a factor... The sole factor for me is if it impacts the bottom line I will do it, otherwise I am not consciously environmentally aware'*. On observation, ad hoc approaches to green initiatives were engaged by OCI4 if requested by a customer. This was reinforced in O/M8's view that, *'If someone comes in to the shop and looks for something, no matter how insignificant you think it is, I write it into the notebook. If it's not in the store we go looking for it'*. These first-hand requests from customers appeared to influence adoption of green initiatives if encouraged by his clientele.

O/M8 believed the role of employees in the green innovation process was also important and that capability enhancement in particular required employee willingness to share and obtain knowledge, which enabled the firm to improve their green innovation capability. However, O/M8 was very cautious not to share new ideas with employees and especially not external network members, *'You*

have got to be careful who your source is, I don't want to set up anyone else in business and you have to be careful about how much your staff knows because they could end up setting up next door to you'. This presented an anomaly between O/M8's expectations regarding his employees willing to share and his own actions.

Perceived Impact of Network Engagement on Green Innovation Capability

While OCI4 sought outside business advice, this was primarily through informal networks and familial ties, *'We [the family] are all in the same line of business so we ask each other for advice'*. OCI4 also displayed a protectionist view in terms of information sharing and knowledge transfer, depending on these familial ties for new information and knowledge sharing, *'I don't like to share information, but I have other family members who are all in business, we meet up and discuss our business and share it together'*. Trust in this family network created a sense of security in context, *'we network among ourselves, advise each other and we keep it among ourselves'*.

O/M8 was involved in local networks including Chamber of Commerce, Comhaltas Ceoltóirí Éireann¹⁵ and the local GAA club. Despite initial reservations, these networks proved to be a source of value as a resource sharing tool, business support and idea generation mechanism. Structured social interaction was believed to be vital for capability development and knowledge transfer initiatives in micro-firms, *'Other business owners come into my shop and we discuss issues and that happens every day so we keep an eye on things and we know what is going on'*. O/M8 also found value in contributing to the local business community on a voluntary basis, even if this contribution did not directly impact the business,

'I am involved in the local chamber of commerce. When you live in a small town you have to. It is very important that you support your local chamber because word gets out which businesses didn't support it. No matter how much you think you are getting out of it, I will contribute to St Patrick's Day float, Christmas lights'.

'I would support the local GAA [sports] club very strongly and have always given them raffle spot prizes, and help them out; then the parents of the kids will support us because

¹⁵ Comhaltas Ceoltóirí Éireann is the primary Irish organisation dedicated to the promotion of the music, song, dance and the language of Ireland.

we support them. I will also support the local soccer club, which I have no interest in but the parents are my customers’.

Networking was also found to be beneficial from the social perspective, *‘Sometimes it is costly but the local bars, local dance school are all my customers and would support them. Networking is very important even informal and social networks’* and O/M8 used network involvement to embed himself in the local community even if he were not receiving anything noticeable from it, *‘I am not local to the town but you need to embed yourself in the local community and support local activities, local charities’*.

5.4 Section 3: Facilitated Network Support Structures

Four facilitated network coordinators were interviewed as an aspect of this research, two in Canada (NC1 & NC2) and two in Ireland (NI1 & NI2). NC1 is a non-profit green network, focused on the principles of ‘*living lighter, living richer*’; NC2 is an innovation centre offering shared office space, mentoring, funding and training NI1 is a local enterprise office with 31 teams located around the country providing advice, information and support for starting up or growing a business and NI2 is a government-funded facilitated network focused on the development of the agricultural sector in Ireland. All of the micro-firm cases were involved with one of the facilitated networks (see Table 17).

Network	Focus	Case involved
NC1	Non-profit green network, focused on ‘living lighter and living richer’	OCC1, OCC3, OCC4
NC2	Offers shared office space, mentoring, funding, training and workshops to all business sectors	OCC1, OCC2, OCC3
NI1	Provides support, training and funding to the small and micro enterprise sector	OCI1, OCI2, OCI4
NI2	Facilitated network focused on the agricultural sector	OCI3

Table 17: Networks and Associated Cases

OCC1 and OCC3 were members of NC1. OCC1 used the shared office space at NC1 while OCC3 collaborated with NC1 on workshops and events. OCC1 was also involved as a home advisor and volunteered as a mentor and an advisor on green issues for NC2. OCC2 received information from NC2 and actively promoted energy saving initiatives. OCC3 collaborated with NC2 and stated that it helped to ‘open doors’ for eco farmers. OCI1, OCI2 and OCI4 were all members of NI1. OCI2 and OCI4 collaborate on events with NI1. OCI1 and OCI2 attend training provided by NI1. OCI3 was a member of NI2, receiving advice on sustainability, funding, training, marketing and collaborates with NI2

on farm visits and mentors other farmers on sustainability and filling out forms for funding.

Networks in both jurisdictions provided information on funding, resources and information relating to green initiatives, which helped micro-firms '*learn how to use business as a source for social good*' (NC1). For example, NC1's offered a programme called 'Bio enterprise Seed Funding Program' which O/M3 collaborated on, targeted at agriculture/ agri-food, sustainable and environmental technology sectors. O/M3 also collaborated on green events including NC1's 'Annual Sustainability Social' to 'learn, collaborate with and celebrate the growth of the locale's sustainable business and social ecosystem' (event paperwork). The event encouraged knowledge transfer and networking with entrepreneurs, government leaders, special guests and sustainability experts. Similarly in the Irish case, O/M7 collaborated with NI2 as an advisor, and mentor to other farmers. NI2 acted as an information provider for the sector. As articulated by NI2,

'There is always an environmental side to the information sent out and the discussions e.g. pesticides, not wasting fertilisers – having optimum use, not putting it out randomly. Environmental element is more pronounced with the lower scale farmers, the product they are farming is the environment' (NI2).

While NI1 had yet to provide a specific workshop on green initiatives, it regularly provided online information on packaging regulations, WEEE – Retailers, litter management, battery recycling and tyre recycling online and in leaflet form. All networks provided information on the green economy. In the Irish agriculture network (NI2), the environmental side was incorporated into all information disseminated and was embedded in discussions with farmers. The enterprise network in Ireland (NI1) had run some information sessions on the green economy, '*We give advice on local authority regulations, planning, accessibility, environment, procurement and other issues affecting your business*' (NI1). NI1 also offered a link on its website to greenbusiness.ie – an online resource provided by the Irish environmental protection agency (EPA) to help businesses become more energy efficient and save money (document review).

While green information was regularly distributed and available on network and government support agency websites, the observed networks were primarily in their infancy in relation to providing targeted workshops on green innovation initiatives (Documentary evidence Appendix G (b)), with the exception of the agriculture sector in both jurisdictions. These networks were more mature and exhibited proactive and vigorous activities in providing both information and face-to-face support to assist the micro-firms in reaching regulations and standards by providing resources and information pertinent to micro-firm green innovation capability development,

‘Teagasc brings [the] county council along for talks to ensure that people policing [regulatory fulfillment] are approachable to farmers, no barriers to communication, open discussion, relationships good, treated fairly’ (NI2).

In addition to the above information sessions, green initiatives such as ‘*Food Harvest 2020*’ (Documentary evidence, Teagasc Ireland) helped build awareness and provided support structures to facilitate green innovation within member firms, ‘*there is a huge training element from this Autumn to next Spring over 1400 farmers in this county partly class based/ farm based. 80/ 90 courses will be delivered over next 6 months*’ (NI2). Networks also provided information on funding available for innovation initiatives for green business (Documentary evidence Appendix G (d); NC1; NC2; NI1; NI2, www.greenbusiness.ie), while in the Canadian context, NC1 operated a business boot camp for micro, small and medium enterprises, one aspect of which was to help micro-firms address their environmental impact. NC2 also runs a green workshop initiative called B Corp Bootcamp, where participants can learn business sustainability basics and the ‘ins-and-outs’ of B Corp certification in this workshop, building on the network ethos,

‘The network believes that in finding innovative and practical ways to live more sustainably, one can live more richly: a more vibrant and sustainable local economy, healthier ecosystems and an improved quality of life for everyone’

However, in the absence of regulations, the onus was on the individual to demonstrate green innovation in their micro business (NI1) and to look for the information specific to their industry. It was also the O/M’s responsibility to find

the necessary funding and resources. Thus, the primary focus of the networks (NI1; NC1; NC2) was to mentor O/Ms on the capabilities needed to run their micro-firm and provide information and resources to build awareness of green impact and encourage green initiatives in these businesses.

5.5 Section 4: Cross Country Findings

This cross-country research enables comparison and replication between country-level findings and reduces the risk of country-specific results that are not transferable to other countries. As Reynolds (1991, p. 245) argues,

‘Finding the same empirical patterns in different countries provides evidence that the same explanations of phenomena have broad empirical support and, hence, deserve greater confidence for applications in any one situation’.

By carrying out a cross-country study of Ireland and Canada in this study, it was possible to examine activity at multiple levels (individual, firm, network/industry, country) to identify the drivers and influencers of green innovation guided by OMs within the studied micro-firms.

Overall there appeared to be more similarities than differences in Ireland and Canada in relation to the O/M’s motives, actions and intentions in their collaboration with facilitated networks. It was also evident from the cases studied that the O/M in each country had a direct impact on the micro-firm environmental orientation and culture and hence on green innovation capability development. The micro-firms in both countries experienced similar resource constraints consistent with their small operation size and limited human resource, and the primary strategic goal in all cases was one of survival. The drivers to change as influenced by external green influencers were equally similar, with the underlying theme of economic gain evident in all cases as a key driver, coupled with customer preference and fulfillment of regulatory/ legal requirements. From an Irish perspective it was considered unnecessary to integrate a green mindset into operations, bar O/M7 (the agricultural producer). The other three Irish participants found it unimportant to integrate green initiatives, whereas all four Canadian cases rated it from important to completely important in the green audit. There appeared to be a pattern with country-level respondents in both countries, as they highlighted money/costs and ‘bottom line’ as catalysts for green engagement and rated integration of green as largely unimportant for their day-to-day business operations.

Cases in both countries agreed that networks were a valuable resource and in most cases where the O/M was the only employee, networks were deemed a key resource for leveraging information and knowledge, enhancing capabilities and encouraging innovation. Networks in both jurisdictions provided information on funding, resources and information relating to green initiatives. However, there was a lack of access to information in simple language, specific to the industry sector and with reticence to the size of the firm in both countries. The primary focus of all four networks was to mentor O/Ms on the capabilities needed to run their micro-firm and provide information and resources to build awareness of green impact and encourage green initiatives in these businesses.

The agriculture sector cases in both countries showed how the O/Ms actively pursued regulatory green initiatives dependent on the level of regulation specific to the sector. The O/M from the agricultural case in Ireland stated that they were crippled by regulations in comparison with other countries. In contrast, the agriculture case in Canada mentioned that the regulations were not strict enough, suggesting a cross-country difference between O/M NEO within the agricultural sector. In all other cases the O/Ms perceived they did not have an impact on the green economy due to their minute size and they were not aware of any environmental regulations that were relevant to their firms, despite the existence of relevant environmental regulations that required action on the part of the O/M in each case to ensure compliance. In all cases excluding the agricultural sector, O/Ms knowledge on green issues and the terms green economy and green innovation were unknown terms, although there was a general understanding of what the words meant. In both countries the O/Ms did not proactively seek out information on green innovation unless it was a regulatory requirement, customer request or was going to have a potential economic benefit to the micro-firm.

It proved very difficult to get industry-specific environmental regulations in each jurisdiction, and no central repository appears to exist in either country to the best of the researcher's knowledge (virtual and physical documentary review). Collectively, the environmental websites in each jurisdiction listed all of the regulations, but for a micro-firm to find out what was relevant to their specific

sector and/ or size of business, it was not clearly outlined in simple specific terminology (documentary evidence - Appendix G (f)-(l); respondent perspective - NI1; NI2; NC1). Thus, the onus was on the individual to identify the regulations that applied to their specific industry sector (NI2).

Based on these findings, the emergent themes are summarised in Table 18.

Emerging Theme	Findings
Internal catalyst for green innovation capability development	<p><i>O/M Attitude & NEO orientation</i></p> <ul style="list-style-type: none"> - All participants were of the view that they produced little waste based on perception as opposed to exact measurements. - Evidence pointed to an owner-led firm culture in each case. - There was a correlation between the O/M's NEO and their attitude towards a need for environmental management skills. - The O/M's NEO also dictated the existence and level of green initiatives within the micro-firm as a catalyst to leverage internal human capital. <p><i>Internal operations</i></p> <ul style="list-style-type: none"> - Constrained resource (e.g. time, expertise and finance) was a perceived limiting factor in pursuing green innovation in the micro-firm, which O/Ms believed could only be pursued if the business was running smoothly. - Green innovation was perceived as a cost that required a monetary gain or customer drive to be adopted. - Evidence pointed to limited capability in planning. - Planning was primarily informal and unpredictable market demand made it difficult to plan. - All Canadian cases found it important to integrate green into micro-firm operations, whereas only one of the Irish cases rated this factor as important. - Progressive micro-firms depended on internal human capital and close family ties to develop sustainable business plans. - Employee willingness to share and obtain knowledge enabled the micro-firm to improve its green innovation capability.
External catalyst for green innovation capability development	<p><i>Regulation</i></p> <ul style="list-style-type: none"> - Some participants were not aware of regulations affiliate to their business sector. - Technical/ inaccessible language used in green literature was a barrier to information /knowledge transfer. - It was perceived by all respondents that the onus was on the individual to identify regulations that applied to their specific industry sector. - In Canada, a number of respondents believed that the regulations were too low, whereas in Ireland a number believed they were prohibitively high. - Some respondents believed that regulations improved the micro-firm's absorptive capacity and green capability development. <p><i>Market dynamics</i></p> <ul style="list-style-type: none"> - Customer preference/ demand was a key catalyst in the adoption of green

	<p>initiatives within the micro-firm.</p> <ul style="list-style-type: none"> - Close proximity allowed for green capability development in liaison with micro-firm customers.
Perceived impact of network engagement on capability development	<ul style="list-style-type: none"> - A source of information on green regulations in an accessible language. - Training and development needed to be targeted at immediate business needs to enhance green capability development. - Knowledge sharing/ feedback offered a catalyst for idea generation/ honing business ideas. - Offered a 'shared lens' when developing a green strategy. - A protectionist view by some participants towards knowledge sharing acted as a barrier to capability development. - While sourcing advice was relatively easy within the network, implementation within the micro-firm proved difficult due to lack of internal innovation capability and/ or resources. - Network engagement proved important in transforming knowledge to green innovation capability by sourcing external expertise and/ or resource. - Promotes green initiatives at community and micro-firm level. - Helped alleviate sense of isolation among some O/Ms. - Restricted members/ closed networks created a barrier to wider engagement, potentially restricting access to new knowledge.

Table 18: Emergent Theme from Findings

5.6 Conclusion

The aim of this research was to investigate the perceived impact of facilitated networks on green innovation capability development in the micro-firm. A lack of resources experienced by micro-firms was evident, which acted as a barrier to internal capability development. The supports for identifying and sourcing the resources required and developing the capabilities needed to implement strategic plans proved challenging. The involvement of the micro-firm in a facilitated network was found to have a number of benefits including access to information, training and development, support for idea generation, an accessible knowledge resource, and as a means for transforming knowledge to green innovation capability by sourcing external expertise and/ or resource. In summary, a number of new findings emerged that were not evident in the extant literature. Firstly, the O/M NEO impacted on the existence and level of green innovation in the micro-firm. Secondly, it was also found that the O/M needed to be content with how the micro-firm is running before it could consider implementing additional green innovations into the firm. Thirdly, it was established that a large gap existed

between green innovation ideas generated/ honed through network engagement and obtaining the resources and capabilities to put the ideas into action in the micro-firm. Finally, green innovation was largely associated with business performance-enhancing agendas by the O/Ms and the pursuit of greater revenue or reduced costs was a primary catalyst for adoption. The following chapter discussed the findings in relation to the perceived impact of networks on green innovation capability development in the micro-firm.

Chapter 6: Discussion Chapter

6.1 Introduction

The purpose of this chapter is to explain the implications of the findings in light of the literature and conceptual framework (Chapter 3, Figure 2), and in pursuit of the research aim and objectives. Literature-led themes form the basis for the interview template (appendix A), while the findings expose alternative and additional themes relating to the study. A discussion of the significance of these findings is presented, followed by their compatibility with, opposition to or as an addition to the literature highlighted. The final section of this chapter focuses on the refinement of the innovation capability framework to help determine the key criteria for green innovation capability development in the micro-firm environment.

By adopting a combined resource-based/ dynamic capabilities perspective, this research acknowledges that resources alone are not enough to create sustain green enterprises, they need to be leveraged and exploited through capabilities (Eisenhardt and Martin, 2000; Grant, 1991). This study explored the underlying capability and resource structure which might support the green innovation process in a micro-firm setting (Siguaw *et al.*, 2006). In particular, this study assessed what resources and capabilities each micro-firm focused on to facilitate its capacity to innovate on a continuous basis (Slater, 1997) as opposed to only emphasising single or isolated innovation episodes, in order to sustain success. The O/M green innovation capability development contributes to the sustainability of the micro-firm and aids its capacity to engage with and contribute to the green economy.

6.2 Summary of Key Research Themes

This research study has exposed important insights in the area of green innovation capability development in a micro-firm environment (chapter 5, table 18). Specifically, the reported study shows the extent to which the O/M

underestimated the core professional and personal skills (OCC1; OCC2; OCI1; OCI2) required to operate a micro-firm (Matlay 1999), “*I thought I had some experience, but I had no idea*” (OCI1). Mainly from an Irish perspective (OCI1; OCI4) the results highlight that some O/Ms found it unimportant to integrate a green mindset into operations. While a ‘green mindset’ was not referred to in the extant small firm literature, the studied Canadian case companies exhibited this trait more than their Irish counterparts. This enhanced the value of a cross-country study, possibly showing cultural or O/M orientation differences between the two countries. It is also of interest to note that green strategy skills were largely associated with a business performance-enhancing agenda (OCI3; OCI4), reinforcing the findings of relevant national government agencies (Eco Canada, 2010). However, evident in the literature and the findings was the attitude and mindset of the O/M, deemed critical in influencing the green orientation culture and ultimately, the green innovation capability development in respondent firms (OCC1; OCC2; OCC3; OCI2; OCI4; Papagiannakis *et al.*, 2014; Bar, 2015).

The micro-firm strategy appeared dependent on the underlying goals and NEO of the O/M (OCC1; OCC2; OCC3; OCI3; OCI4) and this strategy is primarily informal in nature. It was shown that some O/Ms perceive themselves to be innovative yet choose not to grow (OCC4; OCI4). Similarly a growth strategy appeared dependent on the O/M mindset; “*The more I think about it, growth is what I am looking for, otherwise I will be here in the next three years doing the same sort of thing*” (OCI1). In either case (growth or subsistence/ lifestyle focus), O/Ms had a fluid almost emergent approach to business planning (OCC3; OCC4; OCI1; OCI2); a finding consistent with the literature (Reinl, 2011; Phillipson *et al.*, 2004; Storey and Cressy, 1996) and a key component of micro-firm strategy planning (Kelliher and Reinl, 2009). The findings outlined that the O/M applied a ‘dual continuous relationship- between employee, customer and family network’ (OCC2; OCC3; OCI1; OCI4) and appeared to respond more quickly to market changes than their larger counterparts (Simon and Houghton, 2002).

Of note are the challenges perceived by the O/Ms in accessing external support and business advice specific to their organisational needs (Davies, 2013; Faherty and Stephens, 2014; OCC1; OCC2). This has been particularly important given

the uncertainty associated with the day-to-day running of the micro-firm, “*With the studio it is hard to see how many people are coming*” (OCI2), “*It is hard, you have the fear what if nothing else comes in after the six weeks*” (OCI1). The findings confirmed that the studied micro-firms (OCC1; OCC3; OCI1; OCI2; OCI3) demonstrate an ‘openness to an active learning culture’ (Eisenhardt and Martin, 2000; Teece *et al.*, 1997; Zahra *et al.*, 2006), and are open to embracing strategies and structures that might support green innovation. The findings also highlight an additional barrier experienced by some O/Ms in the caution demonstrated in sharing new ideas (OCC4; OCI4) with employees and external network members (Huggins, 2010).

The findings (OCC1; OCC2; OCC3; OCI1; OCI2; OCI3) demonstrated a perceived lack of resources limited green innovation capability development and the adaptive innovative process. Relatedly, the respondents placed importance on involvement in facilitated networks generally (OCC1; OCC2; OCC3; OCI2; OCI3), as a consequence of a perceived lack of necessary internal resources (Simpson *et al.*, 2004). The findings indicate that participating case companies viewed themselves as stand-alone entities who interact with others in the network rather than as part of a community of micro-firms in a networked environment, which is similar to the findings of Simpson *et al.*, (2004). From a regulatory perspective it appears that a regulations-led approach was contributing to improvements in micro-firm green innovation capability development (OCC3; OCI3) in interaction with their facilitated networks. The findings confirm that network engagement is recognised as a potential catalyst for the transfer of knowledge into innovation (OCC2; OCI4). However, a perceived use of unfamiliar terminology (OCI3; OCC2) associated with ‘inaccessible’ literature relating to green initiatives acted as a barrier to green innovation capability development and knowledge transfer (Davies, 2013; Seebode, 2012). Furthermore, the findings highlight the process of knowledge transfer and the importance of effective knowledge sharing (Kelliher and Reinl, 2014) among shareholders in the facilitated network (OCC4; OCI4).

The preceding summary has shown the importance of the ‘dynamic innovation process’ (Baker *et al.*, 2016), which to be effective requires interaction with other

firms in the micro-firm setting (NI1; NC1; NC2). The findings show that green-led capability development and acquisition of knowledge for achieving green goals require network engagement (NC1; OCC1; OCC2; OCC3; OCI2; OCI4). Case observations show that collaborative knowledge sharing was significant for O/M innovation capability enhancement (Cavusgil *et al.*, 2003; Uzzi, 1996); a finding that was consistent in most cases (OCC1; OCC2; OCI1; OCI2, OCI3; OCI4). However, while the O/M could access the information pertinent to green innovation, they did not have adequate resources nor capabilities to convert the knowledge into innovation (OCC1, OCC2, OCC3, OCI1, OCI2, OCI3).

There are a number of themes which have been extracted from the research findings relative to the perceived impact of facilitated networks on green innovation capability development that were not evident in the extant literature and which were significant to this study. Firstly, the O/M's personal focus on green issues (e.g. their NEO) impacts on the green innovation in the micro-firm (OCC1; OCC2; OCC3; OCI4). Secondly, the O/M needed to be content with the core business performance before they could consider implementing (additional) green initiatives into the firm (OCC1; OCC2; OCI1). Thirdly, a large gap exists between the generation of innovative ideas and the ability to obtain the resources and capabilities required to bring the ideas to fruition (OCC1; OCC2; OCI2). Finally, a green energy strategy was largely associated with business performance-enhancing agendas, and the language used was perceived to be inaccessible by the majority interviewees (OCC1; OCC2; OCI1; OCI3). The following sections discussed each theme in detail.

