A Capabilities Perspective on Patterns of Environmental Action in Traditional Services: The Case of Energy Efficiency Adoption

A thesis submitted to the University of Manchester for the Degree of

Doctor of Philosophy (PhD)

in the Faculty of Humanities

2013

Lisa Pace

Manchester Business School

Table of Contents

72,370 words including headings, tables and footnotes (excluding references and annexes)

List of Tables

List of Figures

List of Graphs

Abstract

The University of Manchester
Lisa Pace
Doctor of Philosophy (PhD)

A Capabilities Perspective on Patterns of Environmental Action in Traditional Services: The Case of Energy Efficiency Adoption

24th July 2013

The point of departure for this thesis is how a traditional service sector shifts towards becoming more energy efficient and the processes that enable environmental action. Traditional services are generally considered to be poorly innovative and inclined towards routine activity; this leaves a gap in understanding how these adapt to the challenge of taking environmental action. The study argues that service firms adapt by deploying capabilities to multitask or to carry out innovative activity alongside routine activities related to service delivery. The research problem is addressed through three objectives: i) explicating how dynamic capabilities enable environmental action in traditional services with a focus on energy efficiency; ii) investigating the interface between the service firm and a type of intermediary, the knowledge intensive business service firm (KIBS), and how this acts as a locus for intermediation activity, or the exchange of knowledge about energy efficient technologies and measures; and iii) exploring how developments in the external context may influence the firm's capabilities to adapt.

The key contributions are two-fold. Firstly, the research links different combinations of capabilities with particular innovative behaviours in service firms; this underscores the presence of a differential multitasking potential across firms in the same sector. Secondly, it demonstrates a link between the service firm's internal capabilities and the extent to which it mobilizes absorptive capacity to obtain knowledge about energy efficiency measures from its relation with KIBS.

A qualitative study is designed with the hotel sector in Malta as the empirical setting. The fieldwork was undertaken through interviews with 26 hotel managers, 14 engineering consulting firms and 16 actors in the broader institutional environment. The data from the hotels were clustered to derive different adaptation modes characterized by particular capabilities and patterns of environmental action. Then, pairs of hotels and engineering consulting firms were identified in order to investigate the relational dynamics that may be influencing intermediation activity.

The findings distinguish between hotels with a low multitasking potential that adopt a narrow range of energy efficient measures and those with a higher multitasking potential that modify activities and make deeper structural changes to shift towards improved energy efficiency. Accounting for the range of multitasking potential are different combinations of capabilities to sense signals in the external environment and interpret these in the firm and the capability for problem-solving for energy efficiency. The findings demonstrate a different pattern of KIBS use by hotels that is suggestive of a cluster differentiation. This is linked to different levels of absorptive capacity in hotels that determines whether intermediation activity and therefore the exchange of knowledge and learning about energy efficient measures is constrained or otherwise enhanced at the KIBS-client interface. The conclusion provides policy implications and areas for future research.

Keywords: traditional services, capabilities, KIBS, intermediation, energy efficiency

Declaration

I hereby declare that no portion of the work referred to in the thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning;

Copyright Statement

i. The author of this thesis (including any appendices and/or schedules to this thesis) owns certain copyright or related rights in it (the "Copyright") and she has given The University of Manchester certain rights to use such Copyright, including for administrative purposes.

ii. Copies of this thesis, either in full or in extracts and whether in hard or electronic copy, may be made only in accordance with the Copyright, Designs and Patents Act 1988 (as amended) and regulations issued under it or, where appropriate, in accordance with licensing agreements which the University has from time to time. This page must form part of any such copies made.

iii. The ownership of certain Copyright, patents, designs, trademarks and other intellectual property (the "Intellectual Property") and any reproductions of copyright works in the thesis, for example graphs and tables ("Reproductions"), which may be described in this thesis, may not be owned by the author and may be owned by third parties. Such "Intellectual Property and Reproductions" cannot and must not be made available for use without the prior written permission of the owner(s) of the relevant Intellectual Property and/or Reproductions.

iv. Further information on the conditions under which disclosure, publication and commercialization of this thesis, the Copyright and any Intellectual Property and/or Reproductions described in it may take place is available in the University IP Policy (see http://www.campus.manchester.ac.uk/medialibrary/policies/intellectual-property.pdf), in any relevant Thesis restriction declarations deposited in the University Library, The University Library's regulations (see ttp://www.manchester.ac.uk/library/aboutus/regulations) and in The University's policy on presentation of Theses.

To my parents, Alphonse and Marisa

Acknowledgements

I am grateful to Prof. Ian Miles for his mentorship that spurred me to keep working up to completion of this degree. In particular, our discussions and his insights helped me moult my skin as a natural scientist and start thinking with the hat of a social scientist. His guidance was particularly valuable in exploring different research avenues whilst at the same time keeping an eye on detail and sharpness that is required to undertake social sciences research. I would also like to thank Dr. Sally Randles, my second supervisor, for her guidance and encouragement throughout these years. Prof. Philippe Laredo followed my progress through the end of year reviews and his feedback was also valuable in shaping my research.

I would like to thank Dr. Pim den Hertog and Prof. Marcela Miozzo, the examiners of this PhD thesis for their constructive comments and suggestions.

Most of my fellow colleagues who started the PhD journey with me have now completed and have moved on to continue with their research careers. Good luck to Robert Lai and Kalle Stahl Nielsen for their imminent completion.

Whilst working at the Malta Council for Science & Technology, Dr. Jennifer Cassingena Harper was inspirational in opening new horizons and research opportunities in research and innovation policy and inspired me to take up a research interest in innovation and policy studies. Thank you also to Dr. Ozcan Saritas at MIoIR for his support during my first year at Manchester. A special mention goes to the late Professor Noel Zarb Adami at the University of Malta, once my tutor in inorganic chemistry and a person of great vision and forward thinking.

My thanks also go to Fr. Patrick Magro SJ and Fr. Jimmy Bartolo SJ, rectors at St. Aloysius' College, for releasing me from work when I needed to be in Manchester for my studies.

I am particularly grateful to my parents and my sister, Maria Pia, who have always believed in me and have supported me throughout this long journey and were my main source of encouragement.

I would like to thank the Post-Graduate Office, particularly Mr. Daniel Wheatcroft, for patiently answering all my questions and assisting with the submission phase of the thesis. Finally, I also thank all the respondents who have contributed to shaping the outcomes of this research.

The Author

Lisa graduated with a BSc. in Biology and Chemistry (1995) and a Master's degree in Biology (1998) from the University of Malta. She was a part-time researcher with the Malta Council for Science & Technology (MCST), the national agency responsible for the formulation of science and technology policy and the implementation of the National Research and Innovation Strategy. Within the MCST, Lisa worked on foresight-related projects including a COST Action on Foresight Methodologies (A22) and the Forsociety ERA-NET. Lisa also had the occasion to deliver lectures on foresight and the environment within the University of Malta's Master's degree course on Creativity and Innovation and the International Ocean Institute's Course on Ocean Governance; alongside lecturing Biology at St. Aloysius' College, Malta. Through the University of Malta, she was involved as project-manager in an FP6 Project entitled: 'Researching Inequalities in Science & Technology' in a Work Package led by Prof. Susan Cozzens at the School of Public Policy, Georgia Institute of Technology, University of Georgia, Atlanta. The project focussed on the distributional impacts of emerging technologies.

These experiences spurred Lisa to undertake further independent work on matters relating to R&D&I policy. She was the country correspondent on the EU's Trendchart Network (2007-2009) mapping innovation policy trends and the Erawatch Observatory (2006-2012) that focussed on the national research policy landscape and supporting measures; and the EU's METRIS Network - Monitoring European Trends in Social Sciences & Humanities.

Publications:

Pace L. (forthcoming) The Diffusion of Emerging Technologies in a Micro-Economy: The Case of Malta in COZZENS S.E. & THAKUR D. (eds.) *Innovation and Inequality: Emerging Technologies in an Unequal World* Edward Elgar, UK.

Gatchair S., Bortagaray I. & Pace L. (forthcoming) Cross-Country Analysis: Genetically Modified Corn in COZZENS S.E. & THAKUR D. (eds*.) Innovation and Inequality: Emerging Technologies in an Unequal World* Edward Elgar, UK.

PACE L., (2013) Strategic Planning for the Future: Malta's eFORESEE Experience in BORCH K., DINGLI S.M. & SØGAARD JØRGENSEN M. (eds.) *Participation and Interaction in Foresight: Dialogue, Dissemination and Visions* Edward Elgar, UK, Chapter 16.

SARITAS O., PACE L., & STALPERS S.I.P. (2013) Stakeholder Participation and Dialogue in BORCH K., DINGLI S.M. & SØGAARD JØRGENSEN M. (eds.) *Participation and Interaction in Foresight: Dialogue, Dissemination and Visions* Edward Elgar, UK, Chapter 3.

Peer-Reviewed Conference Presentation:

Pace L. (2010) Energy in Transition: Tourism Perspective in a Small Island State Conference Proceedings ERSCP-EMSU International Conference on Knowledge Collaboration & Learning for Sustainable Innovation, Delft The Netherlands 25-29th October 2010. Financially supported by a Research Student Conference Grant provided by RADMA, Research & Development Management, UK. **Oral Presentation**

Chapter-1: INTRODUCTION

1.1 - Introduction

Traditional services are generally considered to be poor innovators and inclined towards routine activity. This leaves a gap in understanding how such firms are able to adapt to emerging challenges which in this study relate to shifting towards improved energy efficiency. Hotels, an intrinsic component of tourism, provide an example of this problem that applies to other traditional service sectors, and therefore it is important to think of the capacity of these firms to adopt innovations that enable environmental action.

Energy efficient technologies and measures can be grouped under the wider umbrella of environmental or eco-innovations that have been broadly described as new technologies, new services, new management practices or changes in the organizational structure and administrative processes of a firm that may result in a reduction of environmental risk, pollution and other negative impacts of resource use (Damanpour, 1991; van Vliet and Spaargaren, 2000; Green and Randles, 2006; Kemp and Pearson, 2007; Reid and Miedzinski, 2008).

This study explores the different adaptation responses of firms in the same service sector and the way in which these firms are able to obtain external knowledge about environmental innovations with particular reference to energy efficient technologies and measures. It examines the assumptions in the literature on innovation in services and based on a qualitative study, it contributes a deeper understanding of the dynamics of innovation in traditional services and of capabilities for adaptation.

1.2 - Research Problem

New and unexpected environmental problems and pressures have the potential to stimulate innovative responses that can lead to transformations in incumbent systems of provision and consumption (Berkhout, 2008). The literature has devoted considerable attention to the role played by radically new technologies in bringing about such a shift (for e.g. Geels and Schot, 2007 and Geels, 2011 in the tradition of socio-technical transitions). To date, this analytical approach has ignored an increasingly urgent question for theory and practice; this is how traditional or so-called 'low-tech' sectors respond to the challenge of innovating and implementing environmental action. This research looks at the firm and the processes through which the firm shifts towards paths characterized by enhanced energy efficiency; therefore it is a study about adaptation at the micro-level.

Adaptation is about making adjustments and finding a fit with the external environment; it can be a matter of survival or of gaining competitive advantage (Chakravarthy, 1982). Adaptation can

be understood as a process through which firms adopt new or modified practices and technologies that enable them to respond to external change (Berkhout, 2012). Following this interpretation, innovation processes in firms can provide insight into how these adapt in response to new emerging challenges related to environmental action (after Boelie and Wieczorek, 2005).

This study considers a traditional service sector that is not typically inclined towards undertaking innovative activity (Sundbo, 2011). There is some evidence of adaptation processes underway in traditional services, including in hotels (Sundbo, 2011; den Hertog *et al*., 2011), though this is often difficult to measure through innovation surveys that adopt a technology-biased definition of innovation (den Hertog *et al*., 2011). This outlook leaves a gap in understanding the processes through which traditional services innovate and adopt novel measures and practices resulting in enhanced energy efficiency.

A widely used approach explaining firm adaptation is the dynamic capabilities approach (Teece, 2007). The literature on strategic management discusses the role of dynamic capabilities in firms as a means of achieving competitive advantage in fast changing technological environments (Teece, 2007). This approach has also gained ground in explaining how services innovate (den Hertog *et al*., 2010; Sundbo, 2011; Kindström *et al*., 2012). Amongst current contributions, Sundbo (2010, 2011) discusses traditional service firms' capabilities to multitask or engage in innovative activities whilst keeping the service running. Den Hertog *et al*., (2010) put forward a model about dynamic service innovation capabilities. Despite these recent contributions, there is as yet limited theoretical and empirical work addressing the concept of dynamic capabilities as applied to services (den Hertog *et al*., 2010). Secondly, the literature appears to make assumptions about the types of capabilities that service firms mobilize to adapt to change; yet the missing link is to understand those combinations of capabilities that are driving innovative activity and how these may differ between firms.

Innovation relies on bringing together different types of actors and information sources. Amongst these, knowledge intensive business services (KIBS) have emerged as an important source of specialist knowledge in services (den Hertog, 2000; Tether and Tajar, 2008). KIBS are a type of intermediary acting between the external knowledge base and the client to support innovation (Howells, 2006; Toivonen, 2009). Whereas many studies have focused on the KIBS aspect, the KIBS-client interface is emerging as an equally interesting locus to analyze the exchanges and interactions amongst the KIBS and the client (Miles, 2012). The dynamics of the KIBS-client interaction and how these may be influencing intermediation activity deserve further analytical attention to enrich the literature addressing this aspect of the relation (e.g. Webb, 2002; Grimshaw and Miozzo, 2004; Strambach, 2008; Miles, 2012).

The capacity of the client to exploit its relation with KIBS, or its absorptive capacity is one aspect of the relational dynamic that deserves further investigation (Miles, 2012). There appears to be a gap in understanding what absorptive capacity is for a traditional service sector

that is not ‘R&D’ based and how the service firm mobilizes its relation with the KIBS in order to adopt energy efficient technologies and measures.

Finally, the behaviour of firms is shaped by factors in the external context that influence how firms operate and innovate (Hoffman, 2001); this also applies to the adoption of environmental innovations (Fleiter *et al*., 2012). Although not developed at a conceptual level, the aspect of how the external context bears on firm adaptation responses is relevant in so far as it views the firm as part of a wider system.

1.3 - Research Questions

The overarching question of this study is how a traditional or ‘low-tech’ sector adapts along a trajectory characterized by improved energy efficiency and the processes that enable environmental action.

In this study, adaptation is understood as a process through which energy efficient technologies and measures are adopted and are integrated into existing activities in the firm. Another aspect of adaptation is the way the firm makes adjustments in its organizational structure and therefore how it organizes and distributes activities and coordinates these activities to achieve energy efficiency.

The research problem is addressed by the following three questions:

1. **How can a capabilities-perspective explain the adaptation of a traditional service sector to achieve energy efficiency?**

   Sub-questions:

   - What internal capabilities do traditional services possess that enable them to adopt energy efficient measures and practices?
   - How do these capabilities differ amongst firms in the same sector and how may these differences account for the differential responses of firms?

   The question asks about the processes through which traditional services adapt to achieve enhanced energy efficiency and the capabilities that can account for particular responses. There can be heterogeneous responses within the same sector in that not all firms adopt the same type of energy efficient measures and practices. Thus the question addresses a gap in understanding the different adaptation responses of firms through an investigation of their capabilities to innovate and how these capabilities may be distributed.

2. **How does the relation of the service firm with a type of intermediary, the KIBS, influence environmental action and the adoption of energy efficient measures?**

   Sub-questions:

   - When do KIBS take up the role of change agents in influencing the adoption of energy efficient measures and practices in their clients?
   - Which aspects of the KIBS-client relation influence the adoption of energy efficiency measures in the client?

   Outside the firm is a body of information and knowledge about environmental technologies and energy efficiency measures. One source comes from knowledge intensive business service firms or KIBS, a type of intermediary acting between the hotels and this external body of knowledge.

   This question explores the KIBS-client interface as a locus for intermediation activity, where information and knowledge about energy efficiency measures may be exchanged between the two classes of actors. At this interface, there may be different types of relations, characterized by different 'client' and KIBS types. Two aspects are considered relevant. One is explicating how the dynamics of the relation may be influencing intermediation activity. The second is understanding how absorptive capacity in services may affect intermediation activity.

3. **How do policy and other factors external to the service firm influence the adoption of energy efficient technologies and measures?**

   Environmental innovations are not adopted in isolation from the external context. In this study the external context is that of tourism and issues around energy prices and an array of policies and incentives aimed at stimulating environmental action in firms generally and energy efficiency measures in particular. This research question explores how service firms are responding to these signals and the extent to which these may be influencing environmental action.

1.4 - Research Context

Tourism is a global phenomenon: its importance in terms of contribution to gross domestic product and investments has grown worldwide (Blanke and Chiesa, 2011). One 'side-effect' of this growth is the increased resource consumption and waste production, and greenhouse gas emissions (JRC, 2012). This study is located in Malta, an island destination in the Mediterranean that relies heavily on tourism and takes the case of the hotel sector to study how this shifts towards enhanced energy efficiency. The focus on tourism firms restricts the

generalizability of the study to similar contexts - that is other tourism-dependent small economies. However, there may be dynamics and issues that apply more widely, for example, to traditional service sectors embedded in similar contexts.

1.4.1 - Innovation Activity in Tourism – A Focus on the Hotel Sector

Tourism encompasses a complex of different industries including airlines, tour operators, hotel chains and retail and entertainment as representative dominant players (Coathup, 1999). This study focuses on hotels, a sub-set of hospitality[1]. According to UNEP (2011) "after transport, accommodation is the most energy-intensive component of the tourism industry with its demand for heating or cooling, lighting, cooking (in restaurants), cleaning pools and, in tropical or arid regions, the desalination of seawater." (p. 421).

Tourism and within this hotels, is representative of a mature or traditional service industry that is generally regarded as exhibiting low innovative performance because it lacks many of the pre-conditions for innovation: it has poor direct links with academia, low in-house research and development (R&D) capacity; a majority of low-skilled personnel and high personnel turnover rates (Hjalager, 2010). Thus, tourism is not inherently innovative at its core, and is more likely to adopt innovations that are not new to the market but that have been developed elsewhere (ibid).

Although there is a good potential for tourism firms to mitigate undesirable effects of their activities on the environment, few studies have addressed how this can be achieved (Hall, 2009). This study intends to make a contribution to understanding how tourism firms adapt along trajectories characterized ultimately by improved energy efficiency.

The hotel sector is variable in terms of size, ownership and business models (Chon and Maier, 2010); these characteristics have been shown to influence innovative activity in hotels (Orfila-Sintes and Mattsson, 2009; Martinez-Ros and Orfila-Sintes, 2009). There is also some evidence of multinational hotel chains exhibiting superior environmental performance compared to smaller domestic hotels based on the possession of more and better resources to implement environmental innovations (Molina-Azorín *et al*., 2009). This study does not explicitly distinguish between multinational hotel subsidiaries and domestic firms; nor does it attempt a comparison between the two types of firms. Instead the hotels investigated in this study represent a heterogeneous sample of the hotel sector in Malta as discussed in Chapter 5.

[1] Hospitality is an industry that essentially provides a service to guests when these are away from home (Chon and Maier, 2010 p. 5). International hospitality includes three key elements namely hotels, restaurants and contracted foodservice (ibid). Hotels represent one type of accommodation establishment. The national context may include a wider diversity of accommodation arrangements such as self-catering, camping sites, motels, bed and breakfast etc. The European industry standard NACE (Nomenclature Statistique des Activités Économiques dans la Communauté Européenne), classifies hotels and restaurants together in NACE Code 55 (section H). Source: European Commission NACE Codes accessed 11th February 2013 at: http://ec.europa.eu/environment/emas/pdf/general/nacecodes_en.pdf.

1.4.2 – Engineering Consulting Firms as a Type of KIBS

The empirical investigation showed that a type of KIBS, the engineering consulting firm, is acting as an intermediary between the hotel and a body of information and knowledge on environment innovations and energy efficiency measures and technologies. The engineering consulting firms fall in a group of T-KIBS, where 'T' stands for technology-based activities (Miles, 2012). These T-KIBS offer a range of technical and engineering services to hotels as well as services related to energy auditing and management. The research provides an in-depth analysis of the relationship between engineering consulting firms and their clients - the hotels – as an example of how this might be influencing intermediation activity and the exchanges of information and knowledge about energy efficient measures.

1.4.3 – Characterizing Environmental Action in Hotels - A Focus on Energy Efficiency

This study focuses on end-use energy efficiency rather than on efficiency of energy use in production. Therefore it discusses energy efficiency at the level of the end-consumers specifically business firms and how these introduce technologies and measures to enhance the efficiency of their operations. The phrases 'environmental action' and 'environmental response behaviour' are used throughout this thesis to describe the action taken by firms, including the adoption of novel technologies and practices, to shift towards trajectories characterized by enhanced energy efficiency.

Energy efficiency is defined in terms of the energy balance: energy efficiency occurs when energy inputs are reduced whilst maintaining the level of service or alternatively providing enhanced services for the same input of energy (US-DOE, 1995). Accordingly it may not always result in energy-savings (Fleiter *et al*., 2012). Energy efficiency is often taken to be synonymous with energy conservation though the two concepts have different meanings. Conservation refers to reducing consumption through lowering the quality of energy services provided such as lowering heating levels, through turning down thermostat levels and setting consumption limits on appliances (Herring, 2006).

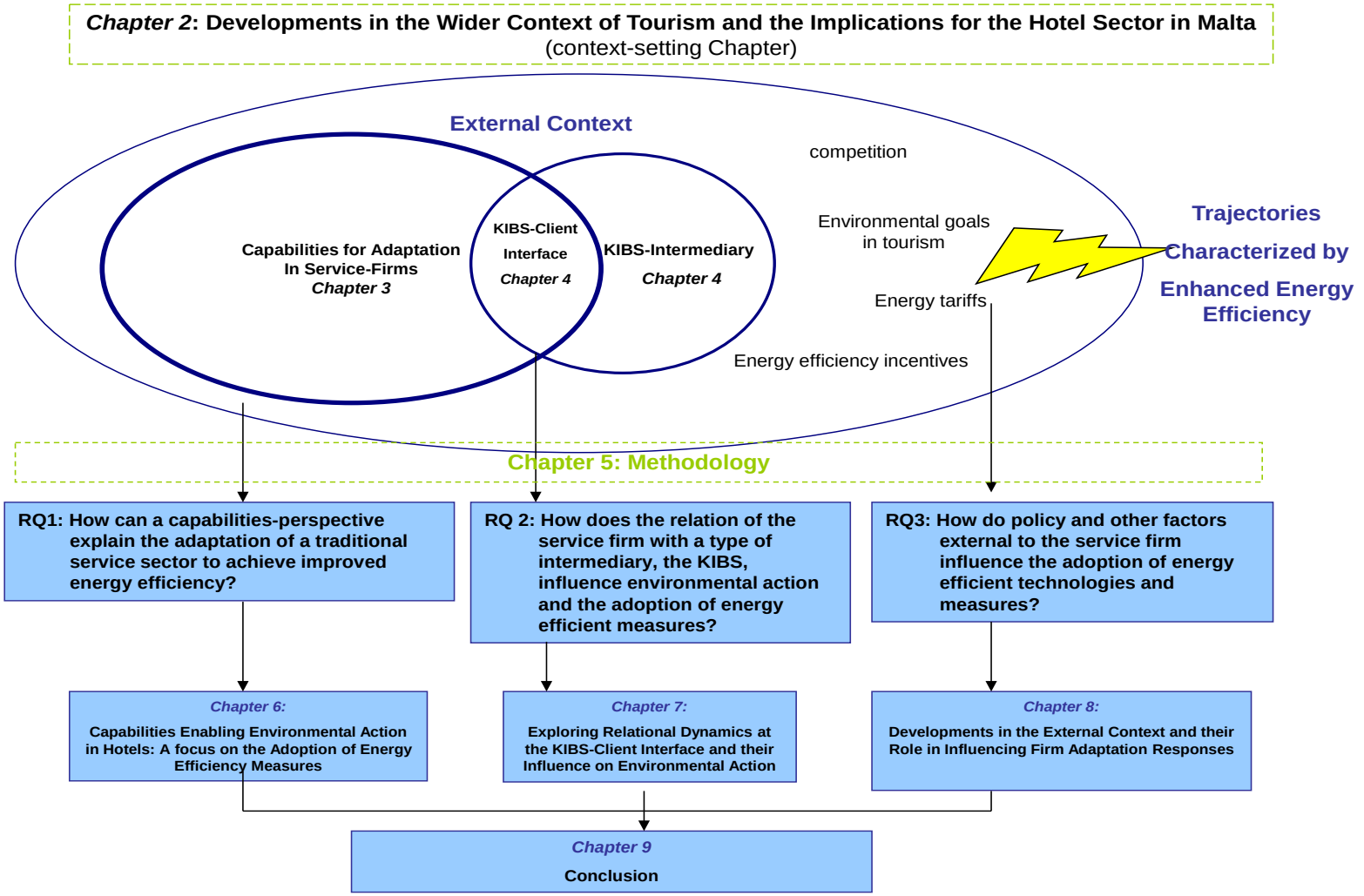
The environmental benefit of energy efficiency is often debated: reducing energy consumption may have a rebound effect (Herring, 2006); however there are economic gains for hotels that benefit from reduced operational costs when implementing energy efficient measures (JRC, 2012). Also, energy efficiency is recognized as playing a key role in future scenarios of reduced energy consumption and abatement of carbon dioxide emissions (IPCC, 2007; UNEP, 2011).

1.5 - Research Aims and Objectives

The processes through which a traditional service sector implements environmental action are investigated through a study on the adoption of energy efficient measures and practices in the

hotel sector in Malta. The analysis is carried out at a number of levels: 1) internal service firm capabilities to adopt energy efficient practices are investigated; 2) the dynamics at the KIBS-client interface and how these influence intermediation activity are explored and 3) the role of the external context and how this influences firm responses and environmental action is examined. A model is built that integrates these three aspects - see Figure 1.1.

Figure 1.1 – Outline of the Thesis Summarizing the Main Themes



The research objectives are summarized as follows:

1. To deepen an understanding about adaptation and innovation in traditional services. In order to achieve this, the study uses insights from the strategic management literature on dynamic capabilities to investigate the distribution of capabilities amongst firms and how these may account for the heterogeneous responses across firms in the same sector. The study builds a framework for capabilities in services and by applying this to explicate how firms engage in environmental innovations, it demonstrates the variety of adaptation responses present in a traditional sector.

2. To understand how service firms obtain knowledge about environmental innovations, in particular knowledge about energy efficient practices and measures. In order to achieve this, the research explores the relation of services with a type of KIBS, the engineering consulting firm. The research provides a demonstration of the relational dynamics that are influencing the adoption of energy efficient technologies and measures. Specifically the research analyzes the client's capabilities and dissects aspects of the relation with KIBS to explicate how these together influence intermediation activity.

3. To explore the role of the external context in firm adaptation responses, the study broadens the analysis to include how firms interpret and respond to external pressures and developments and the effect that these might be having on a firm's environmental response behaviour.

1.6 - Research Contributions

The key contributions of this research are:

Firstly, the research contributes to enriching the literature on innovation in services by highlighting how firms within the same sector may innovate differently and therefore exhibit different patterns of innovation. This makes a contribution to better understanding innovation patterns in traditional services.

Furthermore this thesis characterizes the heterogeneous responses of firms by tracing these to different combinations of capabilities residing within the firm, making a contribution to explicating what dynamic capabilities in services are and how they are deployed for firm adaptation and environmental action.

The analysis of the KIBS-client relation is intended to contribute a deeper understanding of the dynamics that influence intermediation activity and the innovation process. It demonstrates the link between service firm capabilities and intermediation, enriching the literature on the subject. Based on the above, it provides deeper insights on the concept of absorptive capacity in traditional services.

1.7 - Methodological Approach

A qualitative case study approach was deemed to be most suitable to answer the research questions in this study for multiple reasons. Firstly, a case study approach allows for depth over breadth of analysis which a quantitative survey does not convey (Creswell, 2007). In this study the processes leading to adoption of energy efficiency practices within the firm are put under the microscope.

Secondly, a broad spectrum of hotels was considered in order to account for the heterogeneity of firm-types within the sector and corresponding adaptation behaviour; this can give more confidence in generalizing the results to the sector as a whole (Yin, 2003). The cases were selected following a purposive sampling approach which means that hotels actively adopting energy efficiency measures or that had adopted an environment label were selected intentionally so as to provide insight on the capacity for adoption (Berg and Lune, 2012).

Thirdly, the qualitative approach helped characterize interactions, in terms of exchanges and flows, occurring between hotels and knowledge intensive business services (KIBS). Hotels were paired with KIBS with which they maintained a business relation.

In-depth semi-structured interviews were conducted between October 2009 and September 2010 in Malta. A total of fifty-six semi-structured interviews were conducted with twenty-six top and maintenance managers in nineteen hotel cases, senior partners within fourteen engineering consulting firms and sixteen entities representing tourism, education, and other public bodies in the institutional environment. Additional data were collected through website analyses and the researcher's participation in relevant seminars organized locally.

1.8 - Thesis Outline

The thesis proceeds as follows. Chapter 2 sets the scene by providing the context of the study which is that of tourism in Malta and the challenges facing the Maltese hotel sector. It describes the articulation between new developments in tourism related to environmental awareness and the role of policy in framing the hotel sector's responsiveness in terms of moving along paths characterized by enhanced energy efficiency.

Chapters 3 and 4 present the literature review. The decision to include two separate chapters stems from the different levels of analysis considered. In Chapter 3, the firm is taken as the focal point to explore firm-level adaptation from the theoretical perspectives of innovation and dynamic capabilities. At the end it proposes an analytical framework through which to study adaptation responses in traditional service firms through the lens of dynamic capabilities. Chapter 4 then focuses on KIBS as a type of intermediary and reviews aspects of the KIBS-client relation that potentially influence intermediation activity.

The methodology is presented in Chapter 5. This includes a justification for the case selection as well as detail on how the analytical framework is used to design the research strategy and analyze the findings in terms of 1) content analysis; 2) the cluster analysis used to build hotel adaptation modes; and 3) the analysis of pairs of hotels and KIBS used to characterize the exchanges occurring at the KIBS-client interface.

Chapters 6-8 discuss the empirical results. Chapter 6 makes a contribution to understanding the capabilities deployed by traditional services to implement environmental action and adopt energy efficiency measures, answering the first research question. The chapter builds different adaptation modes based on the hotels possessing different combinations of capabilities that account for their adaptation responses and innovation patterns. The second research question on how service firms make use of external knowledge resources in order to innovate is addressed in Chapter 7. Here the KIBS-client relation is dissected in order to determine those aspects of the relation that are influencing intermediation activity, which in this study relates to the potential for exchange of knowledge and learning about environmental innovations. It enriches a discourse on absorptive capacity in services and its impact on intermediation activity. Chapter 8 provides an inside-out view of how the hotel, with its internal capabilities, responds to developments in the wider context answering the third research question.

Chapter 9 summarizes the research findings and draws out the contributions to knowledge. It proposes some implications for policy and practice and then discusses the limitations of the research and ideas for future research.

Chapter-2: DEVELOPMENTS IN THE WIDER CONTEXT OF TOURISM AND THE IMPLICATIONS FOR THE HOTEL SECTOR IN MALTA

2.1 - Introduction

As a backdrop to the study, this chapter describes the external context in which tourism firms operate and how this may be influencing the adoption of environmental innovations, with particular reference to the adoption of energy efficiency measures in hotels. The purpose is to understand how factors external to the firm may be shaping and directing their adaptation responses and the adoption of environmental innovations.

The context is one where tourism activities are growing rapidly and becoming increasingly dependent on natural resources to sustain growth trends. Tourism firms are faced with the challenge of maintaining competitiveness by reducing operational costs and keeping the service standard (HES, 2011a). At the same time, there are signals of the increasing importance of 'greening' in the sector and environmental awareness coming from policy and from certain actors in tourism. The combination of these factors may be spurring accommodation establishments to challenge current practices and move towards greener practices including the adoption of energy efficiency and renewable energy options (HES, 2011a).

Section 2.2 outlines the contribution of global tourism to energy consumption and initiatives towards environmental action, with a focus on hotels. The policies that may be shaping the adoption of energy efficiency are then discussed in Section 2.3. In Section 2.4, the chapter shifts its focus onto Malta, a tourism destination in the Mediterranean and how the Maltese hotel sector is responding to emerging challenges relating to environmental awareness. Section 2.5 provides a summary.

2.2 - Global Tourism Responding to Emerging Environmental Issues

The World Travel & Tourism Council estimates that in 2008, travel and tourism accounted for 10.9% of global gross domestic product, 12.2% of world exports, and 9.4% of world investment, from direct and indirect activities[2]. The geographic importance of tourism destinations sees Europe in first place, attracting just over half of all international tourist arrivals worldwide

[2] World Economic Forum (2011) 'The Travel and Tourism Competitiveness Report 2011: Beyond the Downturn'.

(UNWTO, 2012). Moreover, trends in tourist flows indicate that the Mediterranean region is also attracting a larger flow of tourists that increased by 91% between 1990 and 2010 (ibid).

These trends for growth imply a greater dependence on and consumption of natural resources (JRC, 2012). A business as usual scenario estimates that by 2050, tourism growth may translate into increases in energy consumption by up to 111%, greenhouse gas emissions by 105%, water consumption by 150% and solid waste disposal by 252% compared to current levels (UNEP, 2011). Apart from the direct impacts on global greenhouse gas emissions and climate change; tourism growth and competitiveness is contingent on the availability of natural resources (UNEP, 2011).