6.2.1 Theme 1 External Catalyst for green innovation capability development

The first theme extracted from the data analysis was environmental influencers. The nature of this theme was to discuss the external factors that influenced green innovation in the micro-firm. In the literary review the sub-themes identified under the mantle of environmental influencers were; (a) market and regulatory dynamics, (b) environment resources, (c) green economy, and (d) sustainable

micro-firms. In some cases the findings expanded on these themes, while in others the research exposed new insights. This theme is discussed under the three main sub-themes emerging from the findings, partially echoing the literary theme insights; i) micro-firm market and regulatory dynamics ii) environmental resources and the green economy, and, iii) customers as a catalyst for green adoption in micro-firms.

6.2.1.1 Micro-firm market and regulatory dynamics

The findings revealed that micro-firm O/Ms believe they operate in a lean manner; *“I am very frugal”*(OCC4) and felt they do not have an impact on the environment (Simpson *et al.*, 2004) as a result. Notably, the O/Ms believed they *“don’t produce waste”* (OCC4), a marked contradiction considering the recorded waste levels of 70% of industrial waste affiliated with this business cohort (Hillary, 2000; Miller *et al.*, 2011). This finding reinforced the view that micro-firms perceived themselves as a stand-alone entity (Simpson *et al.*, 2004); *“I am just one person. I don’t produce waste”* (OCI1), rather than viewing their engagement with, and impact on, the green economy as a collective force. Despite O/M misperception that micro-firm business activities do not impact the environment, Ireland and Canada have yet to meet green economy goals based on international agreements including KYOTO¹⁶. As such, each country will have to pay substantial fines and these are likely to be passed on to industry, including micro-firms. Thus, regulations are an important environmental influencer (Environment Agency, 2011) and appear to be a driving force for green innovation in the studied firms; *“We are certified organic and we require that from our tenants even if they don’t certify they have to follow the organic regulations”* (OCC3).

Similar to the literary findings (Collins *et al.*, 2007) many micro-firms felt overloaded with current regulations and that some countries or sectors were treated more harshly than others when it came to environmental requirements, *“it is not a level playing pitch across Europe and across the world they are very*

¹⁶ The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change, which commits its Parties by setting internationally binding emission reduction targets. (United Nations)

stringent in Ireland...farmers will be penalised, they will lose their single farm payment” (OCI3). However this assumption of stringency appeared to be a perceptual bias as Ireland was facing fines of €26 million with daily fines of €33,000 due to regulatory non-compliance in this field (Documentary evidence, Appendix G). The findings also reveal that the enforcement and awareness of regulations vary depending on industry sector. Some sectors have stricter regulations e.g. Agriculture, *“regulations are killing it”* (OCI3) while others such as Retail, Hospitality, Recruitment believed they have fewer regulations affiliated to environmental requirements; *“I am ashamed to say this but I would not be aware of any green issues... I would have a lot of boxes, packaging”* (OCI4). This misconception among participants that the regulations don’t apply or impact them, and that *“there are no regulations regarding waste management that I am aware of”* (OCI4), *“no regulations”* (OCC4), despite regulations affiliate to their respective sectors. For example, the European Commission Communication Zero waste programme for Europe (EC, 2014) introduced a wide set of waste objectives (Documentary evidence, Appendix G) that affect the sectors represented in this study, although respondents do not appear to be aware of these EC objectives; *“I am not aware of them”* (OCI4).

Based on the research findings, regulations would appear to be an enabler of green innovation (Bar, 2015; Environment Agency, 2011) and impact on micro-firm business activities, *“There are Government regulations and certified organic also need to comply with federal regulations”* (OCC3). The findings also revealed that regulations improved the micro-firms’ absorptive capacity (Liao *et al.*, 2009) and green innovation capability development and that collectively, these activities presented the micro-firm with market opportunities in the emerging green economy. In the absence of regulations the onus was on the individual to demonstrate green innovation in their business (NI2), to look for the information specific to their industry and find the necessary funding and resources to enact these innovations within the micro-firm. Both the literature and findings concur that micro-firms are unlikely to engage in voluntary greening activities (Collins *et al.*, 2007; OCC3; OCI3; OCI4). But, in the presence of regulations, the observed network members assisted each other in achieving the regulatory requirements, guided by the network facilitators or invited specialists (NC1; NC2). Micro-firm

O/Ms also helped others in pursuit of compliance. For example, OCI3 educated other network members on waste reduction initiatives in order to meet energy regulations and proactively sought measures for waste and energy reduction among network members, *“Glanbia.....are very stringent on quality marks”* (OCI3), *“NFU¹⁷ lobby with Government about policies they keep track of, these are farmers as well as advocates and at a different life stage”* (OCC3).

6.2.1.2 Environmental Resources and the Green Economy

It has been well documented in the literature that micro-firms suffer from resource constraints (European Commission, 2011; Welsh and White, 1981), a finding reinforced in the current study. The constraint of time was of particular concern; *“You don’t have... the space mentally to create”* (OCI2), highlighting the need for resource slack when pursuing innovation capability development. The variety of management capabilities needed for running a micro-firm was apparent in the interview transcripts and green audit, in addition to a perceived shortage in relation to green resource requirements, *“Farmers find administration very difficult”* (OCC3) *“the administrative/ secretarial functions are much bigger than I ever anticipated”* (OCC1). The findings agreed with other researchers (O’Dwyer and Ryan, 2000; Kelliher and Reinl, 2009) that O/Ms underestimate the core professional and personal skills required to operate a micro-firm, *“nothing can prepare [you] for everything as it is completely different”* (OCI1). Specifically in the context of the current study, the energy management skills considered in the green audit were; energy efficiency, reduction in energy use, renewable energy sources and upgrades, building energy standards and sustainable and renewable building materials, skills that did not naturally exist in the studied O/Ms skillset.

While Florida *et al.*, (2000) highlighted only two factors (the firm’s resources and capabilities) in a firm’s drive to adopt environmental factors, the current study findings revealed that an openness to engage with other firms and the influence of

¹⁷ The National Farmers Union (NFU) is a direct-membership voluntary organization made up of Canadian farm families who share common goals.

regulations are two further external driving forces in the adoption of green initiatives, *“I also do work exchanges with people where they pay for our services by contributing their talents to our business instead of money”* (OCC1). With regard to these additional forces, the findings suggest that a core innovation capability structure can be achieved by developing capabilities to effectively manage the firm’s innovation resources (Walsh *et al.*, 2012), this can be achieved by pooling/bundling resources obtained through green network involvement; *“I collaborate with folks like eco farmers, looking at developing training program with them and can be; farm start, local community, open doors with EMERGE”* (OCC3).

The findings expanded on the conclusions of Camarinha-Matos *et al.* (2010) and Gabler *et al.* (2015) and suggest that perceived economic benefit sways all other environmental influencers for the micro-firm (OCC3; OCC4; OCI3; OCI4), *“you see the difference, it saves money”* (OCC1), *“Green innovation is important to me if it saves me money, if it doesn’t it isn’t a factor”* (OCI4). The respondents also spoke about contemplating energy-saving initiatives using cost-benefit analysis, *“How can I tap the sun’s energy to free energy?”* (OCC3), *“We have looked at solar panels but it isn’t economically viable for us, everything has to have an economic benefit for me to do it”* (OCI3), pointing to a perception that environmental regulations and policy were viewed as a cost-based activity in the micro-firm setting. Economic impact was therefore perceived as an enabler of green innovation by O/Ms, particularly if coupled with the penalties associated with non-compliance, *“All the plastic is put in on spot and we pay to dispose of it. If we use chemical sprays they also have to be disposed of properly. There are environmental regulations across Europe, if you don’t follow it you are penalised”* (OCI3) (Documentary evidence, Appendix G).

6.2.1.3 Customers as a catalyst for green adoption in micro-firms

Changing customer preferences were also an influencing factor on green innovation, as consumers became more aware of the environmental impact of their purchase decisions, resulting in an O/M desire to *“keeping customers happy”*

(OCI4) in relation to their green concerns. O/Ms acknowledged that these changing attitudes influenced their own approach to green innovation as, “*if the customer asks for something we write it down*” (OCI4). When contemplating changing customer needs, respondents noted that, “*We look after our customers well and we keep the shop well stocked*” (OCI4), but that this alone did not meet the growing green expectations among customers. This in turn affected the O/Ms approach to green innovation as “*we need consumer support*” (OCC3) to sustain the business (Greene and Brown, 1997; Liberman-Yaconi *et al.*, 2010; Penrose, 1959). Proximity to customers (European Commission, 2011; Industry Canada, 2007) was found to be vital for both innovation and decision making in micro-firms in both studied countries. This finding pointed to the efficient and effective flow of green information, not only from regulatory sources but also through their changing customer requirements, such that O/Ms are more fully involved in the implementation of green policy.

6.2.1.4 Sustainable Micro-firm Activities

Green capabilities were reinforced and sustained through gradual positive feedback through a process of engagement with key stakeholders (Powell and DiMaggio, 1991). The more integrated green strategies were to the micro-firm’s overriding business strategy, the more positive the outcomes (Papagiannakis *et al.*, 2014). There was evidence in the findings that those micro-firms that pursued green activities based on values and commitment received more positive outcomes than those that do so for economic gain alone (Arend, 2014; Menguc and Ozanne, 2005). As articulated in the finding, “*Positive psychology is the scientific study of the strengths and virtues that enable individuals and communities to*” (OCC1), pointing to the O/M NEO as a key resource in context. However, the findings also agreed with Papagiannakis *et al.* (2014), that micro-firms have neither the internal skills nor resources necessary to conduct green innovation in isolation. The participants in this study stated that green strategies came second to business strategies, “*It is hard when you are up to your butt in alligators. It is hard to remember the objective is to drain the swamp*” (OCC1) and survival was the main priority for the majority of respondents (Devins *et al.*, 2005; Roper, 1999). OCC1, OCC2, OCI1 and OCI2, alleged that green skills

were not important to their micro-firm as they produced minimal waste, “*don’t produce waste to start with*” (OCC2), “*produce very little waste*” (OCI1), “*don’t waste*” (OCC1). This assumption was based on their own perception of their relative consumption and waste levels, rather than through specific measures or adherence to regulatory requirements.

6.2.2 Theme 2 Internal catalyst for green innovation capability development

The second theme extracted from the data analysis was micro-firm green capability characteristics. The purpose of this theme was to discuss the factors that affected micro-firm green innovation capabilities. In the literary review the sub-themes identified under the mantle of micro-firm green capability characteristics were; (i) Micro-firm dynamic capability (ii) Resource limitations (iii) Strategic planning and decision making (iv) knowledge transfer. In some cases the findings expanded on these themes, while in others the research exposed new insights.

6.2.2.1 Micro-firm dynamic capability

Micro-firms have the unique ability to respond quickly to market changes due to the O/Ms close proximity to employees, customers and suppliers (Blommerde and Lynch, 2014; Chaston and Mangles, 1997; Tamayo-Torres *et al.*, 2016), “*I ask my clients for advice*” (OCI1), “*if the customer is looking for something that we don’t have we write it in the book*” (OCI4). These findings also highlight that the dynamic capability of the micro-firm appears more suitable to an ‘adaptive dynamic innovative process’ (Merrilees and Rundle-Thiele, 2010; Philipson *et al.*, 2004; Smith, 1999). This dynamic capability is inimitable (Matlay, 1999) and a source of competitive advantage for the micro-firm (Merrilees and Rundle-Thiele 2010; Philipson *et al.*, 2004; Smith, 1999) “*... looking after your customers well, by being their yourself and keeping a good handle on the business is the most important thing. We look after our customers well and we keep the shop well stocked. When customers come into my shop looking for 1 thing they leave with 12*” (OCI4).

6.2.2.2 Resource Limitations

The findings reinforced the view that micro-firms are unique; they are not small big firms (Welsh and White, 1981) and have specific resource challenges associated with their size (i.e. lack of resources) (Kearney *et al.*, 2012; MacMahon and Murphy, 1999; Reinl and Kelliher, 2010). Specifically, the observed micro-firms were found to be constrained because of their resource configuration, which in turn restricted their internal investment; *“You can implement two big things a year, if you have a major staff overall, maybe not.”* (OCC3). The O/Ms stated that resource constraints impinged on the firm’s ability to grow and innovate (Pett and Wolff, 2012); *“...I don’t have the time or the space, with family commitments. You need a lot of space in your own head [to innovate]”* (OCI2), a perspective echoed by OCC1; OCC3; OCI1. These findings reinforce the challenge faced by micro-firms due to resource shortages, *“... so time and resources to me are the big ones”* (OCI1), *“Staffing can be a problem”* (OCI4). While green information and advice was available to O/Ms through a *“lot of online resources”* (OCC3), and these provided *“a good source of information”* (OCC1), the conversion of green innovation ideas into workable solutions in the micro-firm setting was challenged by resource limitations and the capacity of the O/M to facilitate green engagement in their work setting, *“when you are on your own as a micro business you have got to do everything yourself. It is easy to get advice. The challenge I face is using the advice”* (OCC1), as echoed by OCC4; OCI4. The findings showed a perceived lack of resources limiting involvement in green innovation capability development, in particular financial and time resources, which could be linked to the limited growth strategy goals of the firm and barriers to planning and implementing micro-firm green strategies, as displayed in these findings.

6.2.2.3 Strategic Planning and Decision Making

Strategic planning and its affiliated decision making process in the micro-firm was mainly informal, action oriented and had a short term focus in micro-firms (Simpson, 2001; Duarte Alonso and Bressan, 2014). This perspective came through in the findings with the participants stating that they *“don’t have the time*

to come up with ideas” (OCC2), *“we would get no work done”* (OCI1), *“maybe one of two ideas a year”* (OCC3). McGrath and O’Toole (2013) refer to ‘quality of life’ protection as another reason for the micro-firm not pursuing a growth strategy. While true of some respondents in this study, in certain industry sectors (e.g. Agriculture), a formal strategy was pursued and had both a long and short term focus; *“We do a review every Fall [Autumn], while we are still in season and it is still fresh, taking time away to evaluate and getting input from interns”* (OCC3). Thus, the current study adds to the existing research (O’Dwyer and Ryan, 2000) finding that while decision making in the studied micro-firms in certain sectors was traditional rather than growth focused, this was not found to be true in all sectors. In contrast to the literature (O’Dwyer and Ryan, 2000), it was interesting in the findings that some firms were perceived to be innovative due to industry influencers, yet chose not to grow and in other cases, innovation was dependent on the O/M culture and mindset (Morrison *et al.*, 2003; Reddy, 2007). In the case of OCC4 they had all the resources needed and were capable of being innovative yet felt that there was no need to innovate as they had income from other sources and the hospitality business wasn’t their only source of income. This finding would suggest that lifestyle influencers have a greater influence on innovation in the micro-firm setting than previously considered.

The findings were in agreement with researchers (Devins *et al.*, 2005; Greene and Brown, 1997; Roper, 1999) who suggested that micro-firm growth strategy was a combination of the O/M expectations and their ability to access the required resources. Although this orientation depended on the underlying growth goals of the O/M (Duarte Alonso and Bressan, 2014); *“growth is what I am looking for”* (OCI1), the findings agreed with Greenbank (2000) and O’Dwyer and Ryan (2000) that formalised business planning was not used in many micro-firms; *“The traditional approach is that you do a business plan and it looks like a great plan, but getting the business plan implemented is much more challenging than I ever anticipated”* (OCI1). With reference to green strategy, findings showed that facilitated networks assisted with planning and green innovation (Erkus-Osturk, 2009), *“Glanbia do the marketing”* (OCI3) and that these skills were largely associated with business performance-enhancing agenda i.e. improved quality, enhanced customer value and an increase in the ‘bottom line’.

6.2.2.4 Knowledge Transfer

The literature highlights that innovation is an important capability for firm survival (Carnes and Ireland, 2013; Faherty and Stephens, 2014) and for developing competitive advantage (Hooley and Greenley, 2005). The findings from this study (OCC1; OCC2; OCC3; OCI1; OCI2; OCI3) agree that micro-firms had insufficient internal capabilities and resources for innovation and that they needed to seek new information externally and transform this knowledge into developing innovative capabilities. In particular, the findings from the cases studied showed the O/Ms had an ‘openness’ to an ‘active learning culture’ (Hannon *et al.*, 2000) wherein they depicted “*a love of learning and acquiring knowledge*” (OCI1), as “*if you have an open mind you can learn anything*” (OCI1). This ‘active learning culture’ of the O/M encompassed searching for information online, through networks, other businesses and customers (OCC1; OCC3; OCI1; OCI3). According to Lundvall (1995), learning is the focal point of innovation and is a social activity that involves interaction with people. Similarly, it was apparent in the current research that individuals (OCC1; OCC2; OCC3; OCI1; OCI2; OCI3) were important in the adaptive innovation process, “*The work that I do, you tend to work very closely with managers and they will give me some help and advice*” (OCI1), “*We [the family] are all in the same line of business so we ask each other for advice*” (OCI4). Under this mantel, the O/Ms acted as the main agents of knowledge (Hansen, 1999). These findings also show that collaborative knowledge sharing offered a “*good sounding board and offered practical feedback*” (OCI1), thus was a significant tool for innovation capability enhancement (Gulati and Gargiulo, 1999). These findings extend current literature relating to knowledge transfer and its influence on innovation capability enhancement in the micro-firm setting.

6.2.2.4.1 Networking Capabilities

As outlined earlier, management capability contributes to innovative capability (Hooley and Greenley, 2006) and was found to be enhanced by networking (OCC1; OCC2; OCC4; OCI3; OCI4) and teamwork (Kearney *et al.*, 2013; OCI2; OCI4) in the current study. Networking capabilities include the O/M’s absorptive capacity (Thornton *et al.*, 2014; Zaefarian *et al.*, 2011) and a willingness to share

information. Depth and breadth of network engagement influenced the value the micro-firm O/M acquired from network involvement (Aylward, 2009; OCC1; OCC2; OCC3; OCI1; OCI2; OCI3). By aligning resources to build capabilities and value (Sirmon *et al.*, 2008) and transforming resources to develop innovative capability strategies (Carnes and Ireland, 2013; Gulati and Gargiulo, 1999; Salunke *et al.*, 2011), the micro-firm could build sustainable green capabilities. However, the findings from the research appeared consistent with Eisenhardt and Martin (2000) and Grant (1991) that in order to create sustainable green capabilities, internal and external resources needed to be leveraged and exploited through capabilities enhancement, “*We collaborate with businesses and organisations to benefit rural economies, rural life and the organic farming sector*” (OCC3, Documentary evidence Appendix G(c)). Leveraged innovation resources (Cohen and Levinthal, 1990; Ketata *et al.*, 2015) resulted in a triadic continuous relationship developing between knowledge, innovation and innovation (Slater, 1997). Networking capabilities were enhanced by past experiences of network involvement and the need to bridge resource shortages (Harryson *et al.*, 2008; McGrath and O’Toole, 2013).

6.2.2.5 Human Capital Engagement

When contemplating green capability enhancement, the O/Ms emphasised that they were “*not an island*”(OCC2) and they could not operate in isolation, “*running your own business can be lonely*” (OCC1); “*you need people*” (OCI2). The literature also suggests that internal expertise and/or limited absorptive capacity is a barrier to green innovation implementation, and can be overcome through network engagement (Chesbrough, 2003). Structured social interaction was believed to be vital for capability development in this study, “*collaboration is very important*” (OCI2) (OCC1; OCC3; OCI1; OCI3) and could be achieved through network-led green knowledge transfer initiatives in micro-firms (Baker *et al.*, 2016; Benito-Hernández, *et al.*, 2016; Cainelli *et al.*, 2015; Parida *et al.*, 2016; Schaper, 2016). “*If they [micro-firms] are going to be green they have to do it in different ways and they need each other they can’t do it on their own*” (OCC3). The findings from the observations from the current study resonated with the findings of other researchers (Greenbank, 2000; Simon and Houghton,

2002) that O/Ms gather information through heuristics, in particular through contact with other firms (Lundvall, 1995); *“I meet other businesses to discuss what is happening”* (OCI4), *“I talk to other farmers about what is going on in other countries and how it will affect us”* (OCI3). The findings therefore add to the body of existing research, which has shown that the O/M valued collaboration (Lean, 1998; Forth *et al.*, 2006) with others when ‘*validating ideas*’ (OCI1) and for ‘*getting advice*’ (OCC2) (BIS, 2011). The network facilitators provided the information O/Ms requested and offered resources and information on what was needed to run the business in a green way (documentary evidence; reflective diary). As discussed in the literature (Cavusgil *et al.*, 2003; Parida *et al.*, 2016; Uzzi, 1997; Zahner and Bell, 2005) internal and external close, frequent engagement is important for knowledge transfer, as echoed in the findings *“I didn’t have the support of network. I felt exhausted...I had to be long time in the store,...There was no network at the time, after that happened I started networking”*(OCC2).

6.2.2.6 Leverage internal human capital

Green *et al.*, (2008) posit that the firm should be regarded as a consumer in the supply chain and as a central yet under-emphasised stakeholder in the green economy. The current findings corroborate prior research (Phillipson *et al.*, 2004; Greenbank, 2000) that micro-firm O/Ms appear to have a good knowledge of their resources and capabilities. In this study, O/Ms influenced the green innovation culture of their micro-firms (Morrison *et al.*, 2003; Pett and Wolff, 2012; Reddy, 2007; OCI4; OCC4) and their characteristics determined the firm’s NEO (Abdullah *et al.*, 2016; Noran, 2010; Papagiannakis *et al.*, 2014; Richards *et al.*, 2016; Walsh *et al.*, 2012; OCC3; OCI3). The value of this cross-country study is evident in this finding which showed cultural differences on green innovation between Ireland and Canada. From an Irish perspective it was considered irrelevant to integrate green mindset into operations, *“I presume the local council might [offer green data], but I am not aware of it”* (OCI4). In Canada the four cases highlighted this as important, *“I don’t produce any waste”* (OCC2); *“I am naturally environmentally friendly; I know what my carbon footprint is and I make efforts to reduce it”* (OCC1). Separately, the O/M’s characteristics (Kim *et*

al., 2011) played a key role in the transformational capability of the firm in developing innovation capability (Ebers, 1997; Thornton *et al.*, 2014), with some firms showing a willingness to leverage human capital from a variety of sources, “...same mentors. ... my clients. The work that I do you tend to work very closely with managers and they will give me some help and advice” (OCI1).