Against this backdrop, tourism is challenged to make a contribution to mitigate the impact of its activities on the environment (ibid). When it comes to small islands, energy consumption has been identified as a priority environmental problem, alongside other threats such as climate change and sea level rise, threats to freshwater resources and degradation of coastal habitats (Ghina 2003). Tourism is intrinsically linked to the economy of many small island states; it relies on marketing and exploiting many different aspects of the natural environment of small islands such as marine and rural recreational activities. At the same time, it can also have potentially high impacts on the environment (Blanke and Chiesa, 2011) as it relies heavily on energy and power demand and can also put other resources, such as water and space, under strain.

There is evidence that international policy spheres are responding to the challenge of implementing environmental action by introducing environmental objectives and goals in tourism policy. The UN World Tourism Organization identifies energy efficiency as one response to climate change and to mitigating carbon dioxide emissions in the Davos Declaration (UNWTO, 2009). Improving efficiency in energy, water and waste systems are considered key aspects of a transition towards the greening of tourism (UNEP, 2011).

International developments are pushing for the introduction of environmental measures and standards in the tourism industry, including in accommodation establishments (JRC, 2012). Initiatives promoting the introduction of environmental aspects in tourism are mainly based on voluntary programmes supported by non-governmental organizations (NGOs) in partnership with tourism operators. These range from the implementation of environmental management systems, to the introduction of environmental standards and carbon reduction programmes. It is beyond scope to mention all existing initiatives. Some examples targeting accommodation establishments include: the development of a 'Common Carbon Measurement Mechanism' for hotels supported by the International Tourism Partnership (2012)[3]; the 'Hotel Energy Solutions'[4]

[3] The International Tourism Partnership brings together international hotel companies on issues related to environmental and social responsibility in the hotel sector. Information on the Carbon Measurement Initiative launched on the 12th June 2012 was accessed on 3rd April 2013 at: http://www.tourismpartnership.org/what-we-do/key-issues/carbon.

[4] The e-toolkit is an initiative of the United Nations World Tourism Council, co-funded by the European Commission that supports European hotels in assessing their energy needs and planning for investments in energy efficiency and renewable energy technologies, UNWTC 2011.

e-toolkit targeted at improving the energy efficiency of small and medium-sized hotels in Europe; the development of sustainability guidelines for 'green' hotels and the 'Travelife Sustainability System'[5] which is an international certification scheme for accommodation establishments based on sustainability criteria. There is also the EU's 'Ecolabel' that promotes environmental sustainability amongst businesses.

Apart from initiatives driven by the tourism industry, there are also policies targeted at the adoption of environmental practices and energy efficiency by industry and businesses that may influence the behaviour of tourism firms, and amongst these accommodation establishments. The following section discusses policy initiatives at European level.

2.3 - European Policies Promoting the Adoption of Energy Efficiency

Energy prices are acting as a major driver of energy efficiency adoption in industry in Europe (ITRE, 2010). Adjusting energy prices to reflect the real market price of fuel can serve as a signal to consumers and incentivize investments in energy efficiency measures, especially in energy-intensive sectors including hotels (Schleich and Gruber, 2008; WEC, 2008). However, in many countries, energy is supplied at subsidized rates to mitigate the impact of extreme fluctuations of fuel prices on consumers and households and local industry (WEC, 2008). Therefore, pricing policies alone have proven to be insufficient and need to be complemented by policy measures to develop a market for energy efficient equipment and practices and remove the barriers to adoption (WEC, 2008).

At European level, the majority of these policies are financial instruments that include economic incentives, such as grants and subsidies for the purchase of energy efficient technologies and renewables, and fiscal or tax measures (WEC, 2008).

Subsidies are probably the oldest type of instrument, implemented since the 1970s; they are viewed as a temporary measure to open the market for energy efficiency or to prepare consumers for introduction of regulation and to start changing consumption behaviour (WEC, 2008). An evaluation of energy efficiency policies in European countries conducted by the ODYSSEE-MURE (2012) project[6] shows that financial instruments appear to be having a low impact, in terms of energy savings accrued from the adoption of energy efficiency in industry. In the first instance, firms may prioritize investments elsewhere. If interested in investing in energy efficiency, firms will weigh out the financial support received against the reduction in the total project cost and the lowering of the pay-back periods.

---

[5] Travelife accessed 3rd April 2013 at: http://www.travelife.org/.

[6] The 'Odyssee Project was funded under the Intelligent Energy Europe Programme (2010-2012). It involved participation of the energy agencies across 27 Member States, Norway and Croatia to monitor energy efficiency trends and measures in the respective countries. It has built a data base on energy efficiency data and indicators (Odyssee Database) and policy measures (MURE data base). Accessed 20th March 2013 at: http://www.odyssee-indicators.org/.

Secondly, despite the cost-saving potential, the adoption of energy efficiency measures is relatively slow and a number of barriers to adoption have been identified. Financial measures often do not reach the intended consumer such as small and medium-sized enterprises because of insufficient information dissemination; such that the beneficiaries are often consumers that would invest anyway (WEC, 2008). The bureaucracy associated with grant applications often leads to long delays in obtaining the grant (WEC, 2008). These drawbacks meant that grants and subsidies had to be better targeted to certain types of investments such as those from an approved list of equipment or investments towards technologies with high efficiency gains such as co-generation and to innovative technologies (WEC, 2008).

Firms often need to procure knowledge about energy efficient technologies and practices from external experts; this leads to high transaction costs even when implementing small scale projects in industry (Fleiter *et al*., 2012). The transaction costs may also be related to the availability of staff and the time needed to analyze the potential to improve energy efficiency or the time associated with processing grant application forms (Schleich and Gruber, 2008; WEC, 2008). Another significant barrier is the difficulty to measure and verify the savings incurred from installing energy efficient systems (Fleiter *et al*., 2012).

The IEA evaluation[7] of energy efficiency programmes amongst IEA countries determined that policies are likely to have a higher impact on adoption of energy efficiency when developed as a package of complementary measures rather than through single instruments (OECD/IEA, 2012). These may include a mix of direct subsidies; financial methods that provide low interest loans; and labels and certification that ensure the quality of the product as well as the quality of the installation and its maintenance (WEC, 2008). Regulation is a relatively under-utilized instrument to stimulate adoption of energy efficiency (ODYSSEE-MURE, 2012). The European Energy Performance of Buildings Directive[8] requires that mandatory energy performance standards be established for new and existing buildings. There is also the European Directive[9] on labeling of energy-related products including electrical appliances and lighting products.

New types of measures have grown in importance in the 'policy package' implemented in various European countries in recent years (ODYSSEE-MURE, 2012). These range from energy audit schemes, through measures aimed at increasing awareness about energy efficiency to training of energy managers. Their intended aim is to strengthen firm capabilities to implement energy management practices by providing assistance for the implementation of energy management tools, training of installation contractors, certification of energy managers and quality assurance (OECD/IEA, 2012).

---

[7] The International Energy Agency (IEA) conducted two evaluation rounds of member-country implementation of the IEA energy efficiency policy recommendations in 2009 and 2011.

[8] The recast EPBD was adopted in 2010 by the European Union. It is the main legislative tool to reduce energy consumption of buildings and contribute to the EU's objective of reducing by 20% the EU's energy consumption by 2020, European Union Directive 2010/31/EU.

[9] European Union Directive 2010/30/EU on the 'Indication by Labelling and Standard Product Information of the Consumption of Energy and other Resources by Energy-Related Products', (recast) May 2010.

These policy developments address a major barrier to energy efficiency which is that of supplying information about available technologies and solutions that can significantly reduce energy consumption (WEC, 2008). One example quoted here is a study of renewable energy technologies (RET) penetration in the hotel sector of the Southern Mediterranean region. The lack of technical information e.g. on viable technology options for the hotel sector and experienced know-how (engineers, certified installers) to implement and follow-up energy projects proved to be a significant barrier hampering diffusion (Karagiorgas *et al*., 2006).

In some countries including Malta, Spain, Finland and Germany, policies target specifically small and medium-sized enterprises (SMEs). One important aspect is the fact that SMEs, that also include many hotels, do not usually have skilled personnel to adopt energy efficient measures and external consultants are often considered too costly compared to the expected energy cost savings (Schleich and Gruber, 2008).

The remainder of the chapter looks at tourism in Malta and how Maltese hotels are responding to multiple signals about competitiveness, coping with energy pricing policies and the importance of environmental responsiveness in tourism.

2.4 - Tourism in Malta: An Industry of Growing Energy Demand

Tourism is a critical component of Malta's economy; it represents the third largest industry in Malta, after manufacturing and construction; and contributes 24% of Gross National Product, 25% of goods and services and 27% of total employment (Dodds and Kelman, 2008).

Tourism is energy intensive, particularly for small islands such as Malta with an isolated energy system that has to cater for the added pressure on power demand arising from increasing tourist arrivals. 8% of energy consumption goes to tourism-related activities, with an estimated tourist demand on resources (energy and water) that is 1.5 times higher than that of a Maltese resident (PPCD 2007). Moreover the production of freshwater from desalination by reverse osmosis is an energy-intensive process accounting for 5% of total electricity produced[10]; the desalination process produces almost 60% of the potable water demand (PPCD, 2007). The demands for energy and water resources are expected to increase also as a result of growing tourist arrivals[11].

Malta is totally dependent upon imported fossil fuels, mainly heavy fuel oil, for its energy supply. The cost of electricity production is highly sensitive to fluctuations in international market prices of oil and gas that dictate the utility tariffs and the cost of fuel locally. Over the past decade, energy consumption rose steadily by an average of 3.3% per year, mainly due to higher standards of living and tourism-related activities. Electricity demand increased more rapidly at

[10] National Climate Change Adaptation Strategy Consultation Report 2010.
[11] Ministry for Tourism, Culture & Environment 'Tourism Policy for the Maltese Islands 2012-2016'.

5.3% per year since 1990 (Eurostat, 2009). In 2010, the commercial segment absorbed 29% of electrical consumption followed by the domestic sector (27%) and industry (22%) – NSO (2012).

Peak electricity demand has shifted from the winter months in the early 1990s to the summer months in 2000 mainly due to fuel air-conditioning units; this is typical in a Mediterranean-type climate and tourism is a contributor to these trends. With this, greenhouse gas emissions per person rose from 5.5 tonnes in 1990 to 7.3 tonnes in 2007, as a result of an increased demand for energy, more waste generated and increased road transport.

Malta has so far had limited success in diversifying its energy sources: currently the share of renewable energy sources stands at 0.4% of gross final energy consumption[12]. One reason for this is the limited economic incentive for both private investors and households to invest in alternative energy installations because of low feed-in tariff rates (Yousif, 2012). The implementation of renewable energy technologies is also challenged by the context of a small country. For example, micro-generation from solar power (thermal and photovoltaics) is a more likely option when compared to large-scale PV set-ups because of land-availability constraints. With regard to wind energy, micro-wind generation is not expected to take-off due to planning constraints and visual impacts[13].

Electricity tariffs that up to 2003 were offered at subsidized rates to commercial entities were revised to reflect international market oil prices. The final government subsidies on water and electricity tariffs were completely removed in October 2008, so that current tariffs now reflect the true commercial cost of energy production (METTES 2008). In 2011, industrial consumers in Malta paid the highest electricity prices per kilowatt/hour which at €0.18€/kWhr was double that of the EU-27 average of 0.09€/kWhr[14]. Since the overhaul in utility tariffs, the hotel sector in Malta is estimated to have experienced an average increase of 12% in its utility bills in the first year and a further 7% in each of the following two years[15]. As a result, energy prices became a heightened concern for the hotel sector[16].

The next section traces the developments in Malta's accommodation sector and subsequently maps the policies supporting environmental action in tourism.

2.4.1 - A Profile of Malta's Accommodation Sector

Approximately 60% of tourist accommodation in Malta is in serviced accommodation, namely hotels; whilst self-catering complexes (apartments, farmhouses) and apart-hotels account for the rest (Lockhart, 1997). According to the Malta Tourism Authority, hotels accounted for 108

[12] Eurostat Energy Statistic Code tsdcc110 accessed 13th April 2013 at: http://epp.eurostat.ec.europa.eu/.
[13] Ministry for Rural Affairs & Environment 'A Proposal for an Energy Policy for Malta 2009'.
[14] Eurostat Energy Statistic Code ten00114 accessed 12th September 2012 at: http://epp.eurostat.ec.europa.eu/.
[15] Gozonews.com 'New Energy Tariffs to cost hotels €5m' published 28th November 2008 and accessed 3rd April 2013 at: http://gozonews.com/item/new-energy-tariffs-to-cost-hotels-e5-million.
[16] Malta Hotels & Restaurants Association, personal communication.

licensed operations in 2010 (excluding guesthouses, apart-hotels and hostels). These establishments attract primarily a summer tourism market with 75% of arrivals being concentrated between April and October (Dodds, 2007). Tourist arrivals increased from 12,583 in 1959 to 1.4m in 2011 equivalent to more than three times the total population of Malta[17] (Dodds 2007; Ministry for Tourism, Culture & Environment, 2012).

This type of 'summer' market is highly competitive in the Mediterranean region that sees other destinations offering a similar 'sea and sun' branding; as a result the tourism industry already started to experience a decline in the early '90s, (Dodds 2007). The economy and mid-scale hotel market has been particularly hard-hit by this competition and "most of the establishments moved out of the tourism sector and developed the properties into homes for the elderly or apartment blocks" (Ellul, 2008 p.6).

In order to raise the quality of tourism services, the national Tourism Authority pushed for the hotel sector to obtain internationally accredited standards. In 2000, the authority launched a subsidy scheme to promote the adoption amongst hotels of the 'Hospitality Assured' label[18], which is a recognized standard in the service industry mainly focusing on human resource development and customer satisfaction[19]. In the same period, the financial incentive scheme launched in the 1980s to assist local businessmen when investing in the construction of new hotels was removed, and restrictions on building permits to protect coastal environments were put in place as part of the 1992 Structure Plan of the national Environment & Planning Authority.

One of the government's policies to attract higher spending tourists was to allow only for the development of 4- or 5-star hotels and associated luxury facilities such as marinas. As a result the number of 4- and 5-star hotels increased dramatically from five in the late '80s to fifteen in 2007; local businessmen brought the multinational hotel brands to Malta that served to boost the upscale tourist market in niche areas such as sports and cultural activities.

The performance of the tourism industry is susceptible to developments in the international scenario. The recent surges in oil prices and the economic crisis[20] necessitated the government's support for upgrading hospitality businesses. In 2010, a scheme was launched offering subsidized interest rates on loans for refurbishment of hospitality establishments because of the lack of own funds to upgrade these properties[21].

---

[17] Tourism Policy for the Maltese Islands 2012-2016.

[18] The Business Times of Malta 'First Maltese Hotel Accredited with the Hospitality Assured Label', published 6th December 2000 and accessed 10th September 2010 at: http://www.businesstoday.com.mt/0612/local7a.html.

[19] Information on the Hospitality Assured label accessed on 10th September 2012 at: http://www.instituteofhospitality.org/hospitality-assured/about_ha/ha.

[20] Department of Information "Speech by the Parliamentary Secretary for Tourism, the Environment & Culture at the Malta Tourism Authority Trade Seminar 'Measuring our Tourism Performance'", Valletta 16th April 2010.

[21] Malta Enterprise (2010) Interest Rate Subsidy Scheme for Accommodation Establishments & Restaurants.

2.4.2 – Environmental Objectives in National Tourism Policy

National tourism policy focuses on augmenting tourist arrivals, taken as a primary indicator of performance of the tourism industry in Malta. However, since 2000 the national policy has given more prominence to environmental and social goals. Amongst the environmental goals are those of minimizing resource consumption and moving towards a low carbon resource efficient economy[22]. Sustainable tourism is considered to play a significant role in mitigating the effects of climate change through improved energy efficiency and the reduction in water intensity use[23].

The concept of 'sustainability' was used as the basis of a study in 2000 to develop a carrying capacity scenario for tourism that assessed the 'optimal' level of future tourism development that would not exert undue pressure on utilities and natural resources (Ministry of Tourism, 2000). This study led to the drafting of the first Strategic Plan for Tourism (2000-2002) that includes explicit measures and objectives relating to the environment and links the development and growth of tourism to sustainable management and exploitation of the country's resources and social fabric. As an example, an annual tax on freshwater consumption of swimming pools was enforced on hotels to address the scarcity of this resource.

The Strategic Plan's main thrust was to diversify tourism from the mass tourism that the island had attracted since the '60s, to developing niche markets in order to reduce the impact of tourist arrivals in the summer months that had reached carrying capacity.

The national Tourism Policy (2007-2011) puts some emphasis on energy efficiency and links this with the reduction of fuel consumption as a means of securing 'a cleaner and better environment' (p.19). This approach perhaps reflects a stronger emphasis on economic goals rather than on environmental sustainability. Dodds (2007) cautions that issues around "sustainability" in tourism often come in as a handy solution to solve the problem of declining tourist numbers and sustainability policies are drawn in to re-establish the attractiveness of a destination; therefore they may be geared at risk aversion and competitive management other than sustainability *per se*.

The multinational (MN) hotel brands are very actively introducing environmental measures and standards and are expected to play an important role in shaping the diffusion of environmental practices in the hotel sector in Malta. This is because MN hotels carry environmental good practice internationally and are likely to transmit this to their subsidiaries globally; though the corporate group's environmental programmes are adopted on a voluntary basis by the subsidiaries. There are subsidiaries of seven multinational hotel brands based in Malta and most (> five) are engaged in the adoption of eco-labels and environmental management

[22] Tourism Policy for the Maltese Islands 2012-2016.
[23] National Climate Change Adaptation Strategy Consultation Report 2010.

programmes[24]. This study includes, but is not restricted to, a discussion on MN hotels and their environmental strategies.

2.4.3 – Policies and Measures Promoting the Adoption of Environmental Innovations

National policies are supporting the diffusion of environmental technologies and promoting innovativeness in hotels alongside more 'traditional' aid for infrastructural development and upgrading provided in the '80s. These developments are also expected to contribute towards fulfilling Malta's EU obligations of improving energy efficiency by 20% and increasing by 10% the share of final energy consumption coming from alternative energy sources by 2020 [25].

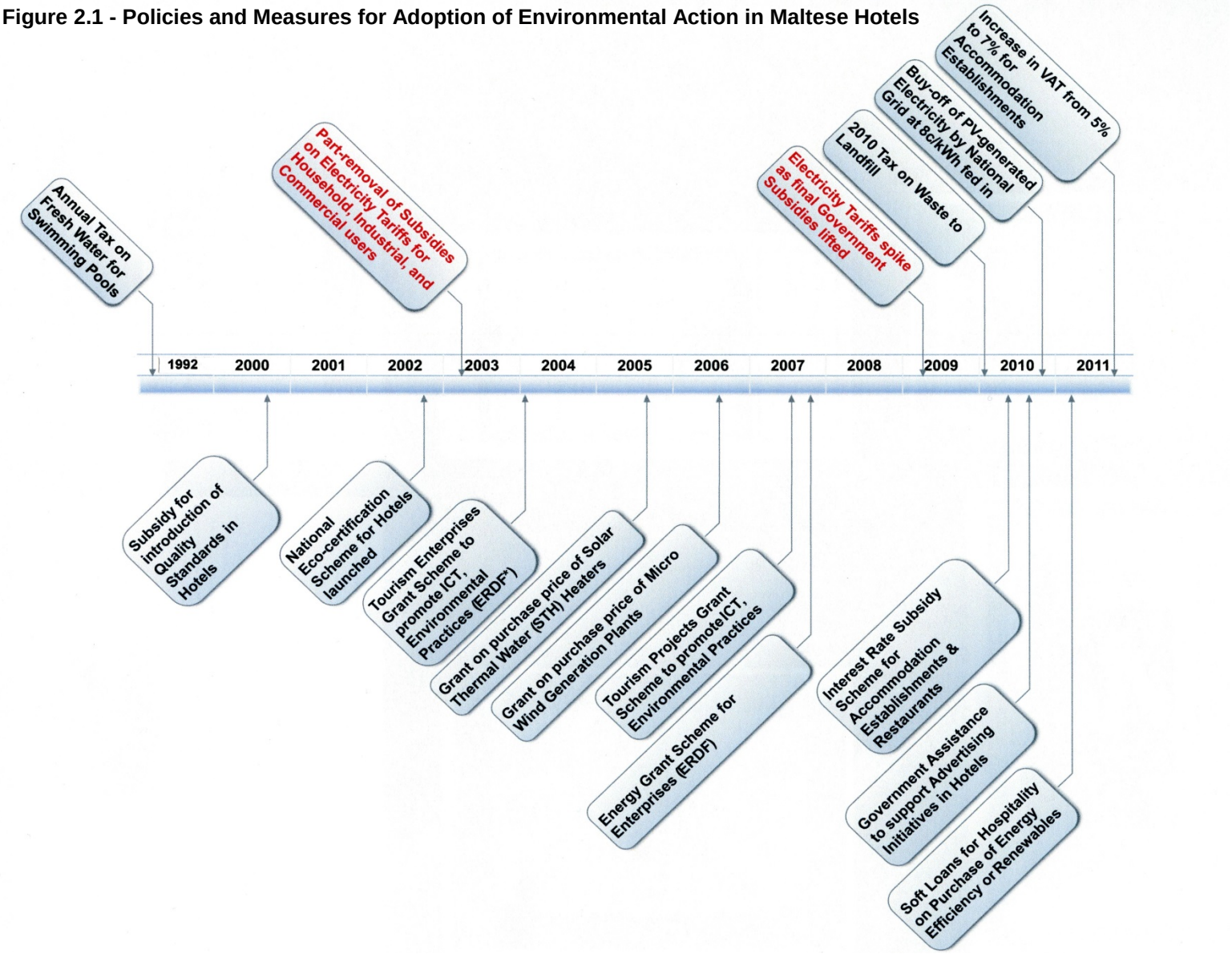
A new policy measure was launched by the Tourism Sustainable Development Unit within government in 2004 to sustain the competitiveness of tourism enterprises. The measure provided a grant for the uptake of information communication technologies, the adoption of environmental practices and more generally for innovative projects. In addition, the support scheme widened its focus to include training for human resources and developing leaders in tourism. This type of incentive was a new development compared to the financial assistance traditionally provided for upgrading facilities and meeting up to quality standards in hospitality.

In 2002, the Malta Tourism Authority (MTA) developed the national eco-certification scheme for hotels that assesses these on a number of criteria aimed at improving their environmental performance and increasing environmental awareness amongst employees. The eco-certification scheme was also conceived as an instrument through which energy and water consumption could be reduced[26].The criteria include assessing initiatives related to environmental management, waste management, aspects of energy efficiency and water conservation, community engagement and information dissemination. In 2012, there were twenty-five hotels that had achieved the eco-certification or 23% of accommodation establishments[27]. As of April 2010, hotels in Malta are also being charged €20 per tonne of waste that is sent to landfill[28]. As a result, processes for minimizing waste have been introduced in a number of hotels, including waste separation by the staff. Figure 2.1 provides a timeline showing the evolution of policies, in the way of taxes and incentives, launched between 1995 and 2011.

[24] The empirical findings and the findings from the desk-based research about the environmental profile of these hotels provides evidence of this.
[25] A Proposal for an Energy Policy for Malta 2009.
[26] Tourism Sustainable Development Unit, personal communication.
[27] Malta Tourism Authority List of Eco-Certified Hotel accessed 12th September 2012 at: http://www.mta.com.mt/eco-hotels.

[28] Malta Chamber of Commerce, Enterprise & Industry (2010).

Figure 2.1 - Policies and Measures for Adoption of Environmental Action in Maltese Hotels



*ERDF is the European Regional Development Fund, part of the Structural Funds Programming Period that supports investments to strengthen Malta's social and infrastructures.

In order to dampen the effect of the spikes in energy tariffs, hotel establishments could benefit from subsidies to invest in energy efficient solutions as well as in renewable energy installations under the 'Energy Grant Scheme for Enterprise' launched in 2006. In 2012, out of 114 beneficiaries, fourteen were hotels[29]. In 2011, another scheme was launched that specifically targeted the adoption of energy efficiency and renewable energy technologies in the hospitality sector[30]. Through this scheme, the government is offering hotels and restaurants 'soft' loans i.e. loans with subsidized interest rates of up to 1.5% on technologies such as thermal insulation, double-glazing, energy efficient lighting, and photovoltaic systems. The loans cover up to 80% of the total cost (capped at €400,000).

The national business support agency (Malta Enterprise) makes available the services of engineering consulting firms or energy assessors through a 'Business Advisory' service scheme to support hotels and other hospitality establishments in undertaking energy audits that provides more detailed information about the hotel's consumption and identifies opportunities for energy conservation. The energy assessors appointed by Malta Enterprise included engineering services firms that already maintain well-established relations with the hotels investigated in this study[31].

The review has shown that policy support has evolved from that targeted at upgrading facilities in hotels and other accommodation establishments towards enhancing innovativeness and the adoption of environmental technologies. There is also evidence that the policy package aimed at stimulating the adoption of environmental innovations is becoming more diverse to include, apart from direct subsidies, measures that provide specialist advisory services, soft loans and financial incentives such as a feed-in tariff.

2.5 - Concluding Remarks

The purpose of this context-setting chapter was to create a backdrop against which to understand the challenges facing Maltese hotels and how these are adapting along paths characterized by higher energy efficiency and the adoption of environmental innovations. These challenges can be summarized as:

- the requirement of the Maltese tourism industry to restructure i.e. to upgrade tourism services to remain competitive as a destination in the Mediterranean;

[29] Malta Enterprise Energy Grant Scheme List of Beneficiaries 2009-2012 accessed 12th September 2012 at:
http://www.maltaenterprise.com/en/support/erdf-energy-grant-scheme.
[30] Malta Enterprise 'Energy Efficiency Measure for the Hospitality Sector' Incentive Guidelines published May 2011.
[31] Malta Enterprise, personal communication.

- the rising costs of utilities that are affecting the ability of accommodation establishments to keep prices competitive; and

- global trends in tourism that are impelling hotels to introduce environmental goals and standards.

The following two chapters review the literature. Chapter 3 focuses on processes of adaptation in firms and the role of dynamic capabilities in service firm innovation. Chapter 4 then looks at intermediaries, with a focus on knowledge intensive business services (KIBS), and how the relation of KIBS with the client may be influencing the innovation process.

Chapter-3: DYNAMIC CAPABILITIES FOR ADAPTATION AND INNOVATION IN SERVICES

3.1 - Introduction

Chapter 2 mapped the challenges that tourism firms face vis-à-vis energy pricing policies and more generally policies that are addressing environmental objectives in tourism. This provides a backdrop to the study that focuses on how hotels, an example of traditional service firms, are adapting to these challenges and the processes through which they implement environmental action, with a particular focus on energy efficiency.

As outlined in Chapter 1, the research discusses adaptation at the firm level and analyzes the differential behaviour of firms within the same sector. In reviewing the relevant literature, this chapter brings together insights from strategic management and dynamic capabilities and integrates these into aspects of innovation in services. Chapter 4, which is the second literature review chapter, focuses on relations with intermediaries.

The chapter starts with a justification of the literature chosen and the conceptual focus used in this study (Section 3.2). It then discusses firm adaptation in Section 3.3. The research is anchored in three literature streams that are reviewed in Sections 3.4-3.6. These pertain to the innovation process in services with a focus on traditional service sectors (Section 3.4), the concept of the firm as a multitasking entity (Section 3.5) and dynamic capabilities (Section 3.6). Section 3.6 also develops a framework for service firm capabilities to adopt environmental innovations. The concluding Section 3.7 outlines an analytical framework integrating aspects of the innovation process in services and dynamic capabilities that is used in this research to study service firm adaptation responses.

3.2 - Positioning the Research and the Rationale for the Choice of the Literature

The environmental behaviour of firms has been investigated from different analytical angles. One approach looks at the 'instruments' that mediate adoption of environmental technologies and measures. The innovation literature has focussed on diffusion patterns and barriers to adoption of clean technologies; for example, Kemp and Volpi (2008) review clean technology diffusion and Rennings (2000) discusses eco-innovation adoption. Studies rooted in the organizational management literature discuss the role of decision-making on the adoption of environmental innovations; e.g. Sandberg and Soderstrøm (2003) look at the role of senior managers in the adoption of energy efficiency. Other studies discuss the link between the

implementation of environmental strategies and firm performance; for a recent study see Kesidou and Demirel (2012) on the implementation of environmental management systems in UK manufacturing.

Another approach, which is that adopted in this study, is that of looking inside the firm and examining the processes leading to adoption of environmental innovations. This approach therefore focuses on how environmental technologies and practices are realized in the firm and become integrated into the firm's operations (Arnell and Delaney, 2006; Berkhout *et al*., 2006).

In order to address this aspect, this study uses as its anchor literature that on dynamic capabilities and innovation in services.

3.2.1 – The Firm as an Adaptable Entity

The strategic management literature discusses adaptation in firms as a process of internal change that may also be influenced by factors in the external environment (Miles *et al*., 1978; Hrebiniak and Joyce, 1985). Adaptation can be understood as a process of renewal and making adjustments in the way firms carry out and organize on-going activities or implement new ones (Berkhout *et al*., 2006). This research is interested in looking at how traditional service firms adapt to the challenge of energy pricing policies and to the goal of achieving higher energy efficiency discussed in Chapter 2. One way of doing so is to analyze the processes leading to the adoption of novel energy efficient technologies and measures.

Traditional services have been described as routine-oriented or not inclined towards innovation (Sundbo, 2011); however this is considered a rather over-simplified notion. Although traditional services are unlikely to be the source of new technology innovations and are rather 'technology-users' (Pavitt, 1984), they may be innovating in other ways, such as in back-office or the processing supporting service delivery, as discussed later in the chapter. Therefore it is relevant to characterize the patterns of innovation in traditional service firms in relation to enhancing energy efficiency in the firm.

3.2.2 - A Dynamic Capabilities View of Firm Adaptation and Transformation

Adaptation mechanisms in firms have been linked to the presence of dynamic capabilities: these equip firms with a competitive advantage in order to adapt to rapidly changing technological environments (Teece, 2007). The motives for orienting the study towards a capabilities perspective on adaptation are based on the following:

The dynamic capabilities approach (DCA) is widely used in the strategic management literature. It has focussed primarily on high technology sectors or on those sectors that base their competitive advantage on research and development and commercialising technological innovations. Notwithstanding, it has a prior record of being applied to services innovation (den

Hertog *et al*., 2010) and is receiving increased conceptual and empirical attention (for example see Kindström *et al*., 2012). Although the literature has contributed to a conceptual analysis of dynamic capabilities, this remains under-developed in services (den Hertog *et al*., 2010).

Moreover, the DCA has been applied to study firm adaptation in relation to environmental action and performance. There are a number of empirical studies linking dynamic capabilities with the adoption by firms of environmental practices (e.g. Post and Altman, 1994; Sharma and Vredenburg, 1998; Florida and Atlas, 2001). Firms with an environmentally proactive attitude have been shown to develop capabilities that help them make the most efficient use of their assets to address environmental challenges (Sharma and Vredenburg, 1998). Post and Altman (1994) build a corporate greening model that establishes a link between firms with proactive environmental strategies and capabilities for innovation and higher order learning which in turn influence firm performance. They treat firm 'transformation' as an evolutionary process proceeding along three stages: from adjustment through adaptation to innovation.

Whilst these and other studies have dealt with identifying a role for dynamic capabilities to a discussion on the adoption of environmental innovations, the nature of these capabilities requires further explication. This study intends to make a theoretical contribution to this discussion by developing an in-depth analysis of what these capabilities are and how they enable a service firm to shift towards achieving improved energy efficiency. This is studied in the context of a traditional service sector, that of hotels.

3.2.3 - Intermediation Activity at the KIBS-Client Interface

The study looks at the interface between the service firm and a type of intermediary, the knowledge intensive business service firm (or KIBS), and how this may be acting as a locus for intermediation activity and knowledge transfer. The interest in intermediaries originated primarily from the empirical investigation that identified KIBS as a relevant actor intermediating between an external body of knowledge on environmental technologies and the service firm. In turn, the service firm requires an absorptive capacity to obtain knowledge and information about energy efficient technologies and measures from its relation with the KIBS. This study links the concepts of absorptive capacity and intermediation. The literature on KIBS and intermediation is reviewed in Chapter 4.

The chapter opens up on these literatures and in the final section presents an analytical framework used in this study to analyze adaptation responses in traditional services.

3.3 - Adaptation: Finding a Fit with the External Environment

Processes of adaptation in business firms can go a long way in explaining how societal systems change in the face of emerging environmental problems (Berkhout *et al*., 2006; Loorbach *et al*., 2010). Adaptation can occur in business practices and strategies and therefore in the ways

firms organize their activities whilst fulfilling their socio-economic purpose of delivering goods or services to customers (Foxon, 2011).

Understanding adaptation at the micro-level can provide some insight on transformation at the macro-level. The macro-level context consists of inter-linkages between technology, the actors involved in maintaining or changing a system and the rules and institutions that form part of the wider landscape and that that guide the actors' activities and initiatives (Geels, 2002). Geels (2011) describes transformation as a multi-level phenomenon and captures this in his multi-level perspective (MLP) framework that has gained ground in explaining how system transformation may come about[32]. According to the MLP framework, transformation proceeds through a long-term process of fundamental change in socio-technical systems which is referred to as a transition (Loorbach and Rotmans, 2006). Although this is not a study about 'transitions' and it does not look at the 'system' level, it provides a micro-level analysis of adaptation and change that can potentially bring perspectives from strategic management and organizational capabilities to a much broader discussion about transformation occurring in the macro-context (Markard *et al*., 2012).

3.3.1 – Defining Adaptation

In the context of global change, adaptation has been defined as "a process, action or outcome in a system (household, community, group, sector, region, country) in order for the system to better cope with, manage or adjust to some changing condition, stress, hazard, risk or opportunity" (Smit and Wandel, 2006, p.282). Smit *et al*., (2000) refer to adaptations of ecological and socio-economic systems to climate change stimuli as ''adjustments in response to actual or expected climatic stimuli, their effects or impacts'' (p.225).