6.2.2.7 Quick response to market/regulatory dynamics

Prior research has shown that the O/M’s characteristics (Kim *et al.*, 2011) and quick response to market changes (Kelliher and Reinl, 2009) play a key role in the transformational capability of the micro-firm and in developing innovation capability (Ebers, 1997; Holmen and Pederson, 2003; Thornton *et al.*, 2014). These views are somewhat emulated in the current study, “*You learn that, you learn how to market your business in the right way effectively, you have got to learn that stuff really quickly and you have got to be able to apply it*” (OCI1); although the findings also demonstrated that micro-firms struggled with assessing and validating the ideas once formulated (OCC1; OCC2; OCI1). There was a gap between innovation and green innovation, and this was mainly due to a lack of micro-firm resources, limited capabilities in terms of absorptive capacity and a lack of information on how to enhance green innovation capabilities within the micro-firm. The lack of resources and management capabilities were also a barrier to green innovation capability development, “*There are many people that can give you advice but finding someone who will do the doing without charging or at a nominal cost is very difficult to find*” (OCC1). However, the findings offered support to other researchers that the necessary specialist skills were obtained from outside the firm, “*I wouldn’t dream of being my own accountant*” (OCI1) and through engagement with facilitated networks.

6.2.2.8 Embedded Innovation Process

Micro-firms followed an O/M-led green culture in this study, “*I got a hybrid, walk as much [as I can], solar panel, everything I buy is organic, I don’t buy anything with packaging, I hate the packaging*” (OCC2). The case findings (OCC3; OCC4; OCI3; OCI4) were consistent with much of the literature (Hansen, 2010; Phan, 2008) and revealed that green capabilities were partially

dependent on the NEOs held by the O/Ms, *“For ecological farmers they are already environmentally friendly”* (OCC3). OCC3 and OCI3 rated the orientation of the O/M as very important to integrate green into business practices reinforcing Walsh *et al.*,’s (2012) perspective, while OCI1, OCI2; OCC2, OCC3; OCC4 OCI4 and OCC1 all rated it as important. The findings also revealed that the beliefs and values of the O/M (OCC1; OCC2; OCC3; OCI2; OCI4) were a key contributor in the green innovation capability of the micro-firm (Papagiannakis *et al.*, 2014; Reflective diary), *“Yes, I would have always been [environmentally friendly] like that, even working for other people. But now in particular when you have your own business you are very conscious. That has been my philosophy all along”* (OCI1).

The findings revealed that green thinking was intrinsic in some participants interviewed and in other cases, it was dependent on the economic implications. Specifically, if the O/M had a positive or proactive NEO, this impacted positively on the micro-firms green innovation, *“I am naturally environmentally friendly; I know what my carbon footprint is and I make efforts to reduce it”* (OCC1). This study allows for the augmentation of this research stream by adding that there is a correlation between O/M with poor NEO and rating environmental management, waste management and green strategy as unimportant, *“I am ashamed to say this but I would not be aware of any green issues. It would not be a factor in the business. I would have a lot of boxes, packaging”* (OCI4). The findings agree with Noran (2010) that an O/M that has a positive attitude towards green innovation is more likely to have positive economic outcomes (OCC3; OCI3), and point to the need for green knowledge to be embedded in the firm’s routines, behavioural patterns, firm’s policies, structure and processes to be effective (Seebode *et al.*, 2012). These results contribute to and further develop current knowledge and agree that the orientation of the O/M (Greene and Brown, 1997; Penrose, 1959) influence the green orientation and the green innovation capability development in a particular micro-firm.

6.2.3 Theme 3 Perceived impact of network engagement on capability development

The third theme extracted from the data analysis was the perceived impact of facilitated network engagement on green innovation. The purpose of this theme was to examine the impact of facilitated networks on green innovations capability. In the literary review the sub-themes identified under the mantel of perceived impact of facilitated network engagement on green innovation capabilities were; (i) Facilitated network as an additional resource (ii) Human capital engagement (iii) Networking capabilities (iv) Networks and green innovation capability development. In some cases the findings expanded on these themes, while in others the research exposed new insights.

6.2.3.1 Facilitated Network as an additional resource

While Faherty and Stephens (2014) state that many micro-firms do not engage in innovation networks, the findings from this study show that networks were perceived to be a valuable resource for innovation, with some participants citing network engagement as ‘huge’ for innovation (OCC1). The evidence collected through a variety of sources confirmed that for micro-firms, networks provided vital resources for the micro-firm (O’Donnell, 2003), “*they [networks] do everything; they organise training, mentoring, advice*” (OCI3). Often, networks were the only resource for building, developing and deploying innovation capabilities and provided social capital (McAdam and McGowan, 2004; Shaw and Conway, 2000), “*You need social and moral support to keep going at an enterprise that barely makes money*” (OCC3). According to Day and Schoemaker (2011) , firms that do not participate in a network are put at a disadvantage when pursuing green innovation. This was also evident in the findings, “*Strong support would be with farmers organisation, National farmers Union is very strong on small family scale eco farms*” (OCC3).

6.2.3.2 Networks and Green innovation capability development

In contrast to prior research which demonstrated that capabilities were developed internally and then deployed (Teece *et al.*, 1997), this research concurred with the findings of Giudici (2013) that innovation capabilities were also deployed in collaboration with network members. Currently, networks were providing little information to the observed micro-firms on the green economy. The information available was inaccessible due to nature of the terminology employed and the way the reports were written. Reported findings highlighted that perceived language issues acted as a potential barrier to green innovation capability development and knowledge transfer, *“I would like information that is in simple language”* (OCC2). This is also a view expressed by Blackburn (2012), that micro-firms need simplified specific information. The findings showed that O/Ms experienced difficulty accessing the information they required, as the information was not in simple ‘layman’s’ language, *“Teagasc would have been trying to explain it to them for the past 20 years I could explain it to them in 20 minutes. Farmers find administration very difficult”* (OCI3). There was also a perceived lack of documentation regarding the means and mechanisms that might support micro firms in transitioning to the green economy (Davies, 2013; Seebode, 2012; NI1; NI2; NC1). This resulted in the micro-firm having to seek out this resource; *“I’d like to learn more about these [environment management capabilities]”* (OCC1); *“To get skills, I think it would be good if the information was out there”* (OCC2). While respondents were open to ‘getting skills’ (OCC2), the challenge of accessible regulations guidelines material remained: *“...I tried to read but it wasn’t for me I didn’t understand it, it was all long words”* (OCC2). These findings show that even when the O/M had access to the information, they did not have adequate resources (in particular, time and expertise) and capabilities to convert knowledge into activities that would support innovation. This is a new finding; advice was difficult to implement due to lack of internal capability, restricted skills and resources: *“.... It is easy to get advice. The challenge I face is using the advice”* (OCC1). Adapting advice was a core challenge inherent in the adaptive innovation process in these case firms, which reinforced the need for targeted micro-firm support structures to capture the opportunities and realise the objectives of the green economy (Brockington, 2012).

The findings concur with previous researchers (Petts, 2000; Ramus, 2002) that the function of facilitated networks and support bodies is to provide the necessary information, *“I presume the local council might [offer green data]”* (OCI4) and necessary support, *“...we do our part but I the County Council doesn’t do their part all the water is flowing into the rivers and they have no filtration systems in place”* (OCI3) to engage with the green economy (Appendix G (k)). Networks have the potential to assist micro-firms to move towards green technologies or green business processes as well as capturing green market opportunities (Day and Schoemaker, 2011; Robinson and Stubberud, 2013), but only if the information is accessible and the O/Ms are capable of implementing the advice.

6.2.3.3 Internal/ External environment resource bundling

The findings agree with the literature (Faherty and Stephens, 2014; Jaouen and Laush, 2015; Kearney *et al.*, 2013) that the O/M performed all the operational and management functions themselves and this also impinged on innovation, *“I thought I had some experience but I had no idea”* (OCI1), *“I am orchestrating a lot of things and to keep them going is tough”* (OCC3), *“It takes a long time to put together an exhibition”* (OCI2), *“Everything is so much more specialised”* (OCC1). The findings suggest that a core innovation capability structure evolved in the O/M by developing the skills for controlling the firm’s innovation resources over time (Walsh *et al.*, 2012; Zeng *et al.*, 2010). This was partly achieved by pooling/bundling resources obtained through network involvement (OCC2; OCC3; OCI2; OCI3). By performing a green audit, this study helped to increase awareness and to articulate the green innovation skills gap in participant micro-firms. Subsequent engagement with relevant environmental regulations increased the perception of green influencers on the micro-firm’s success in the emerging green economy. It also helped to accommodate an understanding of required skills development in the green innovation capacity of each organisation (OCC2; OCC1; OCC3). OCC1, OCC3; OCI3 educated other network members on waste reduction initiatives in order to meet energy regulations and proactively sought measures for waste and energy reduction, reinforcing the value of resource bundling in pursuit of green innovation capability enhancement.

6.2.3.3.1 New/ green knowledge generation

The findings disagreed with extant literature that green innovation involves new knowledge components and the micro-firm required more absorptive capacity to manage this innovative process (Zahra and George, 2002 in Seebode *et al.*, 2012). Even though some of the participants had a green ethic personally and had some of the knowledge required to implement green initiatives in their micro-firms based on the examples given, they also stated that the concepts of ‘green’ and ‘sustainability’ (Seebode *et al.*, 2012; UNEP, 2011; Yarahmadi and Higgins, 2012) was new to them, *“I am really just beginning to understand sustainability”* (OCC1), *“I’m not sure what it is, is it environmentally friendly?”* (OCC4), *“I don’t know what the green economy is”* (OCC2), *“I’m not sure what you mean by that [green economy]”* (OCI2). These findings demonstrate that perceived language issues act as a potential barrier to green innovation capability development and knowledge transfer, *“I would like information that is in simple language”* (OCC2). This was also a view expressed by Blackburn (2012) that micro-firms needed simplified specific information.

6.2.4 Adaptive innovation process in the micro-firm

The findings revealed that in all cases observed the employees (where existent) had an input into the decision making process and in turn were more innovative and open to learning, *“One of the staff is very good at coming up with ideas, she knows what sells and what doesn’t and will come up with ideas for promotion ideas”* (OCI4). Yet, micro-firms also experienced a training paradox, while they understood the importance of training, they only undertook it if was mandatory (Matlay, 1999) *“I probably have not capitalised as much as I should have done and the problem is time. Three days out of five training, it is hard to find time”* (OCI1). The findings pointed to a correlation between an O/M’s positive attitude towards green innovation and positive economic outcomes, *“... everything has to have an economic benefit for me to do it”* (OCI3). This was based on the assumption that green capabilities were reinforced and sustained through gradual positive feedback (Powell and DiMaggio, 1991) and the more integrated green strategies were to the firm’s strategies, the more positive the outcomes

(Papagiannakis *et al.*, 2014). As Lin (2007) highlighted, employee willingness to share and obtain knowledge enabled the firm to improve innovation capability. In this respect, the current study differed from prior research that the micro-firm relied solely on the O/M's knowledge for innovation (Burton, 2001; Chaganti *et al.*, 2008) and instead established that employee involvement had a positive impact in the innovation process, which was also the views of Andries and Czarnitzki (2014) and Klaas *et al.*, (2010). The findings support those of Ketata *et al.*, (2015), who argued that employees required communication and training for knowledge transfer. Davies (2013) go further in this trajectory, suggesting that employees should be involved in government initiatives to ensure that firms have the necessary resources to equip themselves for a transformation to green goals. While this element of green innovation is beyond the scope of this research, it presents a valuable goal for future research.

6.2.4.1 Innovation capability enhancement in a network environment

The participants in this study stated that green strategies came second to business strategies, *“you have to look after your own business needs first before you can think of green issues”* (OCC1) wherein survival was the main priority (Devins *et al.*, 2005; Plato-Jaime *et al.*, 2013; Roper, 1999; Testa *et al.*, 2015). These findings showed that the O/M who applied the principles of ‘dual continuous relationship’ with employees, customers, family and stakeholder networks appeared to positively influence innovation (Bodewes and deJong, 2003; Faherty and Stephens, 2014; Kearney *et al.*, 2013) and respond (more) quickly to market changes. Once in the facilitated network environment, the O/Ms background and previous experience, along with their attitude towards learning (Tippman *et al.*, 2013) and collaboration were believed to be assets in maximising the knowledge obtained, *“Membership of network helps to be innovative”* (OCC1). When transforming knowledge gained from network engagement into capabilities, the research findings highlighted that; *“collaboration is very important”* (OCI2); as it was a mutual benefit; *“the farmers across the board have benefited from learning from each other”* (OCC3). In contrast, evidence of O/Ms being cautious not to share new ideas with external network members was most interesting in terms of

capability enhancement barriers in context, “*we [the family] ask each other for advice*” (OCI4); “*I ask my husband for advice*” (OCC4); “*I ask my wife*” (OCI1), intimating a lack of trust beyond the family network. This research also observed that proactive micro-firms, due to the existence of fewer barriers at organisation level, appeared to exhibit higher levels of human capital engagement (Cross *et al.*, 2003; Hill and Stewart, 1999; Sveiby, 2000) to the benefit of internal relationships. Of note is that these networks are primarily in the early stages of development. In the networks studied only one of the networks had run a green workshop, in all networks interviewed the supports were driven by the micro-firm’s information needs and knowledge requirements.

6.3 Innovation Capability framework for Green Enterprise

The final research objective was to propose a green innovation capability framework for the micro-firm environment, based on the research findings. The following section summarises the discussion of the findings from the literature and the results of individual and network interview transcript reviews, green audit results, and individual micro-firm observations in Canada and Ireland, documentary reviews and researcher reflections. The framework is then revised in light of the research findings.

6.4 Consideration of key findings and literary-led emergent themes

This research expanded upon current knowledge relating to green innovation capability development in a micro-firm setting. It established that dynamic capabilities appear to underpin micro-firm green innovation and that these capabilities are built on the firm’s resource; “*you have got to learn that stuff really quickly and you have got to be able to apply it*” (OCI1). Recognising knowledge as a resource attained internally and externally (Kunapatarawong and Martínez-Ros, 2014) for innovation to occur (Liu *et al.*, 2012); this study considers knowledge transfer through a multi-sourced lens. As noted previously, very often in micro-firms, the O/M ‘is’ the business thereby limiting internal

knowledge to that of the O/M (Hanrahan and Conaghan, 2014), therefore externally-generated knowledge is a key resource, “*Networking is very important even informal and social networks*” (OCI4). Pursuit of such knowledge may not be feasible if the O/M seeks to find it alone, due to the inherent resource constraints, including time, associated with the micro-firm environment, “*you need people*” (OCI2); (Jaouen and Lasch, 2015; Kelliher and Reinl, 2009). Thus, prevailing research recommends that micro-firms engage with fellow providers to combine or ‘bundle’ their resources in pursuit of capability enhancement (Parida *et al.*, 2016). The focus of this study was to explore the perceived impact facilitated networks have on innovation capability development for green enterprise in the micro-firm.

O/M capabilities that support green innovation in this study included networking capabilities (Mitrega *et al.*, 2012) and absorptive capacity (deJong and Freel, 2010; Ketata *et al.*, 2015; Liao *et al.*, 2009) to utilise the knowledge obtained in the facilitated network and allow for incremental green improvements in the micro-firm. However, merely joining a network was not sufficient to achieve enhanced capabilities, O/Ms would appear to require certain network capabilities to benefit from the facilitated network and for it to be a valuable resource to the micro-firm and improve its NEO (Håkansson, 1987; Ritter and Gemünden, 2003).

A willingness to share information with network stakeholders was a key catalyst in obtaining the knowledge the micro-firm required to enhance their green innovation capability (Aylward and Kelliher, 2009), while a fear of competition presented as a barrier in context; “*you have to be careful about how much your staff knows because they could end up setting up next door to you*” (OCI4). The study also unearthed the issue of knowledge sharing and knowledge hoarding (Kearney *et al.*, 2014) in the capacity of O/Ms to share green-led innovation ideas with network members, “*I collaborate with folks like eco farmers, looking at developing training program with them and can be; farm start, local community, open doors with EMERGE*” (OCC3). An O/M who supported a culture embedded with green innovation and employee involvement (Kelliher *et al.*, 2012) was an

important factor to achieve the full innovation potential for the firm. This dual continuous relationship (Stahle and Hong, 2002) was believed to be improved by continuous feedback to improve the adaptive innovative process and as a result became a valuable resource for continuous green innovation capability enhancement in the micro-firm, *“I would have spoken to people in the organisation and told them about my plans to try and validate my idea and I would have got good feedback from that”* (OCI1). The following sections discussed each theme in detail.

6.5 Summary of Key Research Themes

This section compared and contrasted the significance of these themes in combination with the themes extracted from the literature. On careful examination of the themes emerging from the findings, it is evident that micro-firms on their own are unable to develop the necessary resources and capabilities for green innovation to occur. Micro-firms suffer from resource constraints in terms of human, financial and network capability and are therefore deficient to build the necessary green innovation capabilities independently. As a result they tend to follow a reactive approach to decision making, restricting their potential to sustain and/ or grow the firm. Facilitated networks are a vital component in obtaining the resources and knowledge that micro-firms require to build green innovation capability. Thus, to be most effective facilitated networks should be multi-disciplinary, and promote green knowledge transfer and knowledge bundling among a variety of stakeholders, which in turn creates a new and sustainable knowledge resource for the micro-firm.

This research shows that facilitated networks not only provide supports in terms of social interaction, provision of information, generation of new ideas but it is also an additional resource for the micro-firm. Specifically, the network provided a platform for knowledge transfer and facilitated innovation (Gronum *et al.*, 2012; Pikkemaat, 2008; Kelliher *et al.*, 2014). In some cases where a direct benefit wasn't visible, O/Ms still benefited from network membership. However, it was mentioned that the green regulations were believed to be not high enough

in certain cases, suggesting a barrier of understanding, evolution and/ or regulatory intent in this context. In other cases, while the information on supports with respect to green initiatives was available, the O/M often perceived this information to be inaccessible to them (Davies, 2013; Seebode, 2012). This was mainly due to the inaccessible language and terminology used. In addition, there was certain green initiative funding available for use in micro-firms intent on embedding green projects in their business setting, but the interviewees did not have cognisance of these incentives, reinforcing the perceived information gap between support agencies and the recipient firms. In other cases it was found that firms were already overburdened with existing regulations, in particular the Agriculture sector and some perceived that they their burden of green regulation was greater than their counterparts, either at a sectoral or national level. Notably, there was no evidence that this was the case as regulations appeared to be consistently applied within the said environment (e.g. Ireland and the E.U.).

This work expanded on current knowledge relating to green innovation capability development in micro-firms and established that externally-generated capabilities are required by the micro-firm for green innovation to occur (Leonidou *et al.*, 2015). These capabilities include networking capabilities and the development and enhancement of absorptive capacity (deJong and Freel, 2010; Ketata *et al.*, 2015; Liao *et al.*, 2009) in order to utilise the knowledge obtained in a facilitated network environment to allow for incremental improvements to occur within the micro-firm. However, joining a network is not sufficient to achieve enhanced green capabilities as these micro-firm O/Ms need certain network capabilities to benefit from the network, or for it to be a valuable resource to the micro-firm and improve its NEO (Håkansson, 1987; Ritter and Gemünden, 2003).

The knowledge required for innovation (Liu *et al.*, 2012) was acquired internally and externally (Kunapatarawong and Martínez-Ros, 2014), but very often in micro-firms, the O/M 'is' the business, therefore externally-generated knowledge was found to be a key resource. The O/M's background and previous experience, along with their attitude towards learning (Tippman *et al.*, 2013) and collaboration were found to be assets in maximising the knowledge obtained in the facilitated network and when transforming that knowledge into internal

capabilities, “the farmers across the board have benefited from learning from each other” (OCC3). In order to achieve the micro-firm’s full innovative potential other factors including O/M supports and a culture embedded with innovation and employee involvement was important. This dual continuous relationship (Stahle and Hong, 2002) is believed to be improved by continuous engagement to improve the adaptive innovative process and as a result it become a valuable resource for continuous green innovation capability enhancement in the studied micro-firms.

6.5.1 Refined framework

The original conceptual framework (Chapter 3 figure 2) offered a boundary device through which this study could be considered. This framework was subsequently refined based on the current study’s findings. The refined framework for Green Innovation Capability development is presented in Figure 3.

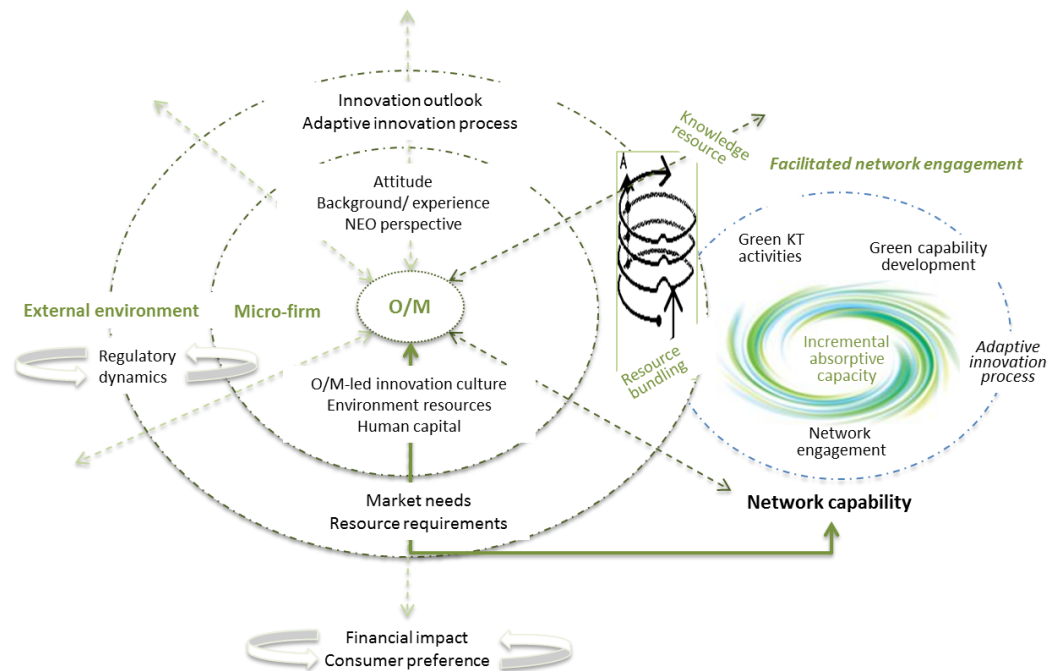


Figure 3: Revised Innovation Capability Framework

The initial framework showed that the O/M's attitude, background and previous experience were determinants of the NEO of the micro-firm (Phan, 2008). Environmental influencers included green regulation in the original framework, expanded to encompass economic gain (e.g. financial impact), and the changing preferences of customers in the refined framework (outer coil). Environmental resources and the green economy were not evident environment influencers in the findings, perceived as either not being available or not being economically viable options for the micro-firm. However, financial motivation was the key influencing factor preceding voluntary NEO of the micro-firm, as exhibited in the refined framework. Unless there was an underlying NEO, micro-firms only implemented green initiatives if they made a positive financial impact on the firm. In the absence of regulations or the perceived exclusion of the firm for said regulations, the onus was on the O/M to pursue green innovation in their micro-firm.