Adaptation refers to a process, though the outcome is also important and it has a temporal dimension as it encompasses adjustment to actual and anticipated future events (Smit *et al*., 2000). Although adaptation has been thought of principally in relation to technological options to respond to particular challenges, for example those related to climate change, it may include changes in processes, practices, or structures "to moderate or offset potential damages or to take advantage of opportunities" (Smit *et al*., 2000).

3.3.2 – Characterizing Adaptation at the Firm-level

In the strategic management literature, organizational adaptation is about maintaining a fit or alignment between the organization and its ability to exist within changing environmental conditions (Miles *et al*., 1978; Hrebiniak and Joyce, 1985); by adapting an organization can survive in a changing environment (Chakravarthy, 1982). Firm adaptation or transformation has been viewed as a process of organizational renewal mediated by internal strategic choices

[32] For a description of the multi-level perspective framework references consulted include Geels and Schot (2007); Geels (2011).

(Hrebiniak and Joyce, 1985) and which is influenced by external pressures such as economic, market and technological developments that create competitive selection for survival (Miles *et al*., 1978; Hoffman, 2001). Similarly, when discussing firm adaptation to climate change, Berkhout (2012) defines adaptation as a process of integrating new or modified solutions within existing practices and activities; often through the adoption of known alternative practices or technologies (ibid).

Through their innovative activities, organizations can play an important role in decreasing the demand for a resource or consume a resource more efficiently and thus contribute towards an environmental goal (Green *et al*., 2000). This aspect can go a long way in explaining how incumbent systems change in the face of emerging problems related to the natural environment and sustainability (Loorbach *et al*., 2010; Foxon, 2011).

The mechanisms of how firms adapt have been subject of extensive research and can be analyzed from at least three different perspectives. In the innovation management literature, firm adaptation can be explained through the lens of the innovation process, which in this study is discussed with particular reference to innovation in service firms. Another perspective which is that rooted in organizational design, argues that firms adapt over time by being ambidextrous i.e. by exploring existing capabilities and exploiting future opportunities for growth (O'Reilly and Tushman, 2007; Einsenhardt *et al*., 2010). An analogous concept is used by Sundbo (2010) to describe how service firms innovate by multitasking. These two perspectives are process-oriented. A third conceptual approach found in the strategic management literature suggests that firms adapt by deploying dynamic capabilities (Teece, 2007).

This research integrates elements of the above perspectives to understand how firms adapt along a trajectory characterized by improved energy efficiency. It does so through the lens of innovation adoption, and the particular dynamic capabilities that enable firms to adopt energy efficient technologies and measures.

The chapter proceeds by outlining the characteristics of innovation in services and then discusses the firm as a multitasking entity.

3.4 – Innovation in Traditional Services

Although traditional or mature industries lie downstream in the innovation value chain, their importance in terms of contribution to total employment and gross domestic product makes them equally an interesting topic for a discussion on innovation (Potters, 2009). They include sectors of manufacturing such as textiles, metal and non-metallic products, and house-building and many professional, financial and commercial services (Pavitt, 1984). This study focuses on hospitality and specifically hotels as a type of traditional service sector and therefore the literature review avoids reference to high technology services.

Traditional or mature industries are often classified as 'low-tech' because of their low apparent innovative activity as measured in terms of R&D intensity[33] (Hirsch-Kreinsen *et al*., 2006). They are classified as 'technology-users' and 'supplier-dominated' according to Pavitt's (1984) classification and are unlikely to be the source of new technology innovations. In these mature sectors, innovation generally proceeds through transforming knowledge, components and technologies developed elsewhere (von Tunzelmann and Acha, 2005; Hirsch-Kreinsen *et al*., 2006). Therefore they exhibit innovative activity that relates to the acquisition and usage of technology other than its development (von Tunzelmann and Acha, 2005). The literature on service innovation also demonstrates that services innovate in a variety of ways beyond the acquisition of technological innovations and the role of non-technological innovations is growing in importance as discussed in Section 3.4.2 below.

3.4.1 - The Components of a Service

Although characterized by a high degree of heterogeneity, services share two prominent features which are their intangibility and interactivity (Miles, 2008; Gallouj and Savona, 2009). The intangibility of a service - the fact that often the output cannot be quantified - makes it hard to distinguish the service process from the service product (Gallouj and Savona, 2009). As Gallouj (2002) states "in many cases, the product in services is in fact a process: a service package, a set of procedures and protocols or an act" (p.40) that results in the service output or service experience (Gallouj, 2002; Gallouj and Savona, 2009).

Many service processes are described by their interactivity because they involve the presence and participation of the customer (Miles, 2008); often the client and service-provider relation becomes the locus of exchanges of information and knowledge. Service management and marketing researchers increasingly see the customer as a 'co-producer' of value contributing to shaping the outcome of the service (Gallouj and Weinstein; 1997).

Another construct that helps to unpack a service is that of the 'service concept' that addresses the '*what'* and '*how'* components of a service (Goldstein *et al*., 2002). The '*what'* component looks at what the service should look like and the customer needs that the service intends to fulfill (marketing content); the '*how'* of a service is how this is made operational through the infrastructures (facilities, equipment, people) and processes needed for developing and delivering the service (ibid).

Creating value for customers in the form of experiences has gained increased prominence in the service industry (Berry *et al*., 2002; Bitner *et al*., 2008). The experience may be functional

[33]The grouping of industrial sectors into 'high', 'medium' and 'low' tech is based on the OECD's (2002) classification that measures innovation based on research and development (R&D) intensity. According to the OECD's definition: "R&D intensity takes into account i) R&D expenditures divided by value added; ii) R&D expenditures divided by production; and iii) R&D expenditures plus technology embodied in intermediate and investment goods divided by production" (p. 205).

(the service is in good working order and “of quality”) and experiential when it elicits emotions and awakens the senses (ibid). The outcomes of a service experience or the service value proposition can be interpreted both from the customer’s perspective of how well the service fulfills customer needs and the organization’s perspective of achieving strategic, operational and financial objectives (Johnston and Kong, 2011).

3.4.2 - The Innovation Process in Services

The innovation process in services is considered unsystematic as it typically occurs outside an R&D department and involves the whole of the firm that pools in diverse resources including human, financial, managerial and knowledge resources at different levels and from different departments (Sundbo, 2011).

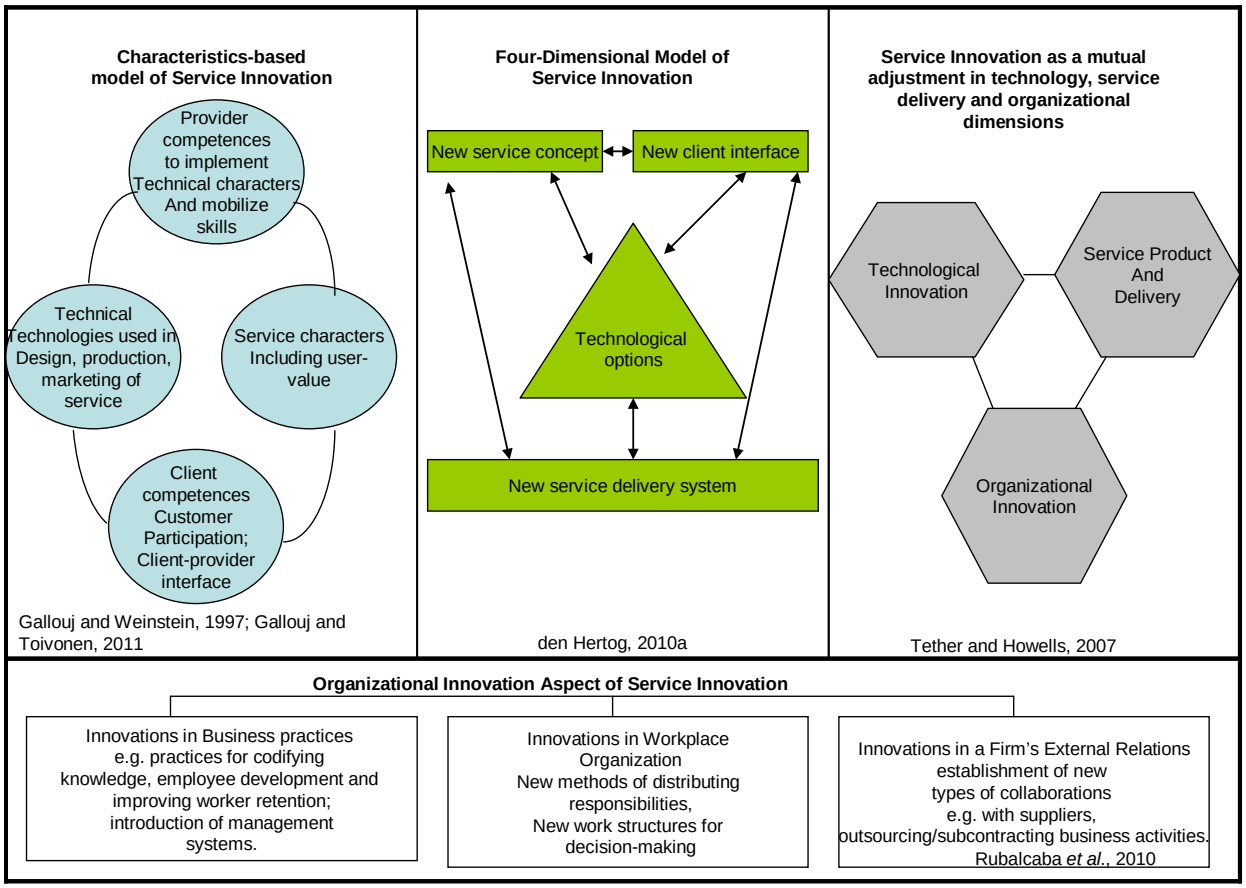
A characteristic of service innovation is that it embodies aspects of both technological innovation and the “soft-side” of innovation that could include service and organizational innovations (den Hertog, 2010a p.306). The definition provided by den Hertog *et al*., (2010) reflects this notion; they define service innovation as:

“*A new service experience or service solution that consists of one or several of the following dimensions: new service concept, new customer interaction, new value system/business partners, new revenue model, new organizational or technological service delivery system*” (den Hertog *et al*., 2010).

According to den Hertog *et al*., (2010), a service firm can innovate along different trajectories so long as these lead to new ways of creating value for the customer. The firm can be innovative in the way it organizes the service delivery system, in terms of how it organizes the work of the personnel and the capabilities of the staff.

Increasingly, innovation in services is being described as a multi-dimensional construct. Figure 3.1 summarizes some principle contributions on the characteristics of innovation in services. Rather than identify types of innovations as product and process innovations that are used for technological aspects, innovation is conceptualized as a process involving dimensions or characteristics of technology, service product and delivery and organizational practices that mix and support each other (Tether and Howells, 2007).

Figure 3.1 - Innovation in Services as a Multi-dimensional Construct



Source: author

Technological innovations are important in so far as they contribute to the efficiency of service provision, one prominent example being the application of information and communication technology (ICT) to support service delivery, back and front office management and new business models (den Hertog *et al*., 2010; Rubalcaba *et al*., 2010).

Thus unlike high-tech firms, where technology takes up a central role in commercial success and competitive advantage, in mature sectors, technology is interpreted differently as not influencing the primary business area or function of the firm (von Tunzelmann and Acha, 2005). Thus the role of technology principally becomes that of cutting costs; whilst the firm appropriates value from professional skills, aesthetic design, trademarks and advertising (Hirsch-Kreinsen, 2008).

Firms generate knowledge related to innovative activity and the adoption of technologies through 'doing and using' (von Tunzelmann and Acha, 2005). Therefore they develop practical rather than scientific knowledge (ibid). Practical knowledge has been defined as a bundle of different knowledge-types that includes both explicit and codified knowledge as well as implicit knowledge that comes from the accumulation of experience and proven and tested routines for solving technical problems (Hirsch-Kreinsen 2008).

The importance of organizational innovations in services has also been highlighted in a number of studies (e.g. Tether and Howells, 2007; Rubalcaba *et al*., 2010; den Hertog, 2010b). Figure 3.1 above provides examples of organizational innovations from a review by Rubalcaba *et al*., (2010). According to the Oslo Manual definition, organizational innovations refer to significantly changed organizational structures and processes that result from implementing new management techniques and working concepts and practices (OECD, 2005 p.37). Rubalcaba *et al*., (2010) quote innovations in business practice, workplace organization and external relations as examples. In a similar way, Birkinshaw *et al*., (2008) refer to management innovations as the implementation of new management practices, processes and techniques that alter the way work is done in the firm.

Tether and Howells (2007) describe how innovation arises through a process of 'mutual adjustment' between technologies new to the firm or to the market, skills and organizational structure (including business relations). In a 2003 survey of 900 European service firms, they found that innovation was the result of finding the right combination of these three aspects and therefore resulted from 'deeper' rooted change in the business beyond the adoption of the technology *per se*.

This aspect of 'mutual adjustment' is particularly relevant to those service sectors, often described as 'low tech' i.e. with a low research and development intensity (Hirsch-Kreinsen *et al*., 2006) that are net 'importers' of technology and must integrate these into their operational systems and practices. In line with den Hertog (2010a), innovation in services is likely to occur through organizational innovations or management innovations (after Birkinshaw *et al*., 2008) such as through re-organizing business routines or introducing new business practices.

Since innovation in services is a multi-component, often complex social process between employees and management, it rarely results in radical innovation or change but is more likely to occur through incremental improvements (Sundbo, 2010).

3.4.2.1 - Innovating in the Back-Office and the Front-Office

This study focuses on innovation in those practices and processes in the firm that lead to enhancing energy efficiency at the operational level and that may influence the service value proposition. Therefore it is relevant to discuss the 'front-office' and 'back-office' distinction that is often made when characterizing the innovation process in services (Voss and Zomerdijk, 2007; den Hertog *et al*., 2011; Gallouj and Toivonen, 2011). The risk with focusing on front-office innovations alone is that back-office or back-stage changes go un-noticed. This is a problem with traditional sectors, including hospitality, that are often considered non-innovative because the service remains unchanged; whilst innovative activity may be taking place in the supporting processes (den Hertog *et al*., 2011).

Front-office operations typically characterize change in the service concept and in the interaction with the customer. However they may also involve process-oriented activities such

as co-production of the service with the client's participation; whilst back-office processes take place "behind the scenes" (den Hertog *et al*., 2011). In services, management innovations (Birkinshaw *et al*., 2008) are likely to be backstage innovations; whilst innovations in the service experience or service solution (den Hertog *et al*., 2010) are front-stage innovations. The two perspectives are not separate: back-office innovations often act as enablers of front-office characteristics of the service. One example is how day-to-day operations management support service delivery and the processing of information relating to the service (Gallouj and Toivonen, 2011).

The front- and back-office distinction is useful to the extent that it maps where and what type of innovations are being implemented in a service firm. Glushko and Lindsay (2009) consider innovation in services as a continuum, occurring along several points of the service innovation value chain. They distinguish innovations in the 'front stage', that occur through direct interaction with the customer, from those in the 'back stage' that are 'hidden' to the customer yet precede the front stage in order to make the service encounter possible. In their example of a 'hotel check-in experience', Glushko and Lindsay (2009) discuss how activities collected in the back stage, about for example the hotel room preferences of a particular guest, may empower the guest's experience if this information is transmitted successfully to the front stage. Bridging front and back stage aspects of a service experience means finding linkages and inter-relations between the two aspects of service delivery (ibid).

In an attempt to distinguish between front and backstage activities, Bitner *et al*., (2008) develop a service blueprinting model of the service process. Here, they dissect out the concept of 'backstage' or 'back-office' by distinguishing between those activities that involve non-visible interaction with a customer, such as a customer telephoning the hotel reception ('invisible contact employee actions') and activities where there is no contact with the customer but that need to be carried out in order for the service to be delivered ('support processes'). Thus, back-office activities are invisible to the customer but may involve some (indirect) interaction.

In the next section, another perspective of firm adaptation is discussed, which addresses how the firm goes about innovating and exploring new opportunities whilst maintaining service activities.

3.5 – The Firm as a 'Multitasking' Entity

In the specific case of traditional service firms, Sundbo (2011) discusses how innovations are "*processes that mix with other processes*" such as the organization's daily activities (p.7). The author uses the notion of employees as 'multitaskers' to explain innovative activity within traditional services such as real estate, travel agency, and food. In these firms, individuals and departments are rarely dedicated to innovative activity alone; therefore in addition to handling day to day jobs, they may spend an unspecified amount of time and effort on innovation activity,

but this may vary and is rarely managed in a formalized setting (ibid). Thus innovation in service firms is related to their capability to multitask or engage in innovative activities whilst maintaining day-to-day operations.

In order to keep the innovative activity running alongside other ongoing processes, firms require capabilities to balance "when to do what and with how much effort" (Sundbo, 2010 p.283). According to Sundbo (2010), traditional service firms generally have limited capacity for multitasking, preferring established structures and routines. The attention devoted to innovative activity becomes dependent on the different goals, interests or focus that employees may harbour (Sundbo, 2010). Thus, multitasking arises as employees take initiative beyond their narrow job descriptions (Nooteboom and Went, 2008; Hellmann and Thiele, 2011).

Sundbo (2010) describes the characteristics that enable individuals to react to change and shift from being routine-oriented to adapting and building a multitasking potential. The capability to innovate stems from two sources: one is the employees' competences and knowledge of the customer and of the market and another is the managers' ability to direct and lead the innovation process (Sundbo, 2011).

The notion of multitasking is not new and has been applied to the modeling of incentive systems in multitask jobs (Holmstrom and Milgrom (1991). Employees operate within an environment where they are called to perform multiple tasks or their jobs are characterized by multiple dimensions (Holmstrom and Milgrom, 1991). Holmstrom and Milgrom (1991) discuss how pay-offs used to motivate employees to take action on specific tasks must take into account the allocation of time and attention dedicated to these particular tasks at the expense of others.

The concept of multitasking is paralleled by that of ambidexterity as applied to firms. O'Reilly and Tushman (2007) view ambidexterity as a balancing act between exploiting existing assets and resources to make profits and simultaneously exploring new opportunities, in the way of emerging technologies and new markets, that enable the firm to innovate and adapt in the long-term. Another interpretation describes ambidexterity as the combined magnitude or effect of both explorative and exploitative activities (Cao *et al*., 2009). Here, firms are able to use existing assets and operational capabilities in order to exploit a new opportunity that is strategically important to the firm.

The qualities of an ambidextrous organization lie in the senior management's choices and behaviours on how to manage the firm's resources in such a way that enables simultaneous exploitation and exploration (O'Reilly and Tushman, 2007). Therefore it is about making choices on which strategy to go for and where to invest resources. This is different to a case where firms follow either an exploratory or exploitative strategy. In the exploitative strategy, firms pursue incremental innovations that result mainly from exploitation of existing assets and resources in order to achieve higher efficiency; whilst the explorative strategy involves implementing radical

innovations that are far removed from their current activities and require new competences and resources. Firms that are ambidextrous are capable of generating both types of innovations.

A number of parallels can be drawn between multitasking and ambidexterity even though the two concepts have been applied at different levels of analysis. Multitasking has been discussed as a property of individuals or sub-units within a firm and ambidexterity as a property of the firm rooted in strategic management choices. In both, the firm is required to find a balance between innovative and routine activities. Ambidexterity is about how the firm deploys resources and competences to explore and exploit technology-related knowledge and guide strategy; whilst multitasking more generally refers to how firms take up new activities over routine tasks and operations.

This study interprets the firm as a multitasking entity. Thus a firm's adaptability depends on its ability to implement innovations and simultaneously maintain on-going operations and tasks resulting in the delivery of the service. This draws from Sundbo's (2010) model of innovation in traditional services and includes elements of ambidexterity in firms.

In both the multitasking and ambidextrous perspectives, the firm uses dynamic capabilities to innovate and adapt to change in the external environment whilst maintaining efficiency (O'Reilly and Tushman, 2007; Einsenhardt *et al*., 2010; Sundbo, 2010). The remainder of this chapter focuses on what dynamic capabilities are and how these can be used to understand adaptation in a service-based context.

3.6 - A Capabilities Perspective on Service Firm Adaptation

Service firms require capabilities in order to obtain and assimilate knowledge and information in the external environment that enhances their ability to adapt to emerging challenges and innovate (Hirsch-Kreinsen *et al*., 2006; Salter and Tether 2006). These capabilities are internal to the firm and enable the firm to combine existing and new knowledge and competences in order to innovate. Firms also require an absorptive capacity to capture the necessary external knowledge for successful innovation (ibid).

This study posits that different patterns of firm behaviour can be traced to the presence of heterogeneous resources and capabilities to adapt to emerging challenges about environmental action and achieving energy efficiency (after Berkhout *et al*., 2006). Berkhout (2012) uses capabilities to explain firm adaptation to the emergence of novel situations relating to the impact of climate change on businesses. Adaptation may be based on existing capabilities and therefore involves the adoption of 'known alternative practices or technologies'; alternatively it may require the presence of dynamic capabilities to modify or adapt routines and strategies when firms are faced with new situations for which their current procedures, rules and strategies do not work that well (Berkhout, 2012). Hart (1995) suggests that firms with environmentally-

oriented capabilities e.g. for pollution prevention and product stewardship gain some advantage over competitors that may be either a cost advantage or preferred access to limited resources (e.g. raw materials), new markets of customers, or establishing rules and standards.

Since this study considers a service sector, it makes reference to den Hertog *et al*.,'s (2010) six-dimensional (6D) model linking dynamic capabilities with innovation in services. The 6D model is discussed in Section 3.6.4.

Two issues are considered critical to an analysis on firm capabilities in this study. The first is the emphasis on capabilities in services characterized as non-R&D intensive, which has received less attention, both conceptually and empirically, compared to industries where R&D is a central aspect of innovation. The second related issue is how firms adapt to changes in their environment which are not directly at the core of their business activity; and therefore take into account management or backstage innovations discussed above.

The section starts with an overview of dynamic capabilities and what these mean in a service context. This serves as a backdrop for building a framework for capabilities in services.

3.6.1 - The Nature of Dynamic Capabilities

The concept of dynamic capabilities is rooted in the resource-based view (RBV) of the firm. The RBV takes an introspective view of the firm as an adaptable unit that is capable of surviving thanks to a set of unique and distinctive resources that set firms aside from their competitors (Barney, 1991; Wang and Ahmed, 2007; Helfat and Peteraf, 2009). At the heart of the RBV is the rareness and inimitability of resources that confer competitive advantage to the firm: the resources are fixed assets that reside within the firm and are immobile. These resources may include tangible assets such as specialised equipment and geographic location, intangible assets including human resources, expertise and know-how and organizational assets such as brand image and reputation (Eisenhardt and Martin, 2000). However, this view does not adequately explain how firms adapt in rapidly changing and unpredictable environments (Eisenhardt and Martin, 2000) and thus provides a static view of the firm and adaptation that lacks a temporal dimension.

Building on this stance, the dynamic capabilities approach (DCA) specifies the need to understand how firms are able to differentiate their assets and resources and the processes through which this takes place. The word 'dynamic' therefore implies understanding processes of change and renewal in fast-changing and unpredictable environments; this dynamism is not adequately addressed in the RBV. Thus the DCA suggests that it is not merely the presence of resources that counts; rather how existing resources and competences are combined or 'reconfigured', using Teece's (2007) term, to create value and differentiate firms from their competitors (Teece *et al*., 1997; Eisenhardt and Martin, 2000). The timely deployment of resources is a key tenet of the DCA that accounts for firm differentiation (Teece *et al*., 1997; Einsenhardt and Martin, 2000; Winter, 2003).

One of the most influential contributions to the dynamic capabilities approach (DCA) is Teece's (2007) framework that identifies three dynamic capabilities needed to maintain competitive advantage. These are: 1) sensing opportunities and threats in the environment; 2) seizing the opportunities and 3) managing and reconfiguring assets. The deployment of dynamic capabilities leads to value-creating activities such as creating new products and processes and reshaping or implementing new organizational forms and business models to meet changing customer and technological demands and opportunities (Teece, 2007). Underlying these capabilities are the 'micro-foundations' that include individual- and group-level "skills, processes, procedures, organizational structures, decision rules, and disciplines" that equip firms with a comparative advantage over competitors (p.1319). Einsenhardt *et al*., 2010 root these 'micro-foundations' in individual- and group-level experiences and their ability to exploit experiential knowledge for problem solving and capturing opportunities.

The literature uses varied terms to define the nature of dynamic capabilities. Winter (2003) and Zollo and Winter (2002) distinguish dynamic capabilities from ordinary (zero-order) or operational capabilities. The latter enable a firm to "earn a living now" i.e. to remain established within a given market and to sell the same product or service (Winter, 2003). In other words, operational capabilities enable firms to perform their basic day-to-day operational activities. Capabilities have been described as dynamic or 'higher order' when they enhance a firm's performance and become a source of competitive advantage (Collis, 1994; Teece *et al*., 1997; Eisenhardt and Martin, 2000; Winter, 2003)

Apart from this perspective, other interpretations have been put forward. Dosi *et al*., (2000) describe dynamic capabilities in the broadest sense as aimed to solve problems within an organization. Helfat and Peteraf (2003) associate the presence of dynamic capabilities to widening and improving the resource base; they posit that "all capabilities have the potential to accommodate change", including operational capabilities (p. 998). Similarly, Collis (1994) uses dynamic capabilities to mean the rate of change of ordinary or operational capabilities that may include marketing, distribution and production capabilities; though these are likely to only confer a short-term advantage (Teece, 2007). According to Barreto (2010) dynamic capabilities reflect the potential of the firm to sense opportunities and threats and make timely decisions about changing its resource-base; therefore there can be different levels of dynamic capability rather than it being present or not (p. 273). Table 3.1 below reviews some definitions of dynamic capabilities from prominent authors in the literature; though it avoids reference to the hierarchical nomenclature associated with the use of the term.

Table 3.1 - Defining Dynamic Capabilities

Authors	***Definition***	***Key Features of the Definition***
Teece *et al*., (1997 p.516)	A firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments to achieve competitive advantage.	Timely deployment of capabilities to rapidly changing technological environments.
Eisenhardt and Martin (2000 p.1107)	The processes or routines to integrate, reconfigure, gain and release resources to match and even create market change.	Capabilities as a process that establishes the right resource configurations.
Zollo and Winter (2002 p.340)	A learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness.	Process-oriented definition that focuses on adjustments in operating routines.
Wang and Ahmed (2007 p.35)	The ability to integrate, reconfigure, renew and recreate resources and capabilities and upgrade and reconstruct core capabilities in response to the changing environment to attain and sustain competitive advantage.	Combining existing capabilities and resources to respond to change.
Helfat and Peteraf (2009 p.94)	The capacity of an organization to purposefully create, extend, and modify its resource base.	Extends the notion of capabilities to the resource base of the firm and how this is modified to meet a firm's needs.
Barreto (2010 p.271)	The firm's potential to systematically solve problems, formed by its propensity to sense opportunities and threats, to make timely and market-oriented decisions, and to change its resource base.	The potential of the firm to solve problems shows that different 'levels' of dynamic capabilities may exist in firms.

The definitions in Table 3.1 bring to the fore the importance of timely deployment of resources in order to respond to emerging signals and adapt. They identify that dynamic capabilities are deployed to adapt processes and routines or develop new ones. Routines refer to "the way things are done" in an organization (Dosi *et al*., 2000 p.4); they represent a firm's on-going

activities (Berkhout *et al*., 2006) that depend on an individual's skills and competences to carry out a particular job, whether this relates to operational or strategic activities in the firm (Miozzo and Grimshaw, 2011). Routines include "the forms, rules, procedures, conventions, strategies, and technologies around which organizations are constructed and through which they operate" (Levitt and March, 1988 p.320). In this interpretation, firms develop dynamic capabilities when they learn how to modify routines in order to make a good fit with the external situation (Levitt and March, 1988).

Dynamic capabilities are path-dependent: this is expressed not solely in terms of the life-history traits of the firm and on its resources but also in terms of the learning mechanisms acquired through practice and experience (Eisenhardt and Martin, 2000). The firm learns to adapt over time (Teece, 2007); learning may require the acquisition of new knowledge or the recombination of existing knowledge embodied in individuals within the firm (Teece *et al*., 1997). Thus dynamic capabilities become well established and a persistent feature within an organization, in contrast to one-off activities, such as *ad hoc* responses to change (Winter, 2003).

Although this review does not attempt an in-depth 'knowledge-based' approach to understand firm adaptation, elements of knowledge accumulation and knowledge creation interpose a discussion on dynamic capabilities. This is because capabilities develop and evolve through learning and knowledge accumulation within the firm (Eisenhardt and Martin, 2000; Zollo and Winter, 2002). In relatively stable environments where change is predictable, firms rely on existing knowledge and experience that feed back into operational routines which are thus modified and become more robust or deeply engrained in the firm (Eisenhardt and Martin, 2000). In contrast, high velocity markets, characterized by greater uncertainty and unpredictability require firms to create "*situation-specific knowledge*" (ibid). In such cases, firms are called to challenge their organizational tasks and routines by asking what works and what does not (Zollo and Winter, 2002). This may occur through processes of deliberation and articulation of knowledge that arise through collective discussions, debriefing sessions and performance evaluation and through engaging with 'experiential actions'.

3.6.2 - Absorptive Capacity as a Type of Dynamic Capability

Dynamic capabilities are not only internal to the firm but also reflect how the firm is able to exploit collaboration and relations with external entities as a means of extending and renewing its competencies (Mc Evily *et al*., 2004). This capability is embodied in the concept of absorptive capacity. The interpretation of absorptive capacity as a 'relational' construct is particularly useful to draw upon in this study as it throws light on how traditional services make use of external knowledge sources to adopt environmental innovations. It represents a departure from the original interpretation of absorptive capacity as the firm's ability to acquire knowledge about technological innovations and its application to commercial ends (Cohen and Levinthal, 1990). Knowledge on environmental practices may not always lie at the core of the business function or activity; it transcends sector-specific or native knowledge (van den Bosch *et al*., 1999) and is often assumed to be new to the firm (Siebenhüner and Arnold, 2007).

The literature has attempted to broaden the definition of absorptive capacity "*away from an exclusively R&D focus to a dynamic capability perspective*" (Lane *et al*., 2006, p. 845). In their re-conceptualization, Zahra and George (2002) define absorptive capacity "*as a set of organizational routines and processes by which firms acquire, assimilate, transform, and exploit knowledge to produce a dynamic organizational capability*" (p. 186). They distinguish between a firm's potential absorptive capacity or its receptiveness to acquire external knowledge and assimilate it, and the realized absorptive capacity identified as the capability to transform the acquired knowledge and exploit this in the firm's operations in order to improve performance. In turn, van den Bosch *et al*., (1999) discuss how absorptive capacity is dependent not only upon a firm's level of prior related knowledge and organizational form but also on the combination of its internal capabilities.

In Dyer and Singh's (1998) view, absorptive capacity evolves as a two-way exchange of knowledge amongst partners that largely depends on the interactions and relations established between them. Likewise, Lane and Lubatkin (1998) define absorptive capacity as a learning dyad between partner firms that share a similar knowledge base to facilitate learning whilst at the same time bringing in new learning.

In Chapter 4, the relation of service firms with a type of intermediary, the knowledge intensive business services (KIBS), is discussed in relation to its potential to influence the adoption of environmental innovations (Miles, 2012).

Following from the overview of dynamic capabilities, the next section provides a critical assessment of the dynamic capabilities approach and how this can be interpreted in a service-based context.

3.6.3 - An Assessment of the Dynamic Capabilities Approach and its Applicability to Studying Innovation in Services

A number of issues and challenges have been raised over the use of a dynamic capabilities approach (DCA). In his assessment of the DCA, Barreto (2010) summarizes these as follows:

- The *nature* of the construct is vague. Dynamic capabilities lack one common definition having been referred to as capacities, processes and routines and this demands further clarity. Unlike resources that are observable but not necessarily tangible, capabilities are intangible; this makes them harder to observe and assess (Hoopes *et al*., 2003). Moreover, dynamic capabilities are understood as a *dichotomous* construct in being either present or absent in the firm.

- The *specific role* of dynamic capabilities has been typically understood in terms of changes in resources and operational routines but recent contributions propose including additional roles such as decision-making abilities and capabilities to scan the environment for opportunities and threats.

- The *commonalities paradox* is yet to be resolved. On the one hand, dynamic capabilities are considered unique and idiosyncratic in conferring some advantage to the firm over its competitors (Teece, 2007). On the other hand, dynamic capabilities may share similar key attributes giving rise to best practices (Eisenhardt and Martin, 2000).

- The *context* in which dynamic capabilities are deployed is broad and there seems to be a debate as to whether these are applicable in all types of contexts. Dynamic capabilities have been studied mainly in fast-changing dynamic environments; though they also are relevant in moderately dynamic environments that are "*subject to lower rates of change*" (Zollo and Winter, 2002 p.340).

- The *purposefulness* is inherent in many definitions of dynamic capabilities. Thus dynamic capabilities enable firms to do something (achieve competitive advantage) in particular contexts which are typically those of rapidly changing environments. This is problematic for two reasons. First, it raises a tautological argument, discussed by Eisenhardt and Martin (2000), where firms possessing dynamic capabilities perform better and thus the behaviour (performance) is causal to the capabilities. A second, and related issue, is the difficulty to undertake an *ex ante* empirical investigation to determine or assess those capabilities that influence the behavioural responses observed.

This study addresses a number of the challenges identified when using a dynamic capabilities perspective. It contributes to understanding the nature of dynamic capabilities by taking into account the fact that these may vary between firms; therefore firms may have different types of dynamic capabilities that can also account for differential responses across firms in a sector. This approach avoids the dichotomy of a capability being either present or absent. The context chosen is that of a mature service sector which offers a stable environment compared to high-tech sectors characterized by fast-changing technological environments. Although the scope is not to make a comparison between mature or low-tech sectors and high-tech, this study broadens the scope for studying dynamic capabilities in these types of contexts.