The unique dynamic capability and close proximity to their customer base was a source of competitive advantage for the observed micro-firms (Haghighi *et al.*, 2014; Matlay, 1999; Storey and Cressy, 1996). Evident in the findings was the gap between ideas and implementation, primarily as a result of internal resource and capabilities limitations. Micro-firms due to their size, often had to perform all tasks independently, and were reliant on network-enabled external knowledge transfer for innovation and new knowledge development (Hakansson and Ford, 2002; Kearney *et al.*, 2014; Reinl and Kelliher, 2010; Tinsley and Lynch, 2001), as highlighted in the expanded circuitry on the right of the refined framework.

Micro-firms exhibited an active learning culture and openness to learning skills but were also willing to outsource their knowledge needs (Matlay, 1999), "*I wouldn't dream of being my own accountant, my own lawyer for example*" (OCI1). Evident in the findings was that facilitated networks were not only a source of knowledge transfer (Cavusgil *et al.*, 2003; Lynn *et al.*, 1999; Nonaka and Takeuchi, 1995; Stawasz, 2015) but a vital additional resource for external knowledge transfer for green innovation. Facilitated networks had an important influencing role in capability development and were an additional resource for the micro-firms (Cavusgil *et al.*, 2003; Uzzi, 1997; Zahner and Bell, 2005).

Facilitated networks had the potential to promote cost savings and revenue generating opportunities to encourage micro-firms green innovation capability development (Lorek and Spangenberg, 2013). However, in order to embed this resource in the micro-firm, O/Ms needed to enhance their absorptive capacity (Liao *et al.*, 2009) through ongoing engagement with the facilitated network (Figure 3).

The findings revealed that, to be effective in the network the micro-firms required networking capabilities, developed incrementally through the provision of green knowledge transfer activities and green skills development. These activities interact in a cyclical manner within the network, as exhibited in Figure 3. It was also advised that O/Ms should carefully ‘match’ their needs to the appropriate network to ‘avoid wasting resources’ (OCC1), maximise their use of resources and benefit from network involvement. The observed networks played an important role in resource bundling and knowledge generation (Besser and Miller, 2010; Nieto and Santamaria, 2007) and could provide green information in the form of workshops, training and industry specific green information, although most of the observed networks had not done so.

The micro-firm’s exploitation of new knowledge through absorptive capacity facilitates a micro-firm’s green innovation capability development over time (Liao *et al.*, 2009). Green innovation is therefore both an incremental (Tippman *et al.*, 2013) and perpetual cyclical process. By engaging with continuous green capability enhancement, the micro-firm’s absorptive capacity for green innovation capability development also improved (Gabler *et al.*, 2015). Evident in the findings was, if the micro-firm experienced positive feedback in the form of economic benefits or greater resource, green innovation continued to nurture (Walsh *et al.*, 2012). The refined framework perpetuated the feedback loop into the green innovation capability development cycle with the O/M at the core, as in the absence of continuous feedback and capability exploitation, the cycle stopped. The loop represents a feedback and exploitation loop given the findings i.e. engagement in the network enhancing green innovation capabilities and then exploiting new knowledge through absorptive capacity. The micro-firm’s dynamic capability in the incremental adaptive innovation process (Kelliher and

Reinl, 2014; Phan, 2008) discontinued the green innovation capability that was not receiving economic benefit. In the presence of a positive feedback loop, the micro-firm leveraged and exploited its resource base and transformed capabilities through network engagement and continued the proactive adaptive innovation process (Powell and DiMaggio, 1991).

6.6 Conclusion

This chapter discussed and analysed the findings as identified as a result of this study. The outcomes of each of the three research objectives were examined in relation to the findings identified in chapter six and also in relation to the wider literature as reviewed and evaluated in the earlier literature search. This chapter outlined the findings from this research study and presented the elements and relationships that influence green innovation capability development. The perceived impact of facilitated networks on green innovation capability in the observed micro-firm was discussed. In achieving the research objectives, the green innovation capability skills audit in selected Irish and Canadian micro-firms was analysed and an Innovation Capability Framework for Green Enterprise in the Micro-Firm environment (Figure 3) was outlined. The next chapter discusses the conclusions and recommendations resulting from this study.

Chapter 7: Conclusion Chapter

7.1 Introduction

This, the final chapter of the thesis, considers the conclusions emanating from the research findings and provides a summary of the contributions made at theoretical, methodological and policy/ practice levels, forthcoming from this research study. This chapter commences with a review of the thesis aim and objectives before presenting a summary of the findings and discussing the contribution to knowledge resulting from this study. In addition, the theoretical contributions are outlined and the implications of this study are charted. Reflections on the research approach used and the PhD process and are also set out. To conclude this chapter presents the limitations of this doctoral study and recommendations for future research.

7.2 Thesis aim and objectives

Research in the area of micro-firm innovation has been limited to date (Kearney, 2015;); although that which has been carried out points to the value of innovation capability development for micro-firms (Kearney *et al.*, 2014). Studies relating to green innovation capability development are also scarce (Walsh *et al.*, 2012; Kelliher & Reinl, 2014), as are studies relating to green innovations in the small firm setting (Kelliher and Reinl, 2014).. The reported study contributes to this research gap as documented later in this chapter (see section 7.3 contribution to knowledge; section 7.4 theoretical contributions; section 7.5 practice and policy contributions). Guided by the overriding research aim (to *explore the perceived impact of facilitated network engagement on green innovation capability development in the micro-firm*), the following objectives focused the research trajectory (RO1-3);

1. To undertake an analysis of perceived green innovation capability in selected Irish and Canadian micro-firms;

2. To explore the perceived impact of facilitated network engagement on the micro-firms' green innovation capability development;
3. To propose a green innovation capability framework for the micro-firm environment.

An empirical study carried out in Canada and Ireland from May 2015-April 2016 commenced with the semi-structured interview and a green audit with each of eight O/Ms in selected Irish and Canadian micro-firms, using an audit instrument (appendix A) developed through an informed review of relevant literature (RO1). The researcher then sought to explore the perceived impact of facilitated network engagement on the micro-firms' green innovation capability development (RO2). With reference to the proposed framework (RO3), the literature review facilitated the development of an initial conceptual framework (Chapter 3, figure 2). These methods in combination helped to carefully track the design, development and refinement of the initial framework for the study (Figure 3, chapter 6), and ultimately propose a green innovation capability framework for the micro-firm environment (RO3). This chronology was discussed in greater detail in the summary of research outcomes (chapter 6, section 6.5). It is recognised in the literature that resources alone are insufficient in building capabilities; they need to be leveraged and exploited through green innovation capability development in interaction with the shared lens of network engagement. From the findings, the majority of the observed micro-firms pursued a reactive approach to green economy engagement wherein O/Ms did not pursue green initiatives unless (a) it made a positive financial impact, or (b) where there were environmental regulations in place with a penalty for non-compliance. The NEO of O/M was found to have an impact on proactive green activities, but the findings showed that this activity was also correlated with a financial motivation when related to the micro-firm operation.

Joining a network was not sufficient to achieve enhanced innovation capabilities, micro-firm O/Ms needed certain network capabilities to benefit from the network and for it to be a valuable resource to the micro-firm. The O/M's access to resource and their absorptive capacity were key to obtaining the knowledge the

micro-firm required to enhance their innovation capability. This knowledge can be acquired internally and externally, but very often in micro-firms, the O/M was the only person in the business, therefore externally-generated knowledge was a key resource. The O/M's background and previous experience, along with their attitude towards learning and collaboration were believed to be assets in maximising the knowledge obtained in the facilitated network and transforming it into capabilities for use within the micro-firm. Therefore the micro-firm network capabilities include capacity to build relationships and to develop incremental absorptive capacity to utilise the knowledge obtained in the facilitated network and allow for incremental green innovation to embed in the micro-firm. The O/M support, an innovation culture and proactive employee involvement are important catalysts to achieve the full green innovation potential for the micro-firm. This dual continuous relationship is believed to be improved by a continuous positive feedback loop to improve the micro-firm's adaptive green innovation process. This cyclical approach to facilitated network engagement (Figure 3) becomes a valuable resource for continuous green innovation capability development in the micro-firm.

7.2.1 Summary of Research outcomes

With reference to RO1, the findings from the green audit revealed that there were many similarities between both countries (e.g. Canada and Ireland). However, it was interesting to find that all four Canadian cases rated it 'important' to integrate green into operations, whereas none of the Irish cases rated this as important, suggesting an anomaly between countries in this context. The second research objective (RO2) was to explore the perceived impact of facilitated network engagement on micro-firm green innovation capability development in two contexts, Ireland and Canada. Four network facilitators were interviewed, two in each jurisdiction. Eight O/Ms were also interviewed a number of times (Appendix C (c)) and observations were made regarding their network interactions with both members and facilitators. The findings exhibited that facilitated networks have a significant impact on micro-firms as an important additional resource (social capital, human capital, financial/ access to funding, knowledge). Additionally the

observations revealed that networks played a vital role in advancing innovations (Besser and Miller, 2010; Nieto and Santamaria, 2007) by providing information, support in teasing out ideas and general advice to the micro-firms (OCC1; OCC4; OCI1, OCI2: OCI3). It was also evident that micro-firms that fully engaged in facilitated networks (Chesbrough, 2003) than those who did not. However, the importance of choosing a network carefully was advised by a number of participants to avoid wasting time and resources and to ensure maximum membership benefit was achieved. Similarly, having the necessary networking skills to extract and embed the additional resource in the micro-firm was noted as important in this context.

The micro-firm's unique ability to respond to changes in the market quickly due to proximity was perceived as a distinctive advantage in developing green innovation capabilities in the current study. However, successful knowledge transfer between the environment and the micro-firm needed to occur for capabilities to develop. A culture of 'open learning' inherent in micro-firms was viewed as a positive attribute for the adoption of green innovation. Likewise, the role of the O/M in the enhancement of employee involvement also appeared as a contributing factor for green innovation. Potential positive financial impact has been the predominant influencer for the micro-firm's green economy engagement and dominated most decisions. Of note is enforced regulation as a secondary influencer. Currently the onus is perceived to be on the individual O/M to take the green initiative based on the research findings, emphasising the centrality of the O/M in influencing the micro-firm attitude towards green innovation activities. The O/Ms NEO proved relevant in this regard. Other drivers of the green economy in a micro-firm setting have come from external (Leonidou *et al.*, 2016; Panwar *et al.*, 2016) and internal stakeholders (Hill and Stewart, 1999; Sveiby, 2000), the macro economy and enforced regulations. In a survey carried out by Eco Canada, government policies, customer demands and firm reputation were also outlined as drivers to green economic change (Eco Canada, 2010), a view supported by the current study outcomes.

The case study approach provided rich insights into the perceived impact of facilitated networks on green innovation capability development in the micro-

firm. These insights facilitated the development and refinement of the green innovation capability framework (RO3). The framework outlines the sub-processes recognised in this study as influencers and catalysts which were characteristic for the development of green innovation capabilities in the micro-firm, supported through interaction with the facilitated network. The pattern that emerged from the research was a cyclical sequential process of activities and actions undertaken at O/M, micro-firm and at network level. The initial innovation capability framework (figure 2, Chapter 3 identified that the micro-firm and O/M could adopt in order to develop its green innovation capability, based on extant literature. The necessary conditions were also outlined that encouraged and promoted green innovation development in the micro-firm. Through the process of data collection, data analysis, reflection and both supervisor and conference review, a refined framework of green innovation capability development in the micro-firm setting emerged, taking account of the integration of the empirical findings and the proposed conceptual framework. The refined framework (Figure 3, chapter 6) reflected additional environmental influencing factors and supplementary supports from facilitated network engagement, which signified the incremental and continuous emergence of green innovation capability development in the context of the green economy.

7.2.2 Cross-country case insights

The cross-country approach allowed for data analysis within each setting, and across settings, as well as the opportunity to identify similarities and differences between cases in Ireland and Canada. It was possible to examine activity at multiple levels (individual, firm, network, industry, country) to identify the drivers and influencers of green innovation guided by OMs within the studied micro-firms. Overall there appeared to be more similarities than differences in Ireland and Canada in relation to the O/M's motives, actions and intentions in their collaboration with networks and the micro-firm. It was evident from the cases studied that the O/M in both countries had a direct impact on the micro-firm culture and hence on green innovation capability development. There appeared to be no differences across cases between the O/M's style. The micro-firms in both

countries experienced similar resource constraints within each sector and the strategic goal was first and foremost one of survival in each case, regardless of location. The drivers to change were equally similar with the underlying theme of potential economic gain evident in all cases.

Three of the participants in Ireland found it unimportant to integrate green initiatives, whereas the four Canadian cases rated it from important to completely important in the green audit. There appeared to be a reactive pattern with country-level respondents in both countries, as they highlighted money/costs and ‘bottom line’ as catalysts for green engagement and rated integration of green as largely unimportant in firm operations. One anomaly was the Irish respondents’ view that a green mindset was deemed irrelevant to micro-firm operations, a finding that was not replicated in the Canadian cases.

Networks in both jurisdictions provided information on funding, resources and information relating to green initiatives. However, in the absence of regulations the onus was on the individual to demonstrate green innovation in their business (NI2) and to look for the information specific to their industry and find the necessary funding and resources. One network (NI2) in Ireland had run some information sessions or workshops on the green economy another had no plans at the time of writing to do so (NI1). But the primary focus of the networks (NI1; NC1; NC2) was to mentor O/Ms on the skills needed to run their micro-firm and provide information and resources to build awareness of green impact and encourage green initiatives in these businesses. Cases in both countries agreed that networks were a valuable additional resource and in most cases where the O/M was the only employee, the only resource for leveraging resources, enhancing capabilities and encouraging innovation. The lack of access to information in simple language, specific to the industry sector and size of the firm was evident in both countries and one that acted as a perceived barrier to green innovation in each case.

The agriculture sector cases in both countries showed how the O/Ms actively pursued regulatory-induced green initiatives, with regulatory conformity the key catalyst in context. The O/M from the agricultural case in Ireland stated that they

were crippled by regulations in comparison with other countries, although this amounted to perceptual bias based on EU statistics. In contrast, the agriculture case in Canada mentioned that the regulations were not strict enough, reflecting a more proactive approach to green innovation in this case. In all other cases the O/Ms perceived they did not have an impact on the green economy due to their size and they were not aware of any environmental regulations that were relevant to their firms, suggesting each micro-firm saw itself as a standalone entity rather than part of a cohort of other micro-firms at country or EU level. In all cases excluding the agricultural sectors, O/Ms knowledge on green issues and there was an understanding of what the terms green economy and green innovation meant, although respondents had not heard of the terms prior to the case interviews. In both countries the O/Ms did not proactively seek information on green innovation unless it was a regulatory requirement, based on a customer request or was going to have a potential economic benefit to the micro-firm.

7.3 *Contribution to knowledge*

While micro-firms represent the vast majority of all businesses, they have little individual impact in their respective business environments (Kelliher and Reinl, 2009). Yet, these businesses have a significant impact on the global economy (Eurostat, 2014), collectively representing 83% of all firms in Ireland (EC, 2011) and 75% in Canada (Industry Canada, 2013). Despite their collective importance to the green economy, research relating to micro-firm green innovation capability development and facilitated network engagement has been scarce. This study added to the existing micro-firm research base (O'Dwyer and Ryan, 2000) finding that decision making in the studied micro-firms had a short term as opposed to long term trajectory, and the observed firms did not seek significant growth. There were a number of themes which were extracted from the research findings relative to the perceived impact of facilitated networks on green innovation capability development that were not evident in the extant literature and which were significant to this study. These are highlighted under the emergent themes (right-hand column) in Table 19.

Literary Themes	Key Findings
Market regulatory dynamics are the environmental influencers.	Financial motivation is the biggest incentive for green innovation, with regulatory requirements a secondary catalyst.
Environmental resources influence green innovation.	The concept of “issue” and “cause” is important and O/Ms should have the ability to be proactive in encouraging change to embed green innovation into the micro-firm’s innovation process.
Micro-firms are open to resource sharing; suffer from restricted skills/ resources.	Trust is a factor in whether information is shared amongst stakeholders in the network and mistrust can act as a barrier in context. The network is important in the dual continuous relationship required to facilitate green innovation capability enhancement.
O/M-led innovation culture; open to feedback.	O/M is open to and promotes an active learning culture, innovative behaviour and processes in pursuit of micro-firm green innovation. The O/M’s personal focus on green issues impact on green innovation in the micro-firm; the O/Ms NEO, as well as attitude, background and previous experience influences green orientation. Core business performance should be a level such that the O/M can focus on implementing (additional) green initiatives into the firm.
The facilitated network provided collaborative knowledge sharing (shared lens); green knowledge transfer initiatives.	Network engagement proved important in transforming knowledge into innovation. Internal/ network/ environment resource bundling influenced the transformation of innovation into innovation capability in the micro-firm.
Language impact on green knowledge transfer.	Language is seen as a barrier to green innovation capability development and information resource/ knowledge transfer.
Adaptive innovation process in the micro-firm.	A large gap existed between the generation of innovative ideas and the ability to obtain the resources to bring the ideas to fruition.

Table 19: Comparative table of literary and current research themes

The current study differed from prior research (Burton, 2001; Chaganti *et al.*, 2008) which states that micro-firms rely solely on the O/M’s knowledge for innovation. The current study established that employee involvement and family input have a positive impact on the micro-firm innovation process, expanding on the views of Andries and Czarnitzki (2014) and Klaas *et al.*, (2010). This study has broken new ground through integrating internal (O/M and employee) and external (customer and network) knowledge resources in the pursuit of green innovation capability development. This work has contributed to empirical knowledge and proposed that facilitated networks are an additional resource to micro-firms and have the potential to impact micro-firm innovation capability development as a result. The findings suggest that a green innovation capability structure can evolve by developing skills to leverage the firm’s internal and external innovation resources (Walsh *et al.*, 2012). This can be achieved by pooling knowledge and bundling resources obtained through facilitated network involvement. However, the perceived impact of networks and the value of the

network as a resource are influenced by the micro-firm culture and ultimately the characteristics and natural environmental orientation of the O/M. A key contribution based on the findings is that of the mindset and values of the O/M in influencing innovation capability development as a key green innovation influencer in the micro-firm.

This study contributes to this knowledge that the absorptive capability of the O/M and the micro-firms dynamic capability and proactiveness to assimilate externally generated knowledge are influencing factors in green innovation capability development. Green innovation is only considered by the O/M after core business issues are at a level such that a greater focus might be given over to green innovation, *“It is hard when you are trying when you are up to your butt in alligators it is hard to remember the objective is to drain the swamp”* (OCC1), extending knowledge and comprehension of the resource-based view of the micro-firm (Kelliher and Reinl, 2009). This study also added to the existing research (O’Dwyer and Ryan, 2000) that decision making in the studied micro-firms was traditional rather than growth focused; in this study, lifestyle orientation was the dominant approach to business operation. The findings highlighted that ifestyle influencers have a greater influence on innovation in the micro-firm setting than previously considered.

The observed network members assisted each other in achieving the regulatory requirements affiliate to the green economy, guided by the network facilitators or invited specialists (NC1; NC2). Micro-firm O/Ms also helped others in the pursuit of compliance, particularly in highly regulated sectors (e.g. agriculture). Similarly, this study showed that the O/M’s characteristics determined the value of network involvement and engagement with other network actors. While Florida *et al.*, (2000) highlighted only two factors (the firm’s resources and capabilities) in a firm’s drive to adopt environmental factors, the current study findings revealed that an O/M openness to engage with other firms and the influence of regulations were two further external driving forces in the adoption of green initiatives. In turn, the network facilitator determined the information

flow, by enhancing the benefits of the network through enabling the leveraging of resources and enhancing micro-firm green innovation capabilities.

The intrinsic characteristics of the O/M including willingness to trust others and incremental absorptive capacity (Liao *et al.*, 2009) influenced the transformational process of the innovation capability development and the effectiveness of the continuous relationship between knowledge, innovation and innovation as discussed previously. There was also some evidence in the findings that the micro-firms that pursue green activities based on values and commitment receive more positive outcomes than those that engage with these activities for economic gain alone (Arend, 2014; Menguc and Ozanne, 2005).

7.4 Theoretical contributions of the research

The theoretical underpinnings of this study are drawn from the resource-based view (RBV) and dynamic capabilities (DC) lens. The findings reinforce certain elements of the RBV - micro-firms suffer from resource constraints that are not evident in larger firms. Micro-firms maximise the resources they do have by leveraging and exploiting external knowledge resources through network engagement. Thus, facilitated networks act as an additional resource for the micro-firm, but the effectiveness of network participation is partially dependent on the O/M's networking capabilities. In a micro-firm context, firm performance is a function of managerial capability and the O/M is a central resource for the firm. Researchers posit that 'dynamic capability' is central to sustained innovation (Teece *et al.*, 1997) and the outcome of knowledge integration (Grant, 1996). Under this mantle, capabilities are unique to each firm, acquired through learning or innovation. Routines and competencies are attributable to local and regional forces that shape the firm's capabilities; they cannot be acquired, they need to be built. Micro-firms suffer from resource constraints in terms of human, financial and knowledge capital and therefore have insufficient internal resources to build the necessary green innovation capabilities on their own. As a result they follow a reactive approach to decision making, an inept approach when pursuing sustainable business activities. Facilitated networks are a vital component in

obtaining the resources and knowledge that micro-firms require to build green innovation capability. Thus, to be most effective, facilitated networks should be multi-disciplinary, and promote green knowledge transfer and skills initiatives, which in turn would be a new knowledge resource for the firm, generating incremental absorptive capacity on the part of the O/M. In order to be of further benefit and enable the micro-firm's absorptive capacity, the information, knowledge and skills should be in a format comprehensible to the O/M.

7.5 Practice and policy contribution of the research

This research concurs with previous researchers, exhibiting a gap between the goals and perceptions of O/M and policy makers (Duarte-Alonso and Bressan, 2014; Kearney *et al.*, 2014; McGrath and O'Toole, 2013; Phillipson *et al.*, 2006). The observed network members assisted each other in achieving the regulatory requirements, guided by the network facilitators or invited specialists (NC1; NC2). Micro-firm O/Ms also helped others in pursuit of compliance. The current study findings revealed that an openness to engage with other firms, and the influence of regulations are two further external driving forces in the adoption of green initiatives. This study provides a framework that can be used as a guideline for micro-firm O/Ms and relevant support organisations, including network facilitators to assist micro-firms in reaching their green innovation goals and objectives. The framework outlines the environmental influencers that facilitate green innovation in the micro-firm and in doing so, exhibits the complex nature of the micro-firm involvement in the green economy.

There is also an evident policy implementation gap between green market regulator dynamics and green innovation capability development in the micro-firm environment. This study highlighted this gap and considered using cross-case and cross-country analysis how Ireland and Canada can engage the micro-firm sector in order to foster an innovation-driven culture through eco-innovation initiatives. This study has therefore made a contribution in the formulation of a stronger empirical framework for the further study on green innovation capability development in micro-firms in the context of the green economy.

7.6 *Implications of Research*

Part of the researcher's role in achieving the research objectives was to seek to understand the subjective reality of the O/M in order to be able to make sense of, and understand, their motives, activities and objectives in their collaboration with networks and the micro-firm. In order to understand the micro-firm's resources and dynamic capabilities it was important to understand the meanings attached to the social phenomena of social actors including the O/M's style, views, beliefs and transformational capability. The epistemology adopted for this study was interpretivist due to its appropriateness and applicability to the research project at hand. The feasibility of using semi-structured interviews had already been recognised at the initial stages of the research and in engagement with the first interviewees. Many participants said they had both appreciated and gained something from partaking in the study. The green audit helped to increase awareness among the studied micro-firms and helped to articulate the green innovation skills gap in each organisation. The proposed framework shows how engagement with relevant emerging green market and regulator dynamics increased the O/M's understanding of skills that need to be developed in pursuit of green innovation capabilities in the micro-firm. This cross-country study also contributed to knowledge by permitting for data analysis within each setting, and across settings, as well as the opportunity to identify similarities and differences between cases and countries.

This study examined the important yet often ignored question of how networks are perceived to impact micro-firm capability development by providing support from other micro-firms. Development was found to be through deploying and further developing O/M and micro-firms' existing dynamic capabilities, providing an addition to their limited resources and by offering a facility/space and opportunity for the sharing of resources. While the networks can provide information on how the micro-firm can be more innovative, resource constraints and a lack of internal capabilities may prevent the micro-firm from taking these ideas and implementing them. In the same way, the resource and capability constraints may inhibit the micro-firm from looking at further green innovation.

Fulfilment of their basic business needs is required before they can network and consider green innovation. These findings have implications for micro-firms' resource use and capability enhancement in pursuit of sustainable development in the emerging green economy.

While the studied micro-firms perceived they do not have a significant impact on the environment due to their diminutive size, they collectively account for 70% of industrial waste and pollution (Hillary, 2000) and 64% of all industrial waste (Miller *et al.*, 2011). Therefore, the development of micro-firms green innovation capability is vital for green economy goals to be achieved (Environment Agency, 2011; Robinson *et al.*, 2013). However, due to a lack of internal resources, micro-firms are unable to achieve green innovation independently (Tu *et al.*, 2014). Thus, facilitated networks are important to micro-firms (Greenbank, 2000; Kokkonen and Tuohino, 2007; Reinl *et al.*, 2015; Wyer *et al.*, 2000) as they offer access to additional resources, capabilities and markets not easily accessible for the individual firm (Carter *et al.*, 2013; Dyer and Singh 1998).

7.7 Research Limitations

This study has some limitations. While the findings obtained from the research are valuable and the number of cases is within the domain recommended by other researchers (Guest, 1996), one needs to note that the sample size is small. Yet data saturation was reached, there was enough information to replicate the study (Walker, 2012), the ability to obtain additional new information was attained (Guest *et al.*, 2006), and further coding was no longer feasible (Guest *et al.*, 2006). Due to time and resource limitations affiliate to a single researcher primarily based in Ireland and the nature of the micro-firm as a functioning business, it was only possible to carry out observations at one geographical location in Canada while on site in 2015. Further observations and discussions were facilitated through an electronic audio-visual medium (e.g. Skype), alleviating some of the limitations affiliate to distance between the researcher's main country of residence (Ireland) and the study's cross-country focus (Ireland and Canada).

This research was embedded in the theory of the resource based view and dynamic capabilities perspectives. Alternative theoretical frameworks were available that may shed a different light on the research aim and objectives. For example innovation theory could be used to look at green innovation in different sectors in the micro-firm context. Innovation theory could also be used to examine cultural differences and its impact on green innovation in the context of the micro-firm, and may be an appropriate lens in further studies.

This research alluded to trust and absorptive capacity as components of networking capabilities and influencers of green innovation capability development. Due to the parameters of this study the measurement of trust and absorptive capacity, including their scope and dimensions were not studied as this is a substantial study in its own right and beyond the parameters of the current study but would be useful components to study in more detail for future research.

The research was qualitative in nature and the framework provided in depth contextual understanding of the research aim. From an interpretivist viewpoint there was cognisance that social dynamics can change the network and micro-firm environment. Therefore the initial (Figure 2, chapter 3) and refined frameworks (Figure 3, chapter 6) serve as a guide for both practitioners and academics in the advancement of green innovation capability development in practice and research respectively. The framework provides a detailed map of the micro-firm network environment, but does so with awareness that unique contextual events may impact on the micro-firm at times.

7.8 Recommendations

Given the findings of the research and their contributions to knowledge, and keeping in mind the limitations listed above, this section highlights a number of recommendations.

Significantly, this study found that micro-firms require information that is specific to their industry sector and expressed in accessible terminology/language in order to successfully embed in their organisational setting. As networks are one of the main sources of information for micro-firms, the network has the potential to act as a conduit promoting micro-firm green innovation through training, workshops and the provision of industry specific green information. Notably, with the exception of the agricultural sector, the observed networks had not provided these green innovation support activities to their members to date.

The proposed green innovation capability framework provides a series of processes that allow proactive adaptive green innovation and transformation capability development to be embedded in the micro-firm via the facilitated network. This process countenanced incremental improvement allowing the enhancement of green innovation capabilities, thereby improving the NEO of O/M and over time allowing the green initiatives to be embedded into the mindset of the O/M and employees of the micro-firm. This in turn might assist the micro-firm in embedding green policies proactively into the decision making and planning strategies of the micro-firm.

The reported study also reinforces previous researcher's recommendations that governments should facilitate networks to foster innovation (Huggins *et al.*, 2008). Additionally, at a national level, it is valuable for government agencies to run systematic and collective marketing initiatives with enterprise and networks to promote green innovation among this cohort. At present, the onus is on the individual to take accountability for green innovation, even in the resource-constrained micro-firm environment. However, the author would agree with Benito-Hernández *et al.*, (2016) that assistance through academic institutions in the form of resource provision and cross fertilisation capabilities that may provide increased focus on green innovation.

By including O/Ms in policy and decision making on green innovation this could encourage cohesion in green policies. Equally, by promoting the link between green engagement and productivity and by demonstrating the return on investment that can be achieved from green innovation, O/Ms may see the

benefits of incorporating green innovation into practice and their core business strategies.

7.9 Recommendations for further research

This exploratory study provided a basis on which further research can be undertaken in the area of green innovation, facilitated networks and the micro-firm. First, while Ireland and Canada are the setting for this research, the framework could potentially be applied in other countries and in further micro-firms to test its applicability for the development of green innovation capabilities.

Based on the above suggestion, a study of the effect of facilitated network engagement and/ or a targeted training/ communication strategy on green initiatives over time would further advance the understanding of the concept of green innovation capability development in the micro-firm, and would help to inform O/Ms and public policy makers as to its additional potential. Such a study, as alluded to in the previous section, is not possible here due to the non-availability of such data and the resource limitations affiliate to a single researcher.

A future study developing each of the themes of the innovation capability framework for green enterprise could be carried out. For example, by focusing on how the networking capabilities - trust and absorptive capacity could be measured and enhanced in the micro-firm context. There was also a shortage of research on green innovation capability development when pursuing an understanding of the concepts for the current study. Suggestions for further research could also address the following areas: A repeat of this study could allow for comparisons of the findings. Contemplation of the research questions, what is the effect of learning and development initiatives for green enterprise on micro-firm green innovation capability development?

7.10 Research reflection on the PhD Process

This section reflects on the design of the interpretive case study approach used to serve the research needs of the study. To achieve the research aim, a multi-case cross country interpretive study was conducted over a twelve-month period involving eight micro-firms spread over a number of sectors; in which each O/M and a facilitator from their respective facilitated networks were interviewed a number of times. Each O/Ms green skills were also audited as an aspect of this study. On reflection, the interpretivist approach was appropriate for studying the eight cases and four network facilitators in depth. As well as uncovering the O/M's personal experiences, this approach was conducive to working with micro-firms and O/Ms, as micro-firms were complex and unique (Saunders *et al.*, 2007). The interpretivist approach was also more responsive to the micro-firm's local situations and conditions.

In agreement with Hermel and Khayat, (2011) and Hardie (2011), the observatory case study approach was suitable for exploration of varying environments and illumination of typical processes or structures that were likely to persist. The convergence of the interpretive case study and the green audit enabled greater understanding of the complex environment under study. This research collected data directly from O/Ms in an attempt to understand how the O/M's characteristics and their perceptions of the green economy have influenced green decision making and planning in the micro-firm. The cross-country study allowed the interpretation of cultural and national differences to be identified in the findings, such as that relating to the relative importance of green initiatives in each country. Therefore, this approach was applicable and enabled the rigorous exploration of the research aim and objectives.

The data analysis software tool, NVivo was useful for creating the codes and blending the data in order to provide richer data. In an effort to maximise its use, training was undertaken and one-to-one mentoring throughout the research process was availed of. This was beneficial and would be recommended pre and post data collection. This approach was useful and ensured the questionnaire and audit design had the potential to maximum data for NVivo manipulation. For the

interview process, the interviews were audio-recorded, then transcribed by the researcher using MS Word and imported into NVivo. The transcriptions were sent back to participants to ensure credibility and clarity of information. This process of transcribing was found to be valuable in order to become more familiar with the main topics that arose from the interview. Correlations were identified using patterns and word searches were identified that would not have been as noticeable without the software. This added a further richness to the data.

The reflective diary was valuable as an aide memoir when setting out the goals and objectives for the interview guide and research protocols. It was used after each interview and observation to reflect on the enabling and constraining factors, actions taken, as well as identifying the future direction and feelings in retrospect. This process enhanced the observatory and interview process. It was difficult to maintain the reflective diary entry at write up stage and this is acknowledged in the methodology. During this phase it was used during periods when writing reached a wall or barrier to advancement. Reflective writing at this stage assisted with the literature/ data manipulation, which allowed for further blending and framework advancement.

On individual and professional levels the process has assisted in improving time-management, organisation, analytical and writing skills. Specifically, the research process required extensive preparation and planning for each stage of the study and each stage of the study had to be conducted in an organised manner. The author has also obtained a set of professional and personal insights from presenting the findings at conferences and in the business school annual review seminars at Waterford Institute of Technology. This helped in the progression of a critical mindset and development of self-confidence in both writing and presenting.

7.11 Conclusion

This chapter contemplated the research aim and objectives and reflected on the contributions of the research to the knowledge base from a personal, theoretical,

empirical, and policy perspective. Finally, the chapter reviewed the limitations of the research, outlined suggestions for future research and provided a reflection of the research process.

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Appendix A: Interview Guide and Green Skills Audit

Micro firm green innovativeness capability development Research study 2015

INTERVIEW GUIDE

Key objectives of this interview are to determine o/m's views;

The purpose of the study is to explore the perceived impact of facilitated network engagement on green innovation capability development in the micro-firm. Ultimately, this research will be published as part of my PhD at Waterford Institute of Technology, and seeks to contribute to the policy debate relating to innovation capability development in micro-firms.

Ultimately, this research will be published as part of my PhD at Waterford Institute of Technology, and seeks to contribute to the policy debate relating to innovativeness capability development in micro-firms.

Stress that their views on their business requirements are being sought and are highly valued

Outline confidentiality guarantees and request consent to record interviews

Every effort will be made to ensure confidentiality of any identifying information that is obtained in connection with this study. You will be assigned an Identification Code and your name or other identifying factors will not appear in the final thesis or related publications. Results will be presented in an aggregated format that will not identify any one person. The records of this study will be kept strictly confidential. Audio or video tape recordings will be used for transcription purposes only and destroyed within three years of completion of the research study.

INTERVIEW ARRANGEMENTS

Thank you very much for agreeing to take part in this interview. I very much appreciate your support in this research study.

As agreed, this interview will take no more than an hour.

You are not obliged to answer any of the questions asked.

I intend to hold at least one interview in the owner/ manager's business to observe them in their business context.

Contact Details

Business Name:	
Participant Name:	
Business Address:	
Business Size (no of employees):	
Business Type/Sector:	

TO BEGIN WITH, I WOULD LIKE TO ASK YOU SOME GENERAL QUESTIONS ABOUT YOUR BUSINESS

1. How long have you been in this business?

COULD I ASK YOU ABOUT SOME OF THE SKILLS YOU USE IN RUNNING THE BUSINESS

How long have you been in this business?

COULD I ASK YOU ABOUT SOME OF THE SKILLS YOU USE IN RUNNING THE BUSINESS

How did you learn to run your business?

Probe: Could you give me specific examples?

Where do you get advice about managing the business?

Probe: Is it of value?

THE NEXT QUESTIONS ARE MORE DETAILED ABOUT SOME ASPECTS OF RUNNING YOUR BUSINESS AND THE SKILLS YOU USE.

Do you have anyone working with you in your business?

Probe: ... and family members?

Do you feel that they contribute to the business?

Probe: Could you give me an example?

Who makes the decisions?

Do you find that the decision making tends to be focused on the long or short term?

Who would you consult with in making the decisions?

MAY I ASK YOU ABOUT THE RELATIONSHIPS YOU HAVE WITH THE PEOPLE YOU INTERACT WITH IN AND THROUGH THE BUSINESS

Are there particular people that you speak to about your business?

Probe: Family members/ others

Do you have contact with other businesses in the area?

Probe: How and when do you interact?

I WILL NOW MOVE ON TO NETWORKS

What is the role of the network?

What encouraged you to take part in a network?

What would you hope to achieve from the network?

How many networks are you involved in, (details, names)

Does being involved in a network create any risks for the business?

How does the network benefit you?

What do you find are the best ways of communicating and sharing information in the network?

Do members share information with each other?

If so, was this information sharing valuable to the firm?

I WILL NOW MOVE ON TO GREEN SKILLS AND GREEN ECONOMY

Green economy is described as an economy that results in reducing environmental risks and aims for sustainable development

Green skills (skills for sustainability), are the technical skills, knowledge, values and attitudes needed in the workforce to develop and support sustainable social, economic and environmental outcomes in business, industry and the community (COAG, 2008)

Do you currently take any measures to improve your energy efficiency and reduce your energy costs?

Can you give an example of that?

Do you know how much waste you currently produce?

Does your business currently have:

A green policy	Yes	No
A green champion	Yes	No
Any green/ environmental awards	Yes	No
Membership of green/ environmental charters	Yes	No

What measures do you take to improve your energy efficiency and reduce your energy costs?

Do you know how much waste you produce?

What type of waste is it?

How is it treated/dealt with (eg recycling)?

Do you purchase recycled materials for use in your business	Yes (examples)	No
---	-------------------	----

No

Yes

No

Probe: How

Do you feel that your current skill requirements are being met by educational and training providers?

Why?

What do you feel are the key skills that your business requires to remain sustainable?

Now	Future

I WILL NOW MOVE ON TO INNOVATION

Is there anything the O/M can do to cultivate improvements in the firm?

Do employees get involved in improvement, if so how?

What skills does a firm need to come up with new products, methods or ways of doing things?

What do you think are the key factors in developing improvements?

Have you found that there are any ways to encourage improvement in the firm?

I would like to thank you very much for taking part in the study. Any data collected in the study will be securely kept under lock and key. I will use codes for yourself and your firm in the study so that identification will be difficult. When the interview is transcribed I will forward you a copy for review.

THANK YOU.

b) Green Skills Audit Questionnaire

This questionnaire is to assist in identifying the skill and learning needs in relation to the effective, efficient and sustainable operation of your business. All information provided in this questionnaire will be kept strictly confidential and will be only used by the WIT researcher to determine the current and future skill and learning needs of businesses in the region.

Q1. Business Profile

Name	<input type="text"/>
Business name	<input type="text"/>
County located in	<input type="text"/>
Number of employees in your company	<input type="text"/>
Please indicate what sector you operate in	<input type="text"/>

Q1. How important are the following professional skills are for the sustainability of your business?

On a

scale

from 1

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ortant)

to 7

(Comp

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Import

ant)

please

rate

	Com pletel y Uni mpor tant	Very Uni mpor tant	Uni mpor tant	A ve ra ge	Im por tan t	Ve ry Im por tan t	Com plete ly Imp orta nt
Busin ess Devel opme nt	1	2	3	4	5	6	7
Mark eting	1	2	3	4	5	6	7
Finan ce	1	2	3	4	5	6	7
Sales	1	2	3	4	5	6	7

ICT	1	2	3	4	5	6	7
Sources of Funding & Support	1	2	3	4	5	6	7
Writing Successful Applications	1	2	3	4	5	6	7
Access to Mentoring	1	2	3	4	5	6	7
Other (please specify)							

Q2. On a scale from 1 (Completely Unimportant) to 7 (Completely Important) please rate how important the following energy management skills are for your business.

	Com plete ly Uni mpo rtant	Ver y Uni mpo rtant	Uni mpo rtant	A v er a g e	Im po rta nt	Ve ry Im po rta nt	Co mpl etel y Imp orta nt
Energy Efficiency (measuring /monitoring)	1	2	3	4	5	6	7
Reduction in energy use	1	2	3	4	5	6	7
Renewable Energy Sources & Upgrades	1	2	3	4	5	6	7
Building Energy Standards	1	2	3	4	5	6	7
Sustainable & Renewable Building Materials	1	2	3	4	5	6	7
Other (please specify)							

Q3. On a scale from 1 (Completely Unimportant) to 7 (Completely Important) please rate how important the following waste management skills are for the sustainability of your business;

	Com pletel y Unim porta nt	Very Unim porta nt	Unim porta nt	A ve ra ge	Im por tan t	Ve ry Im por tan t	Com plete ly Imp orta nt
Waste Management (reduction, recycling, recovery)	1	2	3	4	5	6	7
Waste Legislation (duty of care, hazardous waste regulations)	1	2	3	4	5	6	7
Purchasing Recycled Materials	1	2	3	4	5	6	7
Sustainable Packaging	1	2	3	4	5	6	7

Other (please specify)

Q4. On a scale from 1 (Completely Unimportant) to 7 (Completely Important) please rate how important the following environmental management skills are for the sustainability of your business;

	1	2	3	4	5	6	7
Environmental Management System (e.g. identification.	1	2	3	4	5	6	7

implementing auditing & reporting)							
Corporate Social Responsibility (e.g. community engagement, fair trade products, biodiversity)	1	2	3	4	5	6	7
Environmental Standards & Awards	1	2	3	4	5	6	7
Carbon Measurement & Management	1	2	3	4	5	6	7
Pollution Prevention (e.g. legislation & housekeeping, spill management)	1	2	3	4	5	6	7
Other (please specify)	<input type="text"/>						

Q5. On a scale from 1 (Completely Unimportant) to 7 (Completely Important) please rate how important it is to you to integrate green practices into the everyday operation of your business;

Completely Unimportant 1 2 3 4 5 6 7

Q6. What would you say are the skills required to run the business? *(This may relate to skills you feel you need personally or in a business capacity, access to support, training or education, or sector requirements you feel are important for your business)*

	Com pletely Unim porta nt	Very Unim porta nt	Unim porta nt	Av era ge	Imp orta nt	Ver y Imp orta nt	Com plete ly Impo rtant
Business Development	1	2	3	4	5	6	7
Marketing	1	2	3	4	5	6	7
Fi na	1	2	3	4	5	6	7

nc e								
Sa les	1	2	3	4	5	6	7	
IC T	1	2	3	4	5	6	7	

Q7. Finally, the following table is a range of skills, please circle as appropriate

1= *Extremely unimportant* 2= *Very unimportant* 3= *Unimportant* 4= *Average/ Don't know* 5= *Important* 6= *Very important* 7= *Extremely important*

Core Professional Skills	
Business Skills	1 2 3 4 5 6 7
Business Development	1 2 3 4 5 6 7
Sales	1 2 3 4 5 6 7
Marketing	1 2 3 4 5 6 7
Finance	1 2 3 4 5 6 7
ICT	1 2 3 4 5 6 7
Organisational Skills	
Project Management	1 2 3 4 5 6 7
Planning	1 2 3 4 5 6 7
Decision Making	1 2 3 4 5 6 7
Investigation Skills	1 2 3 4 5 6 7
Team Working	1 2 3 4 5 6 7
Technical Skills	
ICT	1 2 3 4 5 6 7
Commercial Awareness	1 2 3 4 5 6 7
Maths Proficiency	1 2 3 4 5 6 7
Sustainability Awareness	1 2 3 4 5 6 7
Financial & Accounting	1 2 3 4 5 6 7
Tendering & Contracts	1 2 3 4 5 6 7
Personal Skills	
Leadership	1 2 3 4 5 6 7
Entrepreneurship	1 2 3 4 5 6 7
Communications	1 2 3 4 5 6 7
Initiative/Adaptability	1 2 3 4 5 6 7
Creativity /Innovation	1 2 3 4 5 6 7
Time Management	1 2 3 4 5 6 7
Energy	
Energy Efficiency (<i>e.g. measuring/monitoring & reduction in energy use</i>)	1 2 3 4 5 6 7
Renewable Energy Sources	1 2 3 4 5 6 7
Renewable Energy Upgrades	1 2 3 4 5 6 7
Energy Cost Reduction Strategy	1 2 3 4 5 6 7
Building Energy Standards	1 2 3 4 5 6 7
Sustainable & Renewable Building Materials	

Waste Management	
Waste Reduction	1 2 3 4 5 6 7
Waste Recycling	1 2 3 4 5 6 7
Waste Recovery	1 2 3 4 5 6 7
Waste Legislation (<i>duty of care, hazardous waste regulations</i>)	1 2 3 4 5 6 7
Purchasing Recycled Materials	1 2 3 4 5 6 7
Sustainable Packaging	1 2 3 4 5 6 7
Environmental Management	
Pollution Prevention (<i>e.g. legislation & housekeeping, spill management</i>)	1 2 3 4 5 6 7
Environmental Management System (<i>e.g. identification, implementing auditing & reporting</i>)	1 2 3 4 5 6 7
Corporate Social Responsibility (<i>e.g. community engagement, fair trade products, biodiversity</i>)	1 2 3 4 5 6 7
Environmental Standards & Awards	1 2 3 4 5 6 7
Carbon Management	
Carbon Measurement	
Green Strategy	
Green Improvement (<i>e.g. new green product design & development</i>)	1 2 3 4 5 6 7
Green Marketing (<i>branding, positioning, promoting, selling, presentation, communicating</i>)	1 2 3 4 5 6 7
Greening your links with Suppliers (<i>green technologies</i>)	1 2 3 4 5 6 7
Research & Development (<i>competitor, customer & supplier research awareness</i>)	1 2 3 4 5 6 7
Green Certification & Accreditation	1 2 3 4 5 6 7
Green Auditing	1 2 3 4 5 6 7
Government Policy on the Green Economy (<i>e.g. legislation & directives</i>)	1 2 3 4 5 6 7
Sources of Funding & Support	1 2 3 4 5 6 7
Quality Management	
Developing a Green Policy	

Comments

Finally, we would kindly welcome any additional comments you may have with regard to the skills and development requirements for your business.