The idiosyncratic nature of capabilities as 'difficult to replicate' can be explained not so much in terms of the capability *per se* but in terms of the types of capabilities mobilized and used to guide choices and create alternative paths and therefore can lead to the identification of best practice as suggested by Eisenhardt and Martin (2000). Thus, dynamic capabilities are idiosyncratic in the sense that there may be different starting points and different pathways but at the same time exhibit commonalities in their finality (after Helfat and Peteraf, 2003).

The implication is that dynamic capabilities share similar key attributes but the paths to achieve these may be different. Therefore explicating the 'paths' towards achieving a particular purpose

or finality, may provide a means of how to assess the role of capabilities in firm behaviour (Eisenhardt and Martin, 2000).

Whilst acknowledging that this approach does not completely overcome the tautological *problematique*, the aim of this study is to explicate those capabilities and combinations of capabilities that firms utilize when engaging in environmental innovation. This re-introduces a reference to the purposefulness of capabilities. The 'purposefulness' of capabilities is assessed in terms of explicating how particular capabilities account for different adaptation response behaviours in firms.

In the next section, a framework for capabilities in services is discussed that also touches on the specific role that dynamic capabilities may play in firm adaptation.

3.6.4 – A Dynamic Capabilities Approach to Innovation in Services

This study intends to make a contribution towards enriching the literature on dynamic capabilities in services which is currently an under-developed field (den Hertog *et al*., 2010).

An early attempt to link firm practices to innovation and its outcomes is the work by Tidd and Hull (2003). The authors used two samples of service firms in the UK and the US and relate different configurations of organizational design to particular types of performance outcomes (measured in terms of product innovation, improvement in service delivery process and cost reduction in service development and delivery). The significance of this study is that it shows how different organizational structures and management processes enable firms to be successful in their niche markets. These configurations are based on an analysis of a number of measures that reflect the firm's knowledge base and knowledge sharing, how the firm uses external linkages with customers and partners/suppliers, and processes of bringing people together to address customer needs.

In a more recent contribution, den Hertog *et al*., (2010) developed a six-dimensional framework of service firm dynamic capabilities. These dynamic capabilities may already be present in the firm or are newly acquired; and are needed to produce a new service innovation in the way of offering a new service experience to the client or providing a new service solution (ibid). The six dynamic capabilities are organized in a circular fashion in den Hertog *et al*.,'s (2010) model. Here they are summarized in table form; see Table 3.2 below.

Table 3.2 - A 6D Model of Dynamic Service Innovation Capabilities (den Hertog *et al*., 2010)

Capability	Description
Signaling user needs and technological options	Relates to the capability to understand user needs and future trends and identify emerging technological solutions to adapt and innovate the service (market and technology scanning activities).
Conceptualizing	Using ideas collected from scanning activity to formulate a new service concept by combining new or existing service elements.
(Un)-bundling	This can take two forms: the first is 'bundling' where the firm produces smart service combinations that integrate different services into one-stop-shop. Otherwise the firm may 'unbundle' services by 'stripping' them to their basic elements and standardizing them. In a similar way, Gallouj (2000) speaks of re-using elements and components of a firm's existing stock of knowledge or competences in order to produce a service with a new combination of characteristics; he terms this 'recombinative' innovation.
Co-producing and orchestrating	This capability describes how firms manage their relations and collaboration with external actors including service providers, service partners and customers in order to provide a new service experience or solution. It embodies the concept of co-production of a service.
Scaling and Stretching	Scaling describes how new services are diffused or launched firm-wide; stretching refers to how a firm may exploit an existing brand-name or reputation in order to penetrate new related service markets.
Learning and Adapting	Learning from the way the service innovation process is managed and applying this learning to implement new services.

Inherent in the model is the concept of the firm as an adaptable unit: the firm learns from experiences of successful and failed innovation experiments and applies this learning to derive new services and service experiences (ibid).

The idiosyncratic nature of dynamic service innovation capabilities stems not so much from the presence of an individual capability but from the combination or mix of capabilities residing in the firm that are deployed to produce a new service experience or solution. The particular combinations of dynamic capabilities depend on the firm's strategy, the market dynamics and the resources accumulated over the years. There is also the implicit assumption that firms are not equally equipped with each of the six capabilities proposed in the model.

Kindström *et al*., (2012) contribute to a discourse on dynamic capabilities in services by describing the 'micro-foundations' or the key characteristics underlying the capabilities that enable product-based firms to introduce service innovations. The authors imply that the 'micro-foundations' contribute to improving service performance; though they do not demonstrate such a link. Likewise, den Hertog *et al*.,'s (2010) model does not relate services dynamic capabilities to particular innovations. A recent study by Kohler *et al*., (2013) builds a preliminary quantitative model that assesses the capabilities for innovation in services based on specific assets present within the firm; the aim of the model is to develop and test indicators of capabilities for innovation.

In this research, only some of the elements of den Hertog *et al*.,'s (2010) 6D model are considered relevant to a discussion on how firms adopt environmental innovations that are not at the core of the firm's business activity, understood as being the delivery of a service experience and service solution. A preliminary empirical investigation showed that adoption of environmental innovations occurs principally in the technical aspects of the innovation process. Therefore, the firm is likely to draw on a specific set of resources and capabilities that differ from those needed to implement a new service experience or solution; these are innovations occurring in the backstage operations discussed above. For this reason this study will only be focusing on relevant aspects of the 6D model proposed by den Hertog *et al*., (2010).

Sundbo (2011) characterizes service firm capabilities as the firm's ability to organize and manage the innovation process and "get the process running" from when it starts out as an idea to when it ends once a new service or organizational process is implemented successfully. Thus, dynamic capabilities can be interpreted in relation to how these enable firms to adapt the service attributes offered or the extent of resources, in the way of materials, facilities, equipment, people, skills and processes, devoted to various dimensions of the service operations (Goldstein *et al*., 2002; Ottenbacher and Gnoth, 2005).

This study analyzes the combination of capabilities that enable service firms to cope with day-to-day duties whilst also dedicating time to innovative activities; in other words it looks at those capabilities that enable service firms to 'multitask' over those firms that are 'routine-oriented' (after Sundbo, 2011).

The following characteristics summarize the conceptual understanding of dynamic capabilities for the adoption of environmental innovations in traditional service firms:

- The nature of dynamic capabilities can be interpreted as a multi-dimensional construct; therefore firms may possess varying degrees or combinations of capabilities that enable them to adapt.
- The 'purpose' of dynamic capabilities is to account for the adoption of innovations that are not at the core of the service; rather they are capabilities enabling supporting processes or backstage activities.

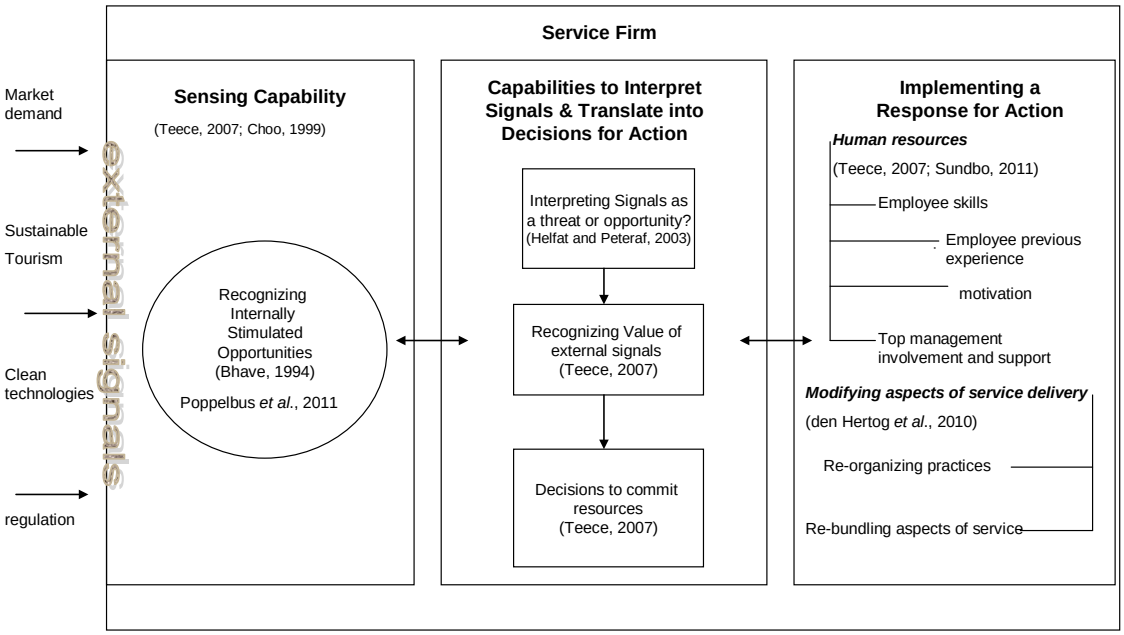
- Drawing from den Hertog *et al*.,'s (2010) 6D model above, the firm's capabilities to scan external signals and the capabilities to modify the service delivery system, appear to be relevant to a discussion on how firms are able to adopt innovations in the backstage that result in the adoption of energy efficiency measures and related environmental innovations;
- The capability to engage with business partners to produce a modified or new service is discussed in relation to how service firms develop absorptive capacity to adopt environmental innovations.

Taking into account the above features, this study makes a contribution to explicating those capabilities that enable firms to adopt environmental action and implement energy efficient measures and practices. It develops a framework that is based on the DCA proposed by Teece (2007) and den Hertog *et al*.,'s (2010) model of dynamic service innovation capabilities.

3.6.5 - A Capabilities Framework Enabling Environmental Action in Services

The framework identifies the capabilities and their underlying characteristics that may explain and account for differences in environmental response behaviour between one firm and another (Teece, 2007; Kindström *et al*., 2012); see Figure 3.2 below. It is based on the premise that different capabilities are needed to adopt innovations that result in enhanced energy efficiency: these include the firm's capabilities to sense signals and take decisions to act upon these emerging signals; and the capabilities to implement action by adopting environmental measures.

Figure 3.2 - A Capabilities Framework for Adoption of Environmental Action in Service Firms



Source: Author

3.6.5.1 - Capabilities to Sense Developments in the External Environment

Scanning External Signals of Change

Firms use scanning capabilities in order to discern change in the environment (Choo, 1999; Teece, 2007). Choo (1999) refers to environmental scanning in a corporate setting as "the acquisition and use of information about events, trends and relationships in an organization's external environment" to help prepare organizations to react in a timely manner to change (p.21).

In services, signaling user needs and identifying technology options have been identified as the principal scanning activities (den Hertog *et al*., 2010). Those service sectors with high customer interaction are expected to have superior "market sensing capabilities" i.e. an enhanced ability to collect and act on information about customer needs and expectations since they rely on customer loyalty and satisfaction to acquire and maintain a market position (Day, 1994; Victorino *et al*., 2005).

Beyond scanning for market-related knowledge, service firms may keep on the lookout for new technology options mainly in relation to how these can be developed and incorporated into new service propositions, such as new ways of interacting with customers or providing customized services (den Hertog *et al*., 2010). With regard to the adoption of environmental technologies, these are typically not developed by in-house research and development departments; nonetheless firms still need to obtain knowledge and information on which technologies to adopt and how to implement them (Pinkse and Dommisse, 2009).

Scanning Internal Signals

A less discussed notion in scanning is the identification of signals arising within the firm and how these may create opportunities for change. Bhave (1994) speaks of "internally stimulated opportunities" that typically arise in response to identified problems. These internal signals could include the recognition that resources are being deployed sub-optimally, such as where there are high operational losses, or the realization that current operational capabilities can be exploited for new untapped markets (Ardichvili *et al*., 2003; Poppelbus *et al*., 2011). Thus Poppelbus *et al*., 2011 extend the notion of scanning to that of recognizing internal 'deficiencies' in service provision or the exploitation of available operational capabilities.

An inherent requirement of scanning is the ability to *recognize* and develop an awareness of both internal and external signals of change. According to Berkhout (2012), firms will only monitor a limited set of signals that influence directly their operations and as a result may be 'blind' to new emerging signals such as those relating to the potential impacts of climate change. Also in relation to climate change, Arnell and Delaney (2006) suggest that firms must build awareness on potential impacts of climate change for them to enact an adaptation

response. However awareness alone may be insufficient to trigger a response if a firm is engaged in what are perceived as more urgent problems such as operational problems; this creates inertia (Sundbo, 2011). When an individual or firm becomes responsive to otherwise unseen market opportunities, this is when alertness is switched on and action triggered (Sambamurthy *et al*., 2003).

The need to be aware and alert about signals and opportunities links to a process of interpretation of these signals of change which is discussed in the next section.

3.6.5.2 - Interpreting Signals

The signals that firms obtain from their external environment go through a process of interpretation or 'acquiring meaning' before a response may be initiated (Daft and Weick, 1984). Ahead of enacting a response, firms evaluate and assess the meaning of "environmental" goals and environmental action in relation to their perceived impact on the business operations (Hertin *et al*., 2003; Berkhout, 2012). In the process, they develop a better understanding of the opportunities or threats ahead and are better able to seize these opportunities or dampen the threats by taking decisions on which resources to commit and on which products, services and processes to invest in (Teece, 2007).

Recognizing the Value of 'Environment'-Related Signals

A firm is exposed to multiple pressures and potential opportunities in its external context and those related to environmental goals and environmental action represent only a sub-set of these pressures (Arnell and Delaney, 2006; Nelson *et al*., 2007). Thus adapting to signals about energy efficiency and environmental action does not take place in isolation (Smit and Wandel, 2006; Berkhout 2012). Ahead of enacting a response, firms evaluate and assess the meaning of "sustainability" and "environment" signals in relation to the perceived impact these might have on the business activity of the firm (Berkhout *et al*., 2006; Hertin *et al*., 2003).

Studies show that firms are less sensitive to the direct impacts of climate change on business function whilst they are more likely to be responsive to indirect impacts such as the need to comply with regulation or to meet up to customer demand (Hertin *et al*., 2003). Therefore beyond developing awareness about these signals, firms must also have a concern about potential impacts on the business (Arnell and Delaney, 2006). When dissecting out the impact of climate change on business, Hoffmann *et al*., (2009) distinguish between the aspect of the business that is more vulnerable - this is the so-called affected business or the ability of the firm to carry out its business activities and that which is not affected by sustainability or climate change (the 'non-affected' business).

Moreover, Hertin *et al*., (2003) hint at the importance of studying the impacts of emerging signals at the sub-organizational level, since the role and positions of individuals within an organization influence the perception of impact. Thus, managers within an organization tend to

assign a 'label' to an issue in order to analyze whether this represents a threat or opportunity (Dutton and Jackson, 1987). In an empirical study on the impact of climate change on the UK house building sector, Hertin *et al*., (2003) show that technical managers were concerned about heating and cooling of buildings whilst land managers focused on potential flooding problems likely to be caused by climate change. In another study, Sharma (2000) demonstrates that the managers' interpretations of environmental issues as opportunities significantly increased the likelihood of implementing voluntary environment strategies.

Another perspective is to interpret the 'value' of a response when assessing the importance of signals relating to 'sustainability' and the 'environment' (Arnell and Delaney, 2006). Therefore the question can be about the type of incentives that are conducive for firms to adapt and respond to given signals (Fankhauser *et al*., 1999); these are typically provided in the institutional environment through policies or incentive measures (ibid).

Another aspect of value is recognizing the knowledge and information acquired from the external environment and that can be exploited in the firm; this is embodied in the concept of absorptive capacity (Cohen and Levinthal, 1990). Todorova and Durisin (2007) also use value-recognition as an important step prior to the acquisition of external knowledge. They argue that acquisition is not an automatic process since firms may fail to identify valuable knowledge either because of cognitive biases and rigid capabilities or because of the criteria used for evaluating external knowledge that could be based on current market needs as opposed to perceived future needs. The aspect of absorptive capacity is discussed further in Chapter 4.

Strategic choice and decision-making have been shown to influence firm interpretation of the external environment (Daft and Weick, 1984; Teece, 2007).

Strategic Choice and Decision-Making

Helfat and Peteraf (2003) emphasize the role of strategic choice in guiding behavioural responses of firms: firms will develop and deploy capabilities according to whether they interpret external factors as providing opportunities or threats. These external factors must be perceived as strong or influential enough to influence the course or trajectory of capability development and the commitment of resources by the firm (ibid).

The interpretation process may motivate or otherwise disincentivize firms to improve existing capabilities, develop new ones or otherwise induce the "death" or retirement of a particular capability (ibid). This is in line with the 'seizing capability' put forward by Teece (2007) that maintaining (dynamic) capabilities requires the firm to recognize problems and trends and direct or redirect resources and reshape organizational structures to meet up to new challenges.