THANK YOU

Appendix B: Case plan

Initial Site visits	<p>Canada -May 2015; Ireland - May 2015</p> <p>Begin by introducing myself and clarifying that I am a Doctoral student researching the (perceived) impact of facilitated networks on green innovation capability development in micro-firms.</p> <p>The initial visit entails a semi-structured interview with the micro-firm O/M who is a member of at least one facilitated network. I will discuss the research study and key literature themes. I will also need to gain an understanding of whether and how the micro-firm develops its green innovation capabilities.</p>
Follow up visits	<p>Canada - November 2015; Ireland – November 2015 -April 2016</p> <p>Follow up visits will be in person or via Skype/Net Meeting. These visits purpose is to explore the perceived impact of facilitated network engagement on green innovation capability development in the micro-firm. Clarifications required/ resulting from initial interviews will be discussed and further interviews carried out if necessary.</p> <p>I would also like to undertake a green innovation capability skills audit in micro-firms in each jurisdiction, based on mutual consent (see appendix 1; terms of reference).</p> <p>I would also like to observe facilitated network engagement in each jurisdiction.</p>

Appendix C: Case Study Protocol

Activity	Description	Timeline
Protocol Purpose	<p>The purpose of this protocol is to guide the case study research. The overall aim of the research is to explore the perceived impact of facilitated network engagement on green innovation capability development in the micro-firm.</p> <p>The research objectives are to:</p> <ol style="list-style-type: none"> 1. To undertake an analysis of perceived green innovation capability in selected Irish and Canadian micro-firms; 2. To explore the perceived impact of facilitated network engagement on the micro-firms' green innovation capability development; 3. To propose a green innovation capability framework for the micro-firm environment. 	May 2015- April 2016
Pilot case study interview	1 hour duration - semi-structured interview including green skills audit	April 2016
Case study duration	12 months intensive	May 2015 – April 2016
Case selection process	<ul style="list-style-type: none"> • The site: micro-firm in Canada and Ireland • The case: the impact of facilitated networks on innovation capability development. • Unit of analysis : micro-firm involved in facilitated network. • Sample: 8 cases, 4 networks 	
Case access	<ul style="list-style-type: none"> • Access negotiated with facilitated network members through WIT and University of Guelph. • Initial discussions between researcher and case participants to establish rapport. 	
Research Instrument	Researcher as the primary research instrument in the application of research methods.	
Research Techniques	<ul style="list-style-type: none"> • Observation at various intervals. • Semi structured instruments with O/M of micro-firms (guided by interview protocol). • Reflective Diary. 	
Data management	Audit trail of data collection methods and processes	
Case report	Written formal case report.	

Adapted from: Yin (2009)

a) Letter of Introduction – Research Request

Dear XXX

My name is Sinead Mellett. I am a doctoral student studying under Dr Felicity Kelliher and Prof Denis Harrington at the RIKON research group, School of Business, Waterford Institute of Technology (WIT) Ireland. Details relating to RIKON and WIT can be found at www.rikon.ie and www.wit.ie respectively. I am currently pursuing a PhD, studying the impact of facilitated networks on micro-firm green innovation capability development. I am about to commence the data collection of my research study.

I am writing to ask for your assistance with this research study. You have been selected as a possible participant in the study because you are the owner/ manager of a micro-firm (that is, a business with fewer than ten employees) and a current/ past member of a facilitated network. Your involvement in this study would include potentially 6 interviews lasting between 30 and 60 minutes, over the next 12 months.

Please feel free to review this consent form in your own time and feel free to ask any questions that you may have by email. I will return in 5 days to discuss the research study. Please note that participation is entirely voluntary and that you can decide to leave the research study at any point up to the point of data analysis.

There are no foreseeable risks of harm in participating in this research, and your contribution may increase the understanding of the impact of facilitated networks on green innovation capability development. Should you wish to verify my legitimacy, please feel free to contact my lead supervisor, Dr Felicity Kelliher at fkelliher@wit.ie.

Thank you very much for taking the time to consider my request.

Yours Sincerely,

Sinead Mellett

b) Research Consent Form

Research Title	A cross-country exploration of the perceived impact of facilitated networks on green innovation capability development in the micro-firm.
Investigator:	Sinead Mellett, PhD Student RIKON research Group School of Business, Waterford Institute of Technology (WIT), Ireland email: XXXXX
Research Supervisors:	Dr Felicity Kelliher, WIT; email: XXXXX Prof Denis Harrington, WIT; email: XXXXX

Purpose of Study

The purpose of the study is to explore the perceived impact of facilitated network engagement on green innovation capability development in the micro-firm.. Ultimately, this research will be published as part of my PhD at Waterford Institute of Technology, and seeks to contribute to the policy debate relating to innovation capability development in micro-firms.

Procedures

Your involvement in this study would include up to 3 interviews lasting between 30 and 60 minutes, and up to 3 over the next 12 months.

Confidentiality

Every effort will be made to ensure confidentiality of any identifying information that is obtained in connection with this study. You will be assigned an Identification Code and your name or other identifying factors will not appear in the final thesis or related publications. Results will be presented in an aggregated format that will not identify any one person. The records of this study will be kept strictly confidential. Audio or video tape recordings will be used for transcription purposes only and destroyed within three years of completion of the research study.

Right to Refuse or Withdraw

The decision to participate in this study is entirely voluntary. You may refuse to take part in the study *at any time* up to the point of data analysis without affecting your relationship with the investigators of this study or Waterford Institute of Technology. You have the right not to answer any single question, as well as to withdraw completely from the interview at any point during the process; additionally, you have the right to request that the interviewer not use any of your interview material up to the point of data analysis.

Right to Ask Questions and Report Concerns

You have the right to ask questions about this research study and to have those questions answered by me before, during or after the research. If you have any further questions about the study, at any time feel free to contact me, Sinead Mellett at XXX. Should you wish to verify my legitimacy or report any concerns relating to this study, please feel free to contact my lead supervisor, Dr Felicity Kelliher at XXX.

Consent

Your signature below indicates that you have decided to volunteer as a research participant for this study, and that you have read and understood the information provided above. You will be given a signed and dated copy of this form to keep.

Participant's Name (print):	
Participant's Signature:	
Investigator's Signature:	
Date:	

c) List of cases and networks studied

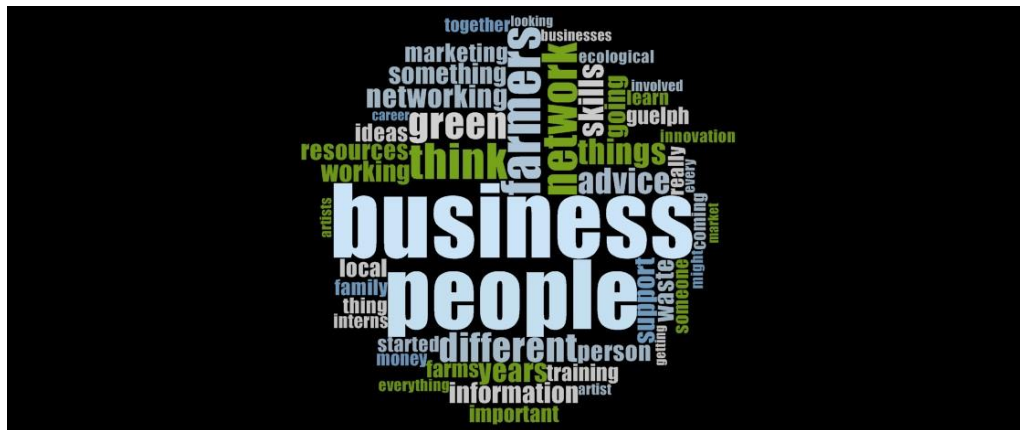
Case	Location	Business Focus	Staff	Length of Interview	Interview details	Length of Observation
O/M1	Canada	Recruitment	O/M	15 minutes 60 minutes 20 minutes	Initial introduction Main interview Green skills audit	2 hours (OCC1)
O/M2	Canada	Artist	O/M	15 minutes 55 minutes 60 minutes	Initial introduction Main interview Green skills audit	2 hours (OCC2)
O/M3	Canada	Farming	O/M + 8	20 minutes 62 minutes 15 minutes	Initial introduction Main interview Green skills audit	4 hours (OCC3)
O/M4	Canada	Hospitality	O/M + 1pt (part time)	25 minutes 25 minutes 20 minutes	Initial introduction Main interview Green skills audit	4 hours (OCC4)
O/M5	Ireland	Recruitment	O/M	15 minutes 49 minutes 41 minutes	Initial introduction Main interview Green skills audit	1 hour (OCI1)
O/M6	Ireland	Artist	O/M	43 minutes 18minutes 15 minutes	Initial Telephone Face to face x 2 Green skills audit	2 hours (OCI2)
O/M7	Ireland	Farming	3ft (full time) + 3pt	20 minutes 43 minutes 42 minutes	Initial introductory Main interview Green skills audit	2 hours (OCI3)
O/M8	Ireland	Retail	O/M+ 2ft	30 minutes 49 minutes 41 minutes	Initial introductory Main Interview Green skills audit	3 hours (OCI4)
NI1	Clare Local enterprise board Ireland	Micro-business; small business	facilitator	25 minutes	Telephone	N/A
NI2	Teagasc	Agriculture	facilitator	25 minutes	Face to face	N/A
NC1	Innovation Guelph Canada	Companies and entrepreneurs	facilitator	40 minutes	Telephone	N/A
NC2	eMerge	Micro-businesses	facilitator	60 minutes	Face to face	N/A

Appendix D: NVivo Charts

Node Chart

Name	References	Sources	Name	References	Sources
Facilitated Network	222	8	Micro firm	350	8
Global perspective	4	4	Advice	29	5
impact of network	35	6	Any challenges~	3	3
International network	5	3	Challenges in micro	8	3
Natural environmental orientation	7	3	Decision Making	11	5
Network involvement	9	4	dynamic capability	6	2
Networking capabilities	19	3	Knowledge Transfer	36	8
Personal Network Knowledge transfer	8	5	Information	12	4
Reasons for not joining network	3	2	Management Skills	10	6
Sharing information	41	6	Marketing business	10	5
Stakeholder engagement	10	5	Micro-firm Capabilities	27	7
Support	37	6	Micro-firm Skills	55	7
To be seen	4	2	outsource	3	2
Trust	3	3	Micro-firm Strategy	15	6
Types of network involved in	32	6	Overheads running c	5	3
Green Economy	106	7	Owner manager char	32	7
Carbon Footprint	15	5	Resource	108	8
Environmental Influencers	43	7	Expertise	30	7
electronic comms; environmental (non-paper)	1	1	Money	30	7
Financially motivated	13	7	Space	15	6
Regulations	17	5	Time	26	6
Link to measures	1	1			
Policy	7	3	Innovation	45	7
Regulations penalty based	1	1	Green innovativeness	10	4
Funding to support green	1	1	Innovativenss	14	6
Micro-firm Green Innovativeness	10	5	Resources and green	8	4
Network impact on green knowledge transfer	4	2	Green skills	8	4
No green focus	1	1			
purchase recycled material	5	3			
Waste management	13	5			

a) Word Cloud from NVivo



b) Sources compared by number of nodes

Sources compared by number of nodes coding



c) Sample of coded references NVivo

Green Economy drivers and motivators

<Internals\\OCC3> - § 3 references coded [7.77% Coverage]

Reference 1 - 1.71% Coverage

More and more people a lot of folks coming in are starting ecological farming because they want to make a difference and be closer to natural eco system, to go with conventional agriculture is not an option for them. For those folks that is where the new eco farmers are coming from.

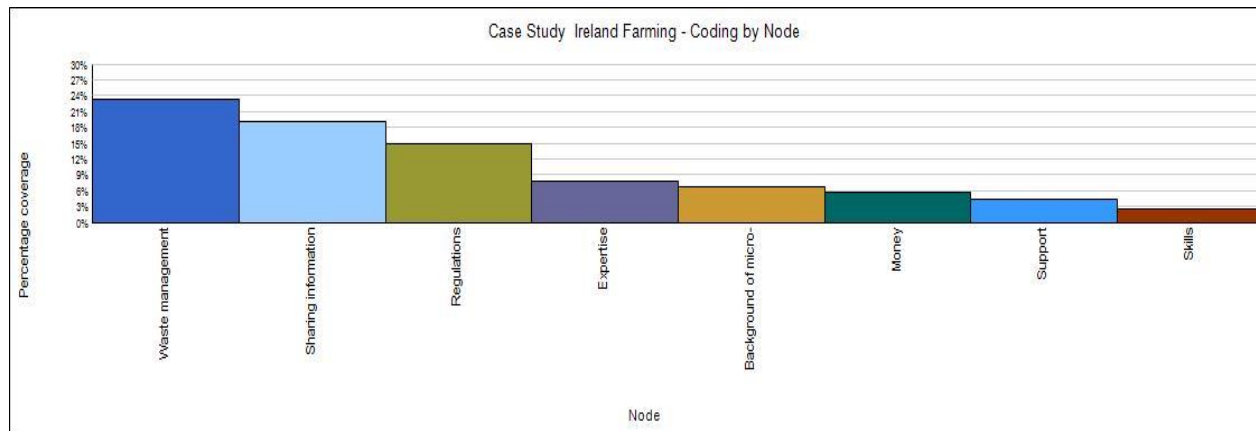
Reference 2 - 5.74% Coverage

The conventional farmers have been, most folks have bought into the green revolution tag which wasn't really ecological, and a term we use here is they need an ecological conversion. What I'm doing on my farm is not why I got into farming that since of am I going to make my actions consistent with what I want to be doing this work. For some farms they are already a long way because they are so connected with their ecosystem. For them it is a matter of choosing different inputs or creating a longer crop rotation or mixing up their crops instead of having one crop divide the field into sections, spacing them out more. So there are different ways the farmer will choose to move it that direction and I think that fortunately or unfortunately as that demographic shifts a lot of young folks might decide not to do that work, the people that take their place are more oriented in that direction. For the next number of years are tough for agriculture

Reference 3 - 0.32% Coverage

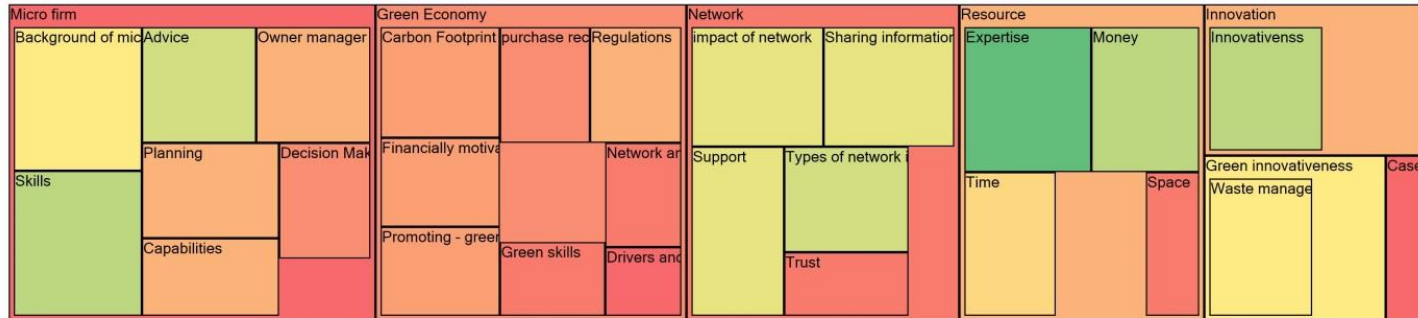
Not designated green champion but everyone is in that.

d) Coding by node sample



e) Nodes compared by number of items coded sample

Nodes compared by number of items coded



Appendix E: Interview Guide for Network Facilitator

Key objectives of this interview are to determine O/M's views;

The purpose of the study is to explore the perceived impact of facilitated network engagement on green innovation capability development in the micro-firm.. Ultimately, this research will be published as part of my PhD at Waterford Institute of Technology, and seeks to contribute to the policy debate relating to innovation capability development in micro-firms.

Stress that their views on their business requirements are being sought and are highly valued

Outline confidentiality guarantees and request consent to record interviews

Every effort will be made to ensure confidentiality of any identifying information that is obtained in connection with this study. You will be assigned an Identification Code and your name or other identifying factors will not appear in the final thesis or related publications. Results will be presented in an aggregated format that will not identify any one person. The records of this study will be kept strictly confidential. Audio or video tape recordings will be used for transcription purposes only and destroyed within three years of completion of the research study.

INTERVIEW ARRANGEMENTS

Thank you very much for agreeing to take part in this interview. I very much appreciate your support in this research study.

As agreed, this interview will take no more than an hour.

You are not obliged to answer any of the questions asked.

Contact Details	
Network Name:	
Participant Name:	
Network Address:	
Network Size (no of members):	
Network Type/Sector:	

COULD I ASK YOU ABOUT SOME OF THE EVENTS/TRAINING/WORKSHOPS YOU USE IN RUNNING THE NETWORK

1. Can you tell me about the businesses that are in the network?
2. How often do they meet up?
3. What activities/events/workshops are organized for the businesses?
4. How is information shared amongst members in the network - formally, informally? Can you give examples
5. What type of advice would micro-firms request about managing the business?
6. Who else would micro-firms go to for advice?
7. In your experience would micro-firms look for advice on green innovation?

THE NEXT QUESTIONS ARE MORE DETAILED ABOUT SOME ASPECTS OF RUNNING THE NETWORK

8. Can you tell me about the workshops that are organized?
 - i. How are these facilitated?
9. What was the focus/ main themes of the green energy workshop?
10. The recent workshop on Green energy was this industry/policy/network driven?
11. Did many attend the workshop? What were the reasons for attending (If known)?
 - i. What was their background
 - ii. Any feedback from attendees

MAY I ASK YOU ABOUT THE RELATIONSHIPS IN THE NETWORK AND HOW THE MICRO-FIRMS INTERACT WITH EACH OTHER

12. Are there particular people that they speak to about their business?

I WILL NOW MOVE ON TO NETWORKS

13. What is the role of the network?
14. What encourages the micro-firms to take part in a network?
 - i. What do they hope to achieve from the network?
 - ii. How many networks are there in the area?
15. How does the network benefit the micro-firm?
16. What do you find are the best ways of communicating and sharing information in the network?
 - i. Do members share information with each other?
 - ii. If so, was this information sharing valuable to the firm?
17. Do any of the micro-firms currently take any measures to improve their energy efficiency and reduce their energy costs?
 - a. Can you give an example of that?
 - b.
18. Do you know if the micro-firms currently have:

A green policy	Yes	No
A green champion	Yes	No
Any green/ environmental awards	Yes	No

Membership of green/ environmental charters	Yes	No
	Yes	No

19. Are you aware of any measures they take to improve their energy efficiency and reduce their energy costs?

20. Do they know how much waste they produce?

a. What type of waste is it?

b. How is it treated/dealt with (eg recycling)?

21. Are you familiar with any support bodies, information services and funding sources that promote green initiatives?	Yes (examples)	No
--	-------------------	----

22. Do you promote any environmental efforts on your website?; Probe: How	Yes
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b. What do you feel are the key skills that the businesses requires to remain sustainable

Now	Future

I WILL NOW MOVE ON TO INNOVATION

23. Is there anything the O/M can do to cultivate improvements in the firm?

24. What skills does a firm need to come up with new products, methods or ways of doing things?

a. What do you think are the key factors in developing improvements?

b. Have you found that there are any ways to encourage improvement in the firm?

25. In relation to innovation, in your experience what are the main challenges facing micro-firms?

26. How do you think networks can impact on the green innovation capability development in the micro-firm?

27. In your experience what are the main challenges facing micro-firms?

28. What are the skills required to run a micro-firm?

29. What are the skills required to be green innovative?

30. Are there courses/workshops that the micro-firms request?

I would like to thank you very much for taking part in the study. Any data collected in the study will be securely kept under lock and key. I will use codes for yourself and your firm in the study so that identification will be difficult. When the interview is transcribed I will forward you a copy for review.

THANK YOU.

Appendix F: Consent Form Network Facilitator

LETTER OF INTRODUCTION – RESEARCH REQUEST

Dear XXX,

My name is Sinead Mellett. I am a doctoral student studying under Dr Felicity Kelliher and Prof Denis Harrington at the RIKON research group, School of Business, Waterford Institute of Technology (WIT) Ireland. Details relating to RIKON and WIT can be found at www.rikon.ie and www.wit.ie respectively. I am currently pursuing a PhD, studying the impact of facilitated networks on micro-firm green innovation capability development. I am about to commence the data collection of my research study.

I am writing to ask for your assistance with this research study. You have been selected as a possible participant in the study because you are involved in a facilitated network. Your involvement in this study would include up to 2 interviews lasting between 30 and 60 minutes over the next 12 months.

Please feel free to review this consent form in your own time and feel free to ask any questions that you may have by email. Please note that participation is entirely voluntary and that you can decide to leave the research study at any point up to the point of data analysis.

There are no foreseeable risks of harm in participating in this research, and your contribution may increase the understanding of the impact of facilitated networks on green innovation capability development. Should you wish to verify my legitimacy, please feel free to contact my lead supervisor, Dr Felicity Kelliher at XXX.

Thank you very much for taking the time to consider my request.

Yours Sincerely,

Sinead Mellett
Email: XXX

f) Research Consent Form

Research Title	A cross-country exploration of the perceived impact of facilitated networks on green innovation capability development in the micro-firm.
Investigator:	Sinead Mellett, PhD Student RIKON research Group School of Business, Waterford Institute of Technology (WIT), Ireland email: XXXXX
Research Supervisors:	Dr Felicity Kelliher, WIT; email: XXXXX Prof Denis Harrington, WIT; email: XXXXX

Purpose of Study

The purpose of the study is to explore the perceived impact of facilitated network engagement on green innovation capability development in the micro-firm.. Ultimately, this research will be published as part of my PhD at Waterford Institute of Technology, and seeks to contribute to the policy debate relating to innovation capability development in micro-firms.

Procedures

Your involvement in this study would include up to 2 interviews lasting between 30 and 60 minutes over the next 12 months.

Confidentiality

Every effort will be made to ensure confidentiality of any identifying information that is obtained in connection with this study. You will be assigned an Identification Code and your name or other identifying factors will not appear in the final thesis or related publications. Results will be presented in an aggregated format that will not identify any one person. The records of this study will be kept strictly confidential. Audio or video tape recordings will be used for transcription purposes only and destroyed within three years of completion of the research study.

Right to Refuse or Withdraw

The decision to participate in this study is entirely voluntary. You may refuse to take part in the study *at any time* up to the point of data analysis without affecting your relationship with the investigators of this study or Waterford Institute of Technology. You have the right not to answer any single question, as well as to withdraw completely from the interview at any point during the process; additionally, you have the right to request that the interviewer not use any of your interview material up to the point of data analysis.

Right to Ask Questions and Report Concerns

You have the right to ask questions about this research study and to have those questions answered by me before, during or after the research. If you have any further questions about the study, at any time feel free to contact me, Sinead Mellett at XXX. Should you wish to verify my legitimacy or report any concerns relating to this study, please feel free to contact my lead supervisor, Dr Felicity Kelliher at XXX.

Consent

Your signature below indicates that you have decided to volunteer as a research participant for this study, and that you have read and understood the information provided above. You will be given a signed and dated copy of this form to keep.

Participant's Name (print):	
Participant's Signature:	
Investigator's Signature:	
Date:	

Appendix G: Document Review

a. Ireland to be fined €26 million and daily fines of €33,000

Ian Carey February 17, 2011 News, Press Releases

The Environmental Pillar calls on the Government: to take seriously its role as protector of the natural resources that are fundamental to all life, including human; to fully implement the Water Framework Directive, the Habitats Directive, the Birds Directive, and the EIA Directive; and in so doing to avoid the Irish taxpayer having to face huge fines.

Because the Irish Government never put in place the necessary procedures regarding assessing the environmental impact of projects, we as tax payers are now collectively facing a fine of €26 million followed by daily fines of €33,000 until our Government learns to obey the rules which it helped to write. Should the European Court of Justice go ahead and fine Ireland it will be because our Government showed contempt to the Court by not complying with a ruling of the same Court made in 2008 regarding the poor implementation of the Environmental Impact Assessment Directive. The 2008 ruling found that the Irish thresholds for conducting an impact assessment for certain types of projects were too high. This has led to the loss of valuable wetlands and the destruction of archaeological remains, according to the Commission.

Speaking on behalf of the Environmental Pillar, Joanne Pender of the Irish Wildlife Trust noted that

“This is not the only case against Ireland that is likely to result in serious fines. Ireland is in the dock for almost 25% of all the environmental cases at the “contempt of court stage” in the European Court of Justice. Ireland also ranks at the bottom of many league tables that assess our environmental performance, especially for nature protection. This is a terrible indictment of the Government’s record in protecting the environment, and a warning to the next Government to implement the European Directives that it signed up to.”

Whatever the complexion of the new Government it will need to dramatically improve on the past record of the State in transposing European Directives as the Commission starts to use its new powers to seek fines against recalcitrant Member States such as Ireland

b. The Environmental Pillar and the Irish Environmental Network

The Environmental Pillar is comprised of 29 national environmental NGOs, who work together to represent the views of the Irish environmental sector.

The main aim of the organisation is to create and promote policies that advance sustainable development. It also provides a channel for the government and other social partners to engage with the environmental sector on policy matters.



The staff of the Environmental Pillar also work as a single secretariate for the Irish Environmental Network, an umbrella network that works to support environmental NGOs through access to funding and services.

The Irish Environmental Network consists of 34 environmental NGOs that carry out their work through practical conservation work, campaigning, lobbying and raising public awareness of environmental and conservation needs.

c. Ignatius Farm

Our Farm Ethic

Ignatius Farm expresses the Program Objectives of the Ignatius Jesuit Centre through organic and relational farming.

Organic farming focuses on management practices that restore, maintain and enhance ecological harmony. We build and sustain healthy soil through the use of composts, complex crop rotations, and green manure crops. The results is that the crops grown in our soil taste delicious and full of life! No synthetic fertilizers or pesticides are used on the farm. Ignatius Farm is certified organic through ECOCERT, a third-party international organic certification and accreditation body.

Relational farming focuses on nurturing human-scale economics. You can have a Zero-Mile Diet by coming to the farm for food we grow, or growing your own in a garden plot! We hold that eating locally and in season does more than reduce the travel distance to our food – farms and communities need each other to survive and thrive. In order to make farms and organic food more accessible, we offer opportunities to get involved

with farming activities, to sponsor harvest shares and garden plots for families and service agencies, and to be mentored in organic agriculture practices.

Ignatius Farm Guiding Principles

We respect all people and the land, and foster community among both.

We practice ecological agriculture and produce quality, healthy, organic food that is readily available while still fresh.

We connect people who eat local food and those who grow it in a relationship of mutuality.

We facilitate the formation and training of organic growers to assure a healthy future for people and for the land.

We collaborate with businesses and organizations to benefit rural economies, rural life, and the organic farming sector.

d. Environment & Rural Affairs Ireland

TIME FOR FARMERS TO BE HEARD IN THE SHANNON PIPELINE DEBATE – IFA

FA Environment and Rural Affairs Chairman Thomas Cooney has urged all farmers and their families who may be impacted by the proposed project to pipe water from the river Shannon to Dublin to attend the Irish Water organised consultation meetings starting this week.

QUESTIONS MUST BE ANSWERED ON IRISH WATER PIPELINE

IFA Environment & Rural Affairs Chairman Thomas Cooney has called on Irish Water to ensure that key questions landowners have raised in recent days are clearly answered before proposed plans to send water to Dublin from the Shannon goes any further.

HERITAGE BILL MEASURES ARE POSITIVE AND BALANCED

In advance of Seanad debate on The Heritage Bill tomorrow, IFA has met with a number of Senators to ensure the Bill is progressed through to the Dáil.

PLANNERS MUST ENSURE FARMERS RETURN LOW EMISSION SLURRY SPREADING FORMS – IFA

IFA Rural Development Chairman Joe Brady has said planners must ensure that where their farmer clients included the low emission slurry spreading (LESS) measure in their GLAS plans, they return their LESS declaration forms by November 15th.

e. Emerge Guelph

eMERGE Guelph leads the way in co-creating resilient, flourishing communities. We do this by connecting citizens and organizations to innovative solutions to maximize resource efficiency and community well-being.

Our Values

At eMERGE we strive to:

Build trust: Be a trusted, credible, collaborative and transparent community partner

Innovate: Be future forward, innovative and on the edge of the emergent future

Empower: Empower the disempowered in the face of global climate change, resource scarcity and growth challenges

Teach/Educate: Use learning and action based approaches with citizens, families and organizations.

Inspire: Show how intentional, meaningful change can be fun, fulfilling and build strong, resilient communities

Our Approach

eMERGE Guelph focuses on five pillars that, when addressed as a whole, can help us succeed in our vision.

Energy

Water

Transportation

Waste

Food

We combine these pillars in different ways at the home, street, and neighbourhood level to engage citizens and organizations. Learn more about the Pathways Program, or click on one of the following levels:

eMERGE Home Tune-Up

eMERGE Streets

eMERGE Neighbourhoods

We also partner with businesses and organizations that share our vision and can come together to contribute to making Guelph a stronger, more resilience community.

f. Water Quality Standards

USEFUL Link SIPE An environmental Standards Information Portal for Europe

This portal interfaces between information from the standards, policies and research communities.

You can browse using four compartments - Water & Marine, Air, Waste & Sludge and Soil & Sediment

EUR-Lex Environment and climate change

- Tackling climate change
- General provisions
- Sustainable development
- Waste management
- Air pollution
- Water protection and management
- Protection of nature and biodiversity
- Soil protection
- Civil protection
- Noise pollution
- Environment: cooperation with third countries

Air Quality Standards

Summary of EU Waste Legislation on Packaging and Packaging Waste
Environmental Management Systems
ISO14001:2004 | EMAS | BS8555:2003 | OSHSAS 18001

Energy Management Systems

ISO 50001: 2011 Energy Management Systems
DIRECTIVES 2012/27/EU OF THE EUROPEAN PARLIAMENT AND
OF THE COUNCIL of 25 October 2012 on energy efficiency, amending
Directives 2009/125/EC and 2010/30/EU and repealing Directives
2004/8/EC and 2006/32/EC
S.I. No. 426 of 2014 European Union (Energy Efficiency) Regulations
2014

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DIRECTIVE	<u>2000/60/EC</u> of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy
Official Journal	L 327 , 22/12/2000 P. 0001 - 0073
Short Title	Water Framework Directive
Description	Relates to planning for protection and improvement of all waters, including surface water, groundwater, coastal and transitional waters. The directive deals also with artificial water bodies – such as canals – as well as waters whose character is substantially changed by human activity - referred to as heavily modified water bodies (HMWBs).
Key terms used in	Inland waters: all standing or flowing water on

the act

the surface of the land, and all groundwater on the landward side of the baseline from which the breadth of territorial waters is measured.

Surface water: inland waters, except groundwater, transitional waters and coastal waters, except in respect of chemical status, for which territorial waters are also included.

Groundwater: all water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil.

Transitional waters: bodies of surface water in the vicinity of river mouths which are partly saline in character as a result of their proximity to coastal waters but which are substantially influenced by freshwater flows.

Coastal water: surface water on the landward side of a line every point of which is at a distance of one nautical mile on the seaward side from the nearest point of the baseline from which the breadth of territorial waters is measured, extending where appropriate up to the outer limit of transitional waters.

River basin: the area of land from which all surface run-off flows through a sequence of streams, rivers and, possibly, lakes into the sea at a single river mouth, estuary or delta.

River basin district: the area of land and sea, made up of one or more neighbouring river basins together with their associated groundwaters and coastal waters, which is identified under Article 3(1) as the main unit for management of river basins.

Implemented by

S.I. 722/2003 European Communities (Water Policy) Regulations 2003

River Basin District -	<ul style="list-style-type: none"> • Shannon International River Basin District • South East River Basin District • South West River Basin District • Eastern River Basin District • Western River Basin District • North Western International River Basin District • Neagh Bann International River Basin District • North Eastern River Basin District
Copies of the draft plans are available on the websites of each River Basin District.	

DIRECTIVE	<u>2008/105/EC</u> of the European Parliament and of the Council of 16 December 2008 on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC of the European Parliament and of the Council
Official Journal	OJ L 348, 24.12.2008, p. 84–97
Short Title	Priority Substances Directive - Surface Waters
Description	
Implemented by	<u>S.I. No. 272/2009</u> — European Communities Environmental Objectives (Surface Waters) Regulations 2009
Parameters	

View European Commission Drinking Water Directive Overview

DIRECTIVE	<u>98/83/EC</u> of 3 November 1998 on the quality of water intended for human consumption
Official Journal	OJ L 330, 5.12.1998, p. 32–54
Short Title	Drinking Water
Description	Relates to quality of water intended for human consumption
Implemented by	<u>S.I. No. 278/2007</u> — European Communities (Drinking Water) (No. 2) Regulations 2007
<p>These Regulations prescribe quality standards to be applied, and related supervision and enforcement procedures in relation to supplies of drinking water, including requirements as to sampling frequency, methods of analysis, the provision of information to consumers and related matters.</p> <ul style="list-style-type: none"> • Section 1 Parameters for which Methods of Analysis are Specified • Section 2 Parameters for which Performance Characteristics are Specified 	

- **Section 3** Parameters for which no Method of Analysis is Specified

View European Commission Groundwater Current legislative framework

DIRECTIVE	<p><u>Directive 2000/60/EC</u> of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy</p> <p><u>2006/118/EC</u> of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration</p>
Official Journal	2006/118/EC L 372/19, 27.12.2006
Short Title	2000/60/EC OJ L 327, 22.12.2000, p. 1–73 Groundwater
Description	This new directive establishes a regime which sets underground water quality standards and introduces measures to prevent or limit inputs of pollutants into groundwater. The directive establishes quality criteria that takes account local characteristics and allows for further improvements to be made based on monitoring data and new scientific knowledge.
Implemented by	<u>S.I. No.9 of 2010</u> - European Communities Environmental Objectives (Groundwater) Regulations, 2010
Parameters & Values	

VIEW European Commission Bathing Water Quality

DIRECTIVE	<p><u>2006/7/EC</u> of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive <u>76/160/EEC</u> with effect from 31 December 2014.</p>
Official Journal	OJ L 64 of 4.3.2006
Short Title	Bathing Water
Description	Relates to quality of water for bathing and protection of bathing areas by their designation
Implemented by	<u>S.I. No. 155/1992</u> — Quality of Bathing Waters

Parameters & Quality Values	Regulations, 1992 <u>S.I. 79/2008</u> Bathing Water Quality Regulations 2008
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DIRECTIVE	<u>2006/113/EC</u> of the European Parliament and of the Council of 12 December 2006 on the quality required of shellfish waters
Official Journal	OJ L 376 of 27.12.2006 P. 0014 - 0020
Short Title	Shellfish
Description	The Directive concerns the quality of shellfish waters, i.e. the waters suitable for the development of shellfish (bivalve and gasteropod molluscs). It applies to those coastal and brackish waters which need protection or improvement in order to allow shellfish to develop and to contribute to the high quality of shellfish products intended for human consumption.
Implemented by	<u>S.I. 268/2006</u> European Communities (Quality of Shellfish Waters) Regulations 2006 <u>S.I. No. 55/2009</u> — European Communities (Quality of Shellfish Waters) (Amendment) Regulations 2009
Shellfish Waters Mandatory & Guide Values	

VIEW European Commission Nitrates Directive

DIRECTIVE	<u>91/676/EEC</u> of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources
Official Journal	OJ L 375, 31.12.1991, p. 1–8
Short Title	Nitrates
Description	Relates to management of farm wastes and run off to protect surface water and groundwater
Implemented by	<u>S.I. No. 101/2009</u> — European Communities (Good Agricultural Practice For Protection of Waters) Regulations 2009 ; These Regulations revoke, and re-enact with amendments, the European Communities (Good Agricultural Practice for Protection of Waters) Regulations, 2006 and 2007. These Regulations come into effect on 31 March 2009.

These Regulations provide strengthened statutory support for the protection of waters against pollution from agricultural sources e.g. by phosphorus or nitrogen. The Regulations require the avoidance of careless practices by farmers, which create a risk of causing pollution and provide for inspections by local authorities.

EU Fact Sheet

Fact sheet on the Nitrates Directive 427kB

DIRECTIVE	<u>86/278/EEC</u> of 12 June 1986 on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture
Official Journal	L 377 , 31/12/1991 P. 0048 - 0054
Short Title	Sewage Sludge in Agriculture
Description	Provides for disposal of sewage sludge to agricultural lands
Implemented by	<u>S.I. No. 267/2001</u> — Waste Management (Use of Sewage Sludge in Agriculture) (Amendment) Regulations, 2001
Parameters & Quality Values	

DIRECTIVE	<u>2006/11/EC</u> OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 February 2006 on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community
Short Title	Dangerous Substances (replaces 76/464/EEC)
Description	Defines Standards for Phosphorus in waters Control of discharges to the aquatic environment
Implemented by	<u>S.I.684/2007</u> Waste Water Discharge (Authorisation) Regulations 2007

DIRECTIVE	<u>91/156/EEC</u> of 18 March 1991 amending Directive 75/442/EEC on waste
Short Title	Waste Directive (replaces <u>75/442/EEC</u>)
Description	Provides for prevention of odour and noise emissions from wastewater treatment facilities
Implemented by	<u>S.I. 787/2005</u> European Communities (Waste Water Treatment) (Prevention Of Odours And Noise) Regulations 2005

DIRECTIVE	<u>98/15/EC</u> of 27 February 1998 amending Council Directive 91/271/EEC with respect to certain requirements established in Annex I thereof
Short Title	Urban Wastewater (replaces <u>91/271/EEC</u>)
Description	Provides standards for treatment for urban waste

Implemented by	water <u>S.I. 254/2001</u> Urban Waste Water Treatment Regulations, 2001
Parameter & Quality Values	<u>S.I. 440/2004</u> Urban Waste Water Treatment (Amendment) Regulations, 2004

DIRECTIVE	<u>74/440/EEC</u> of 16 June 1975 concerning the quality required of surface water intended for the abstraction of drinking water in the Member States These Regulations prescribe quality standards and methods and frequencies of analysis for surface fresh water used or intended for use in the abstraction of drinking water. The Regulations give effect to Council Directives No. 75/440/EEC
Official Journal	OJ L 194, 25.7.1975, p. 26–31
Short Title	Drinking Water Abstraction Directive
Description	Defines various quality standards for waters for abstraction of potable supplies
Implemented by	<u>S.I. 294/1989</u> European Communities (Quality Of Surface Water Intended For The Abstraction Of Drinking Water) Regulations, 1989
Quality Standards & Parameters	

DIRECTIVE	<u>78/659/EEC</u> of 18 July 1978 on the quality of fresh waters needing protection or improvement in order to support fish life
Official Journal	OJ L 222, 14.8.1978, p. 1–10
Short Title	Fresh water fish
Description	Defines quality standards for surface waters to protect fish life
Implemented by	<u>S.I. No. 293/1988</u> — European Communities (Quality of Salmonid Waters) Regulations, 1988.
Quality Values	

DIRECTIVE	<u>2003/40/EC</u> of 16 May 2003 establishing the list, concentration limits and labelling requirements for the constituents of natural mineral waters and the conditions for using ozone-enriched air for the
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	treatment of natural mineral waters and spring waters
Official Journal	L 126 , 22/05/2003 P. 0034 - 0039
Short Title	Bottled Water
Description	These Regulations set certain requirements in respect of the exploitation, treatment, packaging and marketing of bottled waters and also include requirements in relation to labelling and various parametric values.
Implemented by	<u>S.I. No. 225 of 2007</u> European Communities (Natural Mineral Waters, Spring Waters and Other Waters in Bottles or Containers) Regulations 2007
Parameters & Quality Values	

Air Quality Standards

Air Quality Standards in S.I. No 244 of 1987.

- Air Quality Standards for Sulphur Dioxide
- Air Quality Standards for Suspended Particulates
- Air Quality Standards for Nitrogen Dioxide
- Air Quality Standards for Lead

New Air Quality Standards in S.I. No.271 of 2002.

- Air Quality Limit Values and Alert Thresholds Stipulated in the Air Quality Standard Regulations (S.I. No. 271 of 2002).
- Limit Values for Sulphur Dioxide
- Limit Values for Nitrogen Dioxide and Oxides of Nitrogen
- Limit Values for Particulate Matter
- Limit Values for Lead
- Limit Values for Benzene
- Limit Values for Carbon Monoxide

DIRECTIVE	<u>96/62/EC</u> of 27 September 1996 on ambient air quality assessment and management
Official Journal L	296 , 21/11/1996 P. 0055 - 0063
Short Title	Air Quality Framework Directive
Description	Provides standards for ambient air quality
Implemented by	<u>S.I. 271/ 2002</u>

DIRECTIVE	2004/107/EC
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Short Title	Air Quality Standards
Description	Relates to standards for Cadmium, Arsenic, Mercury, Nickel and PAHs
Parameter Guideline Values	<u>S.I. 271/2002 - Schedule</u>
Implemented by	<u>S.I. 58/2009</u>

DIRECTIVE	1999/32/EC
Short Title	Sulphur content of gas oil
Description	Prescribes levels of sulphur in heavy fuels and gas oils
Implemented by	<u>S.I. 119/2008</u>

DIRECTIVE	<u>2004/42/EC</u> of the European Parliament and of the Council of 21 April 2004 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products and amending Directive <u>1999/13/EC</u>
	OJ L 143, 30.4.2004, p. 87–96
Short Title	VOC Paints Directive
Description	Limits emissions of VOCs from painting processes
<p>For the paints, the Directive sets up two sets of limit values for the maximum contents of VOCs in grammes per litre of the product ready for use. The first set of limit values shall apply from 1 January 2007. The second, and stricter, set of limit values apply from 1 January 2010. See Annex II A.</p> <p>For vehicle refinishing products there is only one set of limit values for the VOC contents, which applies from 1 January 2007. See Annex II B.</p>	
Implemented by	<u>S.I. 199/2007</u>
DIRECTIVE	<u>97/68/EC</u> of the European Parliament and of the Council of 16 December 1997 on the approximation of the laws of the Member States relating to measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machinery
Official Journal	Official Journal L 059 , 27/02/1998 P. 0001 - 0086
Short Title	Air pollution from non-road motors
Description	Relates to provision of efficient motors in non road machinery
Implemented by	<u>S.I. 147/2007</u>

DIRECTIVE	<u>2003/17/EC</u> of the European Parliament and of the Council of 3 March 2003 amending Directive 98/70/EC relating to the quality of petrol and diesel fuels
Official Journal	L 076 , 22/03/2003 P. 0010 - 0019
Short Title	Air Pollution
Description	Specification for diesel and petrol fuels
Parameter Guideline Values	<u>S.I. 541/2003 - Schedule</u>
Implemented by	<u>S.I.202/2004</u>

g. Environmental Management Systems

ISO 14001:2004

Environmental Management System specification developed by the International Standards Organisation (ISO). ISO 14001:2004 provides a framework for an organisation to control the environmental impact of its activities, products and services.

This International Standard is beneficial for any organisation that wishes to

- establish, implement, maintain and improve an environmental management system.
 - assure itself and other parties of conformity with its stated environmental policy.
 - demonstrate conformity with this International Standard by seeking certification/registration of its environmental management system by an accredited auditing body.
-

EMAS - Eco-Management and Audit Scheme

EMAS is the EU's voluntary scheme designed for companies and other organisations committing themselves to evaluate, manage and improve their environmental performance.

It is defined by **Regulation No.1221/2009 of the European Parliament and of the Council of 25 November 2009 on the voluntary participation by organisations in a Community eco-management and audit scheme (EMAS)**

The aim of EMAS is to recognise and reward those organisations that continuously improve their environmental performance and go beyond their minimum legal compliance.

- EMAS provides organisations with a quality label for voluntary environmental management, internal efficiency, environmental communication and transparency.
- EMAS is a symbol of environmental excellence
- EMAS is a clear and verifiable way of showing commitment to improving environmental performance.
- EMAS provides a systematic framework for setting targets, and measuring, monitoring and reporting on performance.
- EMAS helps to obtain a more sustainable use of resources
- EMAS assists with the communication of information on environmental performance and can add considerable value and improve market reputation.

BS 8555:2003 - *Guide to the phased implementation of an environmental management system including the use of environmental performance evaluation.*

This standard developed by the British Standards Institute (BSI) specifies a phased system for the implementation of an Environmental Management System and has been designed with small to medium-sized businesses specifically in mind. It breaks down the process of gaining ISO 14001 or EMAS into six clear steps. It provides an SME with a phased approach to implementing an EMS and gives them better control over the process.

The six phases of BS 8555:

- Commitment and establishing the baseline
- Identifying and ensuring compliance with legal and other requirements
- Developing objectives, targets and programmes
- Implementation and operation of the EMS
- Checking, audit and review
- EMS acknowledgement (getting ISO 14001 and/or EMAS)

OHSAS 18001: 2007

This is an international occupational health and safety management system. It is complimentary to and, intended to be used in conjunction with, ISO 14001. It would be an aid to business (especially in the pharmaceutical, food and engineering sectors) seeking an auditable, certifiable system as an effective control of health and safety in the workplace.

OHSAS 18001 has been developed to be compatible with the **ISO 9001** (Quality Management System) and **ISO 14001** (Environmental management systems standards), in order to facilitate the integration of quality, environmental and occupational health and safety management systems by organizations, should they wish to do so.

What are the benefits of OHSAS 18001 registration?

- Customer satisfaction - through delivery of products that consistently meet customer requirements whilst safeguarding their health and property
 - Reduced operating costs - by decreasing down-time through incidents and ill health and reducing costs associated with legal fees and compensation
 - Improved stakeholder relationships - by safeguarding the health and property of staff, customers and suppliers
 - Legal compliance - by understanding how statutory and regulatory requirements impact the organization and its customers
 - Improved risk management - through clear identification of potential incidents and implementation of controls and measures
 - Proven business credentials - through independent verification against recognized standards
 - Ability to win more business - particularly where procurement specifications require certification as a condition to supply
-

h. Energy Management Standard

ISO 50001:2011 (Energy Management Systems)

ISO 50001:2011 (Energy Management Systems), which replaces I.S. EN 16001:2009, was published in June 2011.

ISO 50001:2011 is a voluntary international framework for the effective and sustainable management of energy in any business large or small. Implementation of this standard will assist organizations in reducing energy use through the utilisation of international best practices, measurement and reporting disciplines, continuous improvement and promoting energy efficiency throughout the supply chain.

Organisations of all types and sizes can benefit from energy and cost efficiencies through the implementation of this standard.

ISO 50001:2011 requires organisations to:

- Continually improve energy performance, including energy efficiency, energy use and consumption;
- Define their energy policy and document an energy planning process;
- Review energy use, consumption and efficiency at defined intervals;
- Document the methodology and criteria used to develop the Energy Review considering facilities, equipment, systems or processes;

- Establish an energy baseline and identify EnPIs (Energy Performance Indicators) appropriate for monitoring and measuring its energy performance;
- Establish, implement and maintain documented Energy Objectives and Targets.

An effective energy management system based on ISO 50001:2011 provides an organisation's top management with a roadmap which allows them to:

- Minimise energy usage.
 - More effectively meet legislative and regulatory requirements and therefore be viewed more favourably by regulators.
 - Provide an opportunity to systematically plan, control and monitor operational activities and processes that may impact on energy usage.
 - Incorporate energy efficiency in the planning of all new investments.
-

i. Waste Regulation

Control of Unauthorised Waste Management Activities and Litter

The Waste Management Act makes the operation or “use” of an unauthorised waste management facility an offence. As outlined below, such facilities generally need a waste licence or waste permit in order to operate. In Ireland, the primary responsibility for the policing of unauthorised waste sites rests with the local authority where the facility is situated.

The Act forbids the handling, transportation, recovery or disposal of waste when it is done in a manner which causes environmental pollution. It also requires that, when waste is to be transferred, the waste passes to a body that falls within the legal concept of an “appropriate person”. Organisations that are covered by this definition include local authorities, holders of waste collection permits, waste permits and waste licences. While the nature of these terms is discussed later, it follows that the use of an unauthorised waste collector or waste management facility is an offence.

There is a duty to inform a local authority if there is any loss, spillage or accident involving non-hazardous waste that may cause environmental pollution to arise. Where hazardous waste is involved, both the local authority and the EPA must be informed.

In general, the penalties for the contravention of the Waste Management Act are €1900 or prison sentences of up to 12 months. However, more serious offences can be subject to fines up to €12.7 million and imprisonment of up to 10 years. High Court injunctions can be sought to cause the cessation of unauthorised waste management activities. Vehicles involved in illegal dumping can be confiscated.

The EPA Act (1992) was amended by the Protection of the Environment Act 2003. This Act transposed the Integrated Pollution Prevention and

Control (IPPC) Directive into Irish law. All major industry in Ireland is now subject to this system of licensing. These licences are issued by the EPA and cover all aspects of an affected company's environmental performance, including on-site waste storage activities which have environmental implications. Upgrading of existing IPC license holders who are now covered by the IPPC Directive is due to be completed by the end of 2007. Copies of the IPC/IPPC licence for particular premises can be viewed on the EPA's web site.

For those smaller companies that do not require IPPC licences, the temporary storage of hazardous waste needs to be authorised by a local authority. This requirement applies where:

- The storage period is less than six months; and
- The quantities being stored at any one time exceed 25,000 litres of liquid waste or 40 m³ of non-liquid waste.

If these quantity limits are not exceeded, no such authorisation is needed.

j. **Waste Legislation**

Ireland has experienced a dramatic change in its waste management practices in the last decade. Inadequate environmental standards at much of the landfill infrastructure have been addressed by new licensing controls. Waste disposal prices have increased significantly due to the imposition of higher standards, scarcity in the supply of replacement facilities and increasing waste volumes. These changes have also greatly increased the financial attractiveness of waste minimisation and recycling initiatives.

In comparison to some of the larger EU member states, Ireland's enactment of modern waste management controls commenced quite late. Since that time, there has been a significant catch-up process and now an extremely sophisticated system of regulation is in place. However, the system is still experiencing some difficulties and there is evidence that the legislation needs better enforcement in some areas. Recent and proposed new laws are also expected to better define environmentally acceptable waste management practices and to stimulate further waste reclamation initiatives.

This guide has been compiled to help industrialists to gain a ready understanding of what is now a complex area of law. It summarises the relevant provisions that affect the day-to-day management of wastes, as well as setting out the main elements of the long-term strategic framework for waste management in Ireland. Knowledge of both of these areas is increasingly important - not only for reasons to do with legal compliance. New policies and regulation initiatives are likely to place further restrictions on the use of disposal facilities such as landfill sites for the management of commercial and industrial waste. Mandatory recycling initiatives are also being rolled out. It is therefore becoming crucial that

companies take a more long-term view of both national and regional trends and hence are better prepared to address them.

This waste guide concentrates mainly upon those areas of legislation which have the 1996 Waste Management Act as their statutory basis. However, where necessary, other areas of Irish and EU legislation will also be referenced.

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National Policy and Waste Management Planning:

At national level, the Department of the Environment, Heritage and Local Government (DoEHLG) has primary responsibility for waste policy and legislation. This is articulated mainly through the national laws, policy statements, the Department's funding of local authority waste management activities and also through its Race against Waste campaign and its control of the Environment Fund.

A significant proportion of national policy is governed by European Union (EU) initiatives. The most common form of EU environmental legislation – Directives – need to be “transposed” into Irish law by our own legislation. An example would be the EU definition of “waste”, which is reproduced in Section 4 of the Waste Management Act 1996. However, not all of Ireland's waste management legislation is in direct response to EU provisions. Examples of Irish-based initiatives are the landfill levy and plastic bag levy.

Currently, national waste management policy is contained in the following DoEHLG policy statements, (a) "Waste Management Changing our Ways"(pdf 728KB) – published in 1998, (b) "Preventing and Recycling Waste: Delivering Change" (pdf 1.31MB) published in 2002 and (c) "Taking Stock and Moving Forward" (pdf 737KB) published in 2004. These statements are grounded on the EU concept of a waste management hierarchy (Figure 1), whereby waste prevention and re-use are viewed as the most desirable options for managing wastes with the least desirable option considered being landfill. The overall intent of these policy statements is to move Irish waste management away from landfill into those options that feature in the upper echelons of the hierarchy.

A focus of waste policy is on waste prevention and the National Waste Prevention Task Force and Programme operated by the DoEHLG and the Environmental Protection Agency (EPA) is co-ordinating a range of national initiatives in this area. In terms of the actual legislation, the Waste Management Act 1996 is the main vehicle by which this policy framework is enacted, through the provisions on waste collection, waste planning and via the detailed regulatory package. This Act was changed in 2001 by the Waste Management (Amendment) Act 2001. In summary, the 2001 Act contained new provisions to set up levies on landfill and plastic

bags, as well as providing for a streamlined adoption process for waste management plans.

The Waste Management Act divides the responsibility for the regulation of waste in Ireland between the EPA and the local authorities. The 29 county councils and the five city councils undertake local authority regulation. They also have the main responsibility for the collection and disposal of household waste, as well as currently providing much of the landfill infrastructure. Other bodies have a role in relation to some types of waste, e.g., Repak Ltd's involvement with packaging waste recovery.

It is important to realise that the Waste Management Act 1996 – as well as some of the associated regulations – has been amended a number of times. These amendments are necessary in order to address new EU environmental initiatives or to tighten up on some matters where problems have arisen. Their existence means that readers of the actual legislation will need to take care to ensure that they are in possession of the most up-to-date legislation possible.

k. Waste Management Plans

Waste planning is an important function of the Waste Management Act. Local authorities are responsible for non-hazardous waste planning while the EPA has responsibility for a national hazardous waste management plan.

Non-hazardous waste management plans:

Government policy encourages local authorities to jointly draw up waste management plans and 10 have been prepared regionally. Of the 29 county councils involved in this process, only counties Donegal, Kildare and Wicklow have not partaken in the regional planning approach.

Once it has been drafted, a waste management plan must be issued for public consultation prior to finalisation. Each plan has to be renewed at the end of a five-year cycle. In order to accommodate new developments in the local area, an existing waste management plan can be amended or reviewed within its lifespan.

The Waste Management Act outlines the main requirements on the drafting of waste management plans, with their actual structure and content being determined by the Waste Management (Planning) Regulations 1997. A major purpose of these regulations is to ensure that the different plans are comparable nationally.

In summary, a waste management plan must cover:

- Policies, objectives and priorities for waste management for the area of the plan;
- Data and forecasts of wastes arising in the locality;
- Information on waste disposal and recovery facilities;

- Details of waste management infrastructure which will be required in the planning period;
- Steps to be taken by the local authority to enforce the Waste Management Act;
- An identification and risk assessment of closed waste facilities.

The Waste Management (Amendment) Act 2001 changed the way in which waste plans are adopted by local authorities. If the elected members of a local authority refuse to adopt the plan or inappropriately change its contents – which has happened in the past due to the controversial nature of the waste issue in Ireland – the approval process passes to the county manager.

By the summer of 2002, all of the waste management plans for Ireland had been completed and adopted. Copies of the plans can be purchased from the constituent local authorities.

At present, there is no single, national, plan for non-hazardous waste for Ireland as a whole. Instead, the national picture must be derived from collectively reading the waste plans for the constituent local authorities' areas. However, the EPA periodically publishes national waste statistics, in the form of the National Waste Database Reports. These reports present the most up to date national information available on waste generation and management. They also report on waste management infrastructure and initiatives towards waste prevention and recovery targets. The National Waste Database Reports help all stakeholders in waste management to make informed decisions and to fulfil national and EU reporting obligations. The most recent report was published in January 2007 reporting waste information for 2005.

Sludge Management Plans:

A significant number of local authorities have also produced separate management plans for sludge. While these plans concentrate on sewage sludge disposal from urban wastewater facilities, most cover the increasingly difficult issue of industrial sludge management. These plans have been developed by local authorities acting individually or by small regional groupings. Copies of the plans can be obtained from the relevant county councils.

National Hazardous Waste Plan:

The Waste Management Act requires the EPA to draw up a hazardous waste management plan for Ireland. The first National Hazardous Waste Plan was finalised and published by the EPA in 2001.

In summary, the following key priorities are set out in the National Hazardous Waste Plan:

- The establishment of the implementation committee for the Plan;
- The establishment of the hazardous waste prevention team;
- The elimination of unreported hazardous waste arisings;

- The identification and prioritisation of closed hazardous waste sites;
- The establishment of improved collection systems for hazardous waste generated by householders, by small businesses and by agricultural activities;
- The allocation of financial and technical assistance to address capacity deficits in national hazardous waste management infrastructure; • The development of both hazardous waste landfill and incineration capacity;
- New public awareness initiatives on hazardous waste issues;
- The further development of a number of current initiatives, particular those which relate to “clean technology”.

The Waste Management Act requires local authorities to set out how the proposals in the hazardous waste management plan are to be implemented in their areas. However, as many of the local authority plans were finalised before the publication of the National Hazardous Waste Plan, a number contain limited information in this respect. An exception is the Waste Management Plan for the South East, which was adopted after the National Hazardous Waste Plan was finalised. The EPA is now reviewing the plan and the second National Hazardous Waste Plan is expected to be finalised in 2007.

Management Plan for Polychlorinated Biphenyls (PCBs):

The Waste Management (Hazardous Waste) Regulations 1998 require the EPA to draw up a plan for the management of polychlorinated biphenyls (PCBs). This is an obligation under the EU PCB Directive (96/59/EC) and the Plan was published in 2002. It sets out estimated quantities of PCBs in Ireland and the legislative requirements for their management.

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Where any of the larger PCB-containing equipment remains in use. Both the equipment itself and the doors to the particular premises must be clearly labelled to indicate that PCBs are inside. This information is intended to alert the emergency services of the presence of these harmful materials.

The Waste Management (Hazardous Waste) Regulations mandate that transformers containing defined quantities of PCBs must be decontaminated. If they are to be put back into service, the replacement fluid must not make the transformer difficult to dispose of. After decontamination, the transformer must be labelled to that effect and in the manner set down in the regulations. The regulations require that the decontamination of all larger transformers is completed by the end of 2010.

The Waste Management (Hazardous Waste) Regulations also require that holders of equipment containing PCBs above stipulated levels must notify the EPA of the existence of the equipment. This must have first been done

by 1 September 1998 and notification must be repeated annually thereafter. In 2002, the EPA introduced an annual fee for such notifications.

The regulations ban the importation, production and supply of PCBs in Ireland. PCBs cannot be re-used nor can transformers be topped up with PCBs. Similarly, it is an offence to hold specified levels of PCBs or PCB-containing equipment that has not been notified to the EPA.

Waste Oils:

The Waste Management (Hazardous Waste) Regulations 1998 make the disposal of waste oils to waters or drainage systems an offence. It is also prohibited to mix them with PCBs or other wastes. The regulations impose particular requirements on persons who produce more than 500 litres of waste oils in a calendar year. Such individuals must keep information on the quantity, quality, origin and location of waste oils. When waste oils are to pass to another person, details of the date of transfer and the identity of the transferee must be maintained. This information must be kept for at least two years.

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Ozone Depleting Substances:

EU Regulation 2037/2000 on Substances that deplete the Ozone Layer came into force in Ireland on a succession of dates, starting October 2000. The Irish legislation which implements this Regulation is The Control of Substances that Deplete the Ozone Layer Regulations 2006 (S.I. 281 OF 2006) which entered into force on the 1 June 2006. The competent authority in Ireland for the implementation of the Regulation is the EPA. The Regulation contains a list of substances that damage the ozone layer – these are referred to as ozone depleting substances or controlled substances. Examples of controlled substances include chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), halons, 1, 1, 1, trichloroethane, carbon tetrachloride and methyl bromide. A full listing of controlled substances is listed in Annex 1 of the Directive.

Industrial areas where these controlled substances are most likely to be found include air conditioning and refrigeration, fire suppression systems, chemical/pharmaceutical industries, soil treatment and pest control.

Under the regulations the use of controlled substances (with few exceptions) in aerosols, as refrigerants and solvents are banned since the regulation came into force. The use of methyl bromide is banned since 31 Dec 2005. Exceptions exist – usually in the case of essential or critical use (as defined in the 1987 Montreal Protocol). What constitutes a critical or essential use is decided on by the EPA.

The Regulation also requires the introduction of systems for the recovery of ozone depleting substances (for the purposes of recycling, reclamation or ecologically acceptable destruction) contained in;

- Refrigeration and air conditioning equipment and heat pumps (including household refrigerators and freezers);
- Equipment containing solvents;
- Fire protection equipment and fire extinguishers.

Guidance Notes have been prepared by the EPA to help people or businesses involved in the handling of ozone depleting substances and are available on the EPA website.

Fluorescent Tubes:

In general, spent fluorescent tubes are defined as hazardous waste. Hence they must be subject to the storage and record keeping requirements set out above. In addition, they should also be segregated from other non-hazardous waste and consigned for specialist processing.

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1. Transporting Waste

Waste Collection Permits:

A system for the formal authorisation of all commercial bodies involved in the collection of waste was initiated by the Waste Management (Collection Permit) Regulations 2001. November 30th 2001 was the main deadline for waste collectors to apply for a permit to authorise their waste collection activities. Unless an application had been made by the stipulated date, the legislation forbids a collector from transporting waste until such a permit has been issued.

Since the definition of waste is quite wide, the requirement for hauliers to obtain collection permits extends to companies handling construction and demolition waste, scrap metal, waste paper, cardboard, oils and other recyclable wastes, as well as items such as pallets and scrap computers. Hauling waste without a collection permit is an offence, as is passing waste to a person who is not duly authorised.

A waste collection permit only allows a waste carrier to collect waste within the area of jurisdiction of the issuing authority. In order to simplify the process and to prevent nation wide collectors requiring permits from every local authority in Ireland, the country has been divided into ten areas. These areas are the same as those used for the drafting and implementation of waste management plans. One local authority within each of the areas has been designated as a “nominated authority”, having primary responsibility for the processing of collection permit applications and the granting of such permits for the area as a whole. Table 1 shows the nominated authorities and their functional areas.

Table 1. Waste Collection Permits – Nominated Authorities Area of Ireland	Nominated Authority
South East (Carlow, Wexford, Kilkenny, Waterford City & County, Tipperary SR)	Kilkenny County Council
Cork (Cork City & County)	Cork County Council
North East (Cavan, Louth, Monaghan, Meath)	Meath County Council
South West (Clare, Limerick City & County, Kerry)	Limerick County Council
Connaught (Galway City and County, Mayo, Roscommon, Sligo, Leitrim)	Mayo County Council
Midlands (Offaly, Tipperary NR, Laois, Longford, West Meath)	Offaly County Council
Dublin Region (Dublin City, Fingal, South Dublin, Dun Laoghaire Rathdown)	Dublin City Council
Wicklow	Wicklow County Council
Donegal	Donegal County Council
Kildare	Kildare County Council

Appendix H: Document Review Teagasc, Glanbia, Bord Bia

a. Teagasc

Teagasc – the Agriculture and Food Development Authority – is the national body providing integrated research, advisory and training services to the agriculture and food industry and rural communities.

Teagasc Advisory Service members can avail of:

- An **advisor** with full access to specialist and research backup
 - On-farm visits, according to **contract**
 - Herd and flock management advice
 - Business and financial planning
 - Office and phone consultations
 - Farm management advice
 - Grassland management planning service
 - Breeding advice
 - Nutrition and ration formulation service
 - Advice on farm buildings and paddock layout
 - Assistance with Department of Agriculture schemes
 - Options planning for the future
 - Advice on alternative enterprise development
 - Joint programmes with industry
 - Participation in enterprise-based discussion groups
 - Young farmer discussion groups
 - **Farm partnership services**
 - The Teagasc Cost Control Planner
 - Use of the Teagasc **Profit Monitor**
 - Environment advice and planning service
 - Soil and grass analysis service
 - Access to farm walks, demonstrations and **public events**
 - A monthly newsletter with practical and timely advice
 - Today's Farm magazine six times a year
 - BETTER farm programmes
 - Access to adult farmer education courses and programmes
 - The very latest agriculture and food research updates
 - An independent and confidential advisory service
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b. Glanbia

Glanbia is a global nutrition company, grounded in science and nature and dedicated to providing better nutrition for every step of life's journey.

Today's consumers are increasingly aware of the importance of nutrition in improving their overall health and wellbeing. They are searching for better, healthier and smarter nutritional solutions that fit their lifestyles.

Glanbia takes pure and clean ingredients including milk, whey and grains, and using our expert knowledge and capabilities we produce high-quality nutritional ingredients and branded consumer products for our customers and consumers worldwide.

We employ over 6,000 people across 32 countries and our products are sold or distributed in over 130 countries with an annual turnover of €3.6 billion. Our major production facilities are located in Ireland, the US, the UK, Germany and China. We have four segments; Glanbia Performance Nutrition, Global Ingredients, Dairy Ireland and Joint Ventures & Associates. Our shares are listed on the Irish and London Stock Exchanges (symbol: GLB).

GLANBIA PERFORMANCE NUTRITION

Glanbia Performance Nutrition (GPN) is the number one global performance nutrition brand portfolio comprising of Optimum Nutrition, BSN, Isopure, thinkThin, Nutramino, ABB and trusource, each with its own brand essence. Our mission is to inspire consumers everywhere to achieve their performance and healthy lifestyle goals. We produce the full range of performance nutrition products with broad consumer appeal, and we are the market leader in innovation and new product development.

GLANBIA NUTRITIONALS

Glanbia Nutritionals has a portfolio focused on both dairy and non-dairy nutritional ingredients. We deliver nutritional and functional ingredient solutions, and precision premixes for use in the nutrition-enhanced mainstream food and beverage markets, infant and clinical nutrition and functional nutrition markets. We are also a large-scale manufacturer and marketer of American-style cheddar cheese.

DAIRY IRELAND

Dairy Ireland is comprised of two businesses. Consumer Products is the leading supplier of branded consumer dairy products to the Irish market and long-life products for export. Agribusiness supplies inputs to the Irish agriculture sector and is the leading purchaser and processor of grain and the leading manufacturer of branded animal feed in Ireland.

JOINT VENTURES & ASSOCIATES

We have a three strategic Joint Ventures & Associates: Southwest Cheese in the US, Glanbia Ingredients Ireland and Glanbia Cheese in the UK. These are strategically important partnerships, not only in their own right, but also in terms of the synergies and growth opportunities they bring to the wholly owned Group.

c. Bord Bia

The **Quality Assurance Schemes** provide assurance to both consumers and trade buyers as to the standards under which the Irish food products encompassed by such schemes have been produced. Check out the **Bord Bia Farmer Assist site - farm.bordbia.ie** for information on how to prepare for audit, survey questionnaire and closing out audits. Also see the **frequently asked questions on Quality Assurance** or for further information/documentation on Quality Assurance Schemes contact Damien Murray on 01 6143648 or Email: damien.murray@bordbia.ie.

Origin Green describes our sustainability initiative which does and can call for farm participation. Find out more about the Origin Green initiative at www.origingreen.ie.

Price Tracking provides tracking of prices and other key statistics on meat and livestock from around the world including:

- [Cattle Prices](#)
- [Cattle Throughput](#)
- [Live Cattle Exports](#)
- [Sheep Prices](#)
- [Sheep Throughput](#)
- [Pig Prices](#)
- [Pig Throughput](#)

The **Provision of Technical Support** is a formal notice setting out the basis on which Bord Bia can provide 'technical support' to individual farmers when funded from State sources.