Empirical studies have shed light on how the interpretation of signals related to "sustainability" and "environment" challenges influence strategic responses in the firm (e.g. Sharma, 2000;

Sharma and Vrendenburg, 1998). Hart (1995) suggests that firms with environmentally-oriented capabilities e.g. for pollution prevention, product stewardship and sustainable development gain sustained competitive advantage by developing a cost advantage over competitors or gaining preferred access to limited resources (e.g. raw materials), new markets of customers, or establishing rules and standards that are tailored to the firm's capabilities (p.995). In the specific case of tourism firms, Hall (2009) notes that the capacity of firms to innovate in relation to 'sustainability' and 'climate change' is largely dependent on the extent to which these can create value from such innovations and differentiate themselves from competitors. The role of management in exerting strategic choice has been widely recognized.

The Role of Top Management in Interpretation of Signals and Decision-Making

Nadkarni and Barr (2008) describe how top managers build a subjective interpretation of the external environment and will give more attention to topics that fit their understanding of the context (p.1398). The authors suggest that top managers' attention focus to particular issues they consider most relevant acts as a filter or screen through which important topics in the external and internal environments are identified whilst others are discarded.

Managers tend to assign labels to an issue in order to analyze the issue as representing a threat or opportunity or based on urgency; this categorization has a significant influence on adaptive responses of the firm (Dutton and Jackson, 1987). For example, in a study on the adoption of voluntary environmental strategies, Sharma (2000) showed that the manager's interpretation of environmental issues as opportunities significantly increased the likelihood of implementing voluntary environment strategies. Managers' responses are guided by the organizational context i.e. the firm's corporate identity and business strategy. In an organisation with a pro-environment strategy, managers devoted more attention and resources to environment issues which were considered strategic therefore the environment acquired a corporate social responsibility focus; on the other hand firms with an economic focus to environmental issues adopted a cost-based performance model business (ibid).

3.6.5.3 - Capabilities to Implement a Response for Action

An important component of a service firm's innovative potential is its human resources and the latter's ability to sustain multiple tasks, including innovative activity (Florida and Atlas, 2001; del Brio *et al*., 2007; Sundbo, 2011).

Modifying Tasks and Practices - Employee Skills and Previous Experience

Sundbo (2011) suggests that an employee's drive to keep an innovative activity going stems from employee creativity and knowledge of the customer. The ability of employees to solve problems that arise in innovation development is a critical characteristic that contributes to the efficiency of the innovation process; Sundbo (2011) refers to this property as the individual's

creativity in the innovation process. Employees' skills, obtained through formal training or on-the-job experience may enhance their motivation and ability to implement innovative ideas (Ramus, 2002). One aspect of innovation is the "ability to ask untraditional questions, find new knowledge and combine it into solutions of the problem" (Sundbo 2010, p.287). It has been loosely defined as the ability to come up with novel and useful ideas on a product or service and the ways of producing and delivering this to the customer (Amabile, 1996).

Apart from professional drive, Florida and Atlas (2001) map other organizational resources needed to operationalize environmental capacity that include the size of staff dedicated to environmental issues, their specialized expertise and aptitude to initiate and champion innovative environmental practices. They found that manufacturing firms with larger staff capacity are more likely to harbour managers that spearhead environmental initiatives. However their study looked specifically at firms with staff dedicated to environmental management and therefore the capabilities they identify in their study refer to specialized environmental resources and capability-building within the firm (ibid).

In an empirical study on the implementation of an environment programme in a multinational hospitality group, Bohdanowicz *et al*., (2011) show that implementing environment programmes often falls outside the day-to-day tasks of staff; therefore keeping staff motivated is key to integrating environmental programmes in operational routines (Bohdanowicz *et al*., 2011). Motivation may arise through personal interest (intrinsic) or through a desire to achieve a particular goal e.g. that specified in the company environmental policy – this is extrinsic motivation (Amabile, 1996).

Re-Organizing Resources and Practices for Problem-Solving

The allocation by the firm of time and resources for problem-solving and innovative activity has also been identified as a determinant of the adoption of environmental strategies (Sharma, 2000). Firms may thus re-deploy their resource assets and competences in order to integrate new or modified elements into the various dimensions of the service function (den Hertog *et al*., 2010). In their framework on service innovation, den Hertog *et al*., (2010) discuss how service firms may re-deploy resources and exploit elements of the service process and service delivery system to innovate or adapt; these elements could include technological opportunities, changes in the service concept and organizational practices. In a similar way, Gallouj (2000) discusses how service firms may re-use elements and components of their existing stock of knowledge or competences in order to produce a service with a new combination of characteristics - he terms this 'recombinative' innovation (p.141). Likewise in a study on the adoption of environmentally-conscious manufacturing, Florida and Atlas (2001) speak of the bundles of practices e.g. work rotation, self-directed work teams and continuous process improvement that create a capacity in the firm to respond to internal opportunities and external events.

Reconfiguring and managing resources is a measure of the ability of a firm to create a better 'fit' with its environment (Teece, 2007); thus organizations leverage or adapt their assets and resources in order to develop more effective competencies that will gain them competitive advantage in rapidly changing environments (ibid).

Taking Initiative towards Innovative Activity

An employee's willingness to take new initiatives may also stem from the support received from top managers and supervisors (Ramus, 2002; Sundbo, 2011). Managers that are supportive of implementing innovative ideas that improve the company's environmental performance typically have a risk-taking approach where it is acceptable to have failures; these managers are therefore more likely to provide resources to encourage and support new ideas and experimentation (Ramus, 2002). Managers that effectively communicate the company's commitment to environmental initiatives also foster creativity and motivation amongst staff (ibid).

According to Sundbo (2011), a high level of top management engagement in the innovation process appears not only to motivate employees but determines how much time and resources are re-directed to innovation (ibid); whereas a focus of management on operational issues stalls the innovation process that subsequently loses momentum. Moreover, Florida and Atlas (2001) show that the relation between top and middle management can matter. Specifically the extent of resource commitment by top management to support local managers in manufacturing plants, affects the extent of adoption of environmental practices.

The framework provides a picture of the firm's innovative potential as residing in the employees' propensity to undertake innovate activity over carrying out routine tasks and their expertise and technical capabilities to adopt innovations, in an environment that is supportive of innovation.

3.7 - An Analytical Framework to Study Adaptation Responses in Traditional Services

The study discusses a traditional service sector, which is the hotel sector in Malta, and how dynamic capabilities may account for environmental action and particularly the adoption of energy efficient technologies and measures. As discussed in Chapter 2, the focus on energy efficiency stems from a policy concern about high energy prices and more generally policies steering environmental responsiveness in hotels. The central theme is to understand how Maltese hotels are adapting to these external pressures and changes. Adaptation is understood as a process through which firms shift towards improved energy efficiency by adopting energy efficient technologies and measures and integrating these in the process of service delivery; and making adjustments in the organization and distribution of activities to achieve improved energy efficiency.

The research problem is addressed by the following three questions:

1. **How can a capabilities-perspective explain the adaptation of a traditional service sector to achieve energy efficiency?**

2. **How does the relation of the service firm with a type of intermediary, the KIBS, influence environmental action and the adoption of energy efficient measures?**

3. **How do policy and other factors external to the service firm influence the adoption of energy efficient technologies and measures?**

Understanding Innovation in Services: The process of how service firms innovate provides useful insight on how these adapt to the goal of achieving energy efficiency. The perspective of service firms as multitasking entities, that are able to carry out operational tasks and exploit existing assets whilst simultaneously innovating, is particularly useful to describe innovation in traditional services that otherwise tend to be routine-oriented (after Sundbo, 2010 and 2011). The analysis does not take a strict focus on the adoption of technological innovations; it looks out for innovations in management practices that affect firm adaptation responses. The literature on service innovation provides an explanation of the types of innovations that service firms adopt; where innovation is happening in the firm; and how innovation is organized in service firms. However it does not explain why and how some service firms innovate one way and others innovate in another way. Thus there is a gap in understanding the differential response behaviour of firms in the same sector.

As discussed in Section 3.2 of this review, the dynamic capabilities approach has been applied to study innovation in services and is subject of increasing theoretical and empirical investigation. Therefore it seems an appropriate approach to use in order to investigate how capabilities may account for different patterns of environmental action in traditional service firms. The literature contributions have constructed models that identify the capabilities firms need in order to innovate (den Hertog *et al*., 2010). However, two issues remain under-explored. One is how dynamic capabilities may differ between firms and how this may influence environmental action and the adoption of environmental innovations. In this research, this aspect is studied in relation to adoption of energy efficient measures. Another issue is that the dynamic capabilities approach has by far focussed on the adoption of technological innovations as a source of competitive advantage; whilst for traditional services this may not apply equally and dynamic capabilities to adopt organizational or management innovations acquire more relevance.

The dynamic capabilities approach is used as the basis to investigate the adoption of environmental innovations as outlined below:

Dynamic capabilities as a multi-dimensional construct: Firms do not possess one or other capability to innovate. Den Hertog *et al*.,'s (2010) model of dynamic capabilities in services identifies six capabilities that firms need in order to adopt service innovations. This means that dynamic capabilities need to be understood as a multi-dimensional construct. The analysis focuses on those capabilities that enable firms to undertake particular cases of environmental innovations and contributes to answering the first research question.

Combinations of Dynamic Capabilities Influencing Firm Response Behaviour: Firms in the same sector exhibit different environmental response behaviours. The aim here is to link the presence of different combinations of capabilities to particular environmental innovations (after den Hertog *et al*., 2010). This part of the analysis also addresses the first research question and makes a contribution to understanding the role of different combinations of capabilities necessary to undertake particular innovations over others.

A framework is built in order to analyze the capabilities across the hotel cases and construct adaptation responses based on the nature and types of capabilities. Looking beyond the boundary of the firm, the study asks about how traditional services obtain external knowledge on energy efficient technologies and measures.

Absorptive Capacity and Intermediation: The study uses the perspective of absorptive capacity to understand how service firms exploit their relation with external actors to obtain knowledge about energy efficiency (after Miles, 2012). In order to answer the second research question, the analysis looks at a particular type of relation of the service firm with the knowledge intensive business service firm, or KIBS and how this may be influencing innovation adoption and environmental action in services. The research posits that service firms may have different levels of absorptive capacity that influence the flows of knowledge and learning between the service firm and the KIBS.

Influence of External Context: The analysis attempts to show how factors external to the firm such as policy, economic climate, the availability of incentives, described in Chapter 2, affect the way service firms choose to innovate and how they exploit relations with external actors in order to innovate. This addresses the third research question.

Linking with the analysis of firm capabilities to adapt to change, the next chapter reviews the relation of service firms with a type of intermediary, the KIBS, and how this can potentially make a difference in the adoption of environmental innovations.

Chapter-4: THE RELATION BETWEEN KNOWLEDGE INTENSIVE BUSINESS SERVICES AND THE CLIENT AS A LOCUS FOR INTERMEDIATION ACTIVITY

4.1 - Introduction

The previous chapter provided the theoretical background to this study by reviewing relevant literature on firm dynamic capabilities to innovate. It put forward an analytical framework on how dynamic capabilities may be used to explicate innovative activity in services. The purpose of this chapter is to broaden the theoretical discussion to address how the interactions amongst firms may be acting as a locus for intermediation and innovation adoption.

The interactions discussed in this study are those between service firms and knowledge intensive business services or KIBS. The KIBS represents a type of intermediary which in innovation studies is discussed typically in relation to its role in knowledge transfer and innovation diffusion (den Hertog, 2000; Hargadon, 2002). The client, and its ability to mobilize absorptive capacity to obtain knowledge from the KIBS, is also emerging as a relevant aspect to consider in the interchanges between KIBS and clients (Miles, 2012). The KIBS-client interface thus becomes the locus where intermediation activity takes place; and the relational dynamics at the KIBS-client interface shape the exchange of knowledge and information at this locus (Webb, 2002; Grimshaw and Miozzo, 2004; Miles, 2012).

The type of KIBS considered in this study is the engineering consulting firm. This can be classified under the ‘resource management’ group of firms within the eco-industry that produce environmental technologies and services as secondary activities (OECD, 1999; EC, 2006). This means that these firms produce services that may actually or potentially be useful for environmental protection and resource minimization although this may not be their prime objective (Randles and Tether, 2002). Such activities may include heat/energy saving and management, renewable energies and the management of the water supply (OECD, 1999).

After introducing the concept of the KIBS-client interface in Section 4.2, the chapter reviews KIBS and their role in intermediation in Section 4.3; this also includes a justification for the choice of KIBS as a type of intermediary. It subsequently looks at the client-side of the relation (Section 4.4); and then discusses the KIBS-client interface as a locus where knowledge flows and exchanges are taking place (Section 4.5). The final Section 4.6 provides a summary and highlights the contributions to knowledge that the study intends to make.

4.2 - The KIBS-Client Interface as a Locus for Intermediation Activity

Miles (2005) and den Hertog (2000) posit that in a KIBS-client relation, the ability of the client to use and exploit external knowledge becomes contingent not only on the client's prior knowledge but also on the ability of the KIBS to understand the client's needs and provide adequate solutions. Therefore the exchanges occurring at the KIBS-client interface, in terms of flows of knowledge and information, largely depend on the skills and capabilities present both on the KIBS' side and on the client's side (Miles, 2012). This means that the relation is best studied by analyzing both the KIBS and the client characteristics, an aspect that has often been overlooked in the literature.

The role of the KIBS is to support their clients' business processes by providing solutions to the problems that these encounter (Salter and Tether, 2006; Miles, 2012). As a type of intermediary, KIBS operate between the external environment and the client firm; and in this role they have the potential to influence and transform their client's routines and business practices, acting as change agents in the innovation process (Rogers, 2003).

In turn, the client must be able to exploit its relation with KIBS, in order to acquire new knowledge and assimilate this in the firm (Miles, 2012). In other words, the client needs an absorptive capacity in order to innovate. The previous chapter introduced absorptive capacity as a type of dynamic capability (see Section 3.6.2 on p.54). In this study, absorptive capacity is understood as a firm's capability to exploit relations with external actors (Agarwal and Selen, 2009; Jimenez *et al*., 2010; Miles, 2012). This is different to the definition provided by Cohen and Levinthal (1990) that focuses on the acquisition and exploitation of R&D related knowledge and how this is applied to develop technological innovations. It is considered particularly relevant for services that are not R&D based. Jimenez *et al*., (2010) define absorptive capacity in services as a firm's ability "to identify and recognize knowledge and relationships, make sense of them and embed them in an organization's value systems" (p.9). This perspective of client absorptive capacity is employed as an entry point to discuss the relation of the client with the KIBS and how this influences intermediation activity.

The research interprets intermediation activity as depending on the relational dynamics between the KIBS and the client. Thus, rather than focus on the diversity of types and forms of intermediaries (as in van Lente *et al*., 2003 or Moss, 2011), it takes the two entities in the relation (the KIBS and the client) and builds an analysis on how each of these actor's characteristics may be influencing intermediation activity and innovation adoption.

4.3 - KIBS as a Type of Intermediary

4.3.1 - Justifying the focus on KIBS

As outlined briefly in Chapter 1, the decision to focus on KIBS as an external knowledge source, stemmed from the initial empirical investigation which revealed that a type of KIBS, the engineering consulting firm, may be playing an important role in providing technical solutions to hotels, including on aspects related to energy efficiency. Apart from the empirical relevance, the choice to study KIBS as a type of intermediary is also of theoretical interest.

The relations of service firms with their customers and with suppliers have been extensively studied (e.g. Pavitt, 1984; von Hippel, 2009); whilst research exploring the relations of service firms with other types of actors is under-researched. Moreover, there are relatively few studies that take an in-depth look at the relation between a client and a service provider, with special reference to KIBS (see for e.g. Webb, 2002; Grimshaw and Miozzo, 2004). Pittaway *et al*., (2004) suggest that the role of third parties, including consultants, in innovation in services is under-explored; intuitively they suggest that these third parties are important in the development of informal relationships though the modality and extent to which such relations may influence innovation requires further investigation (ibid).

Tether and Tajar's (2008) analysis of CIS 3[34] data shows that service firms are more likely to maintain links with consultants when tapping specialist knowledge other than using the public science base, corroborating previous work that such knowledge providers may be gaining ground as a 'second' knowledge infrastructure, bridging the gap between the demand and the supply side (den Hertog, 2000). Moreover, service providers with specialized knowledge occasionally play an important role for the innovation strategies of mature sectors since they have specialist competences and can help address technical-related or market-related issues (Hirsch-Kreinsen, 2008).

Due to their function in the knowledge infrastructure of national and regional innovation systems, KIBS have generated considerable research interest (Muller and Zenker, 2001; Miles, 2005). They are considered as intermediaries between the generic knowledge available in the economy and the client-firm's specific knowledge base (Strambach, 2008; Toivonen, 2009).

4.3.2 - Classifying Types of Knowledge Intensive Business Service Firms

KIBS are firms that provide knowledge-intensive inputs to the business processes of other organizations including private and public sector clients (Strambach, 2008; Muller and Doloreux, 2009). They either exist as independent service companies or may be organized as units within

[34] CIS is the Community Innovation Survey undertaken in the 27 Member States of the European Union that collects information at national level on innovation activities of enterprises, as well as various aspects of the innovation process such as the effects of innovation, sources of information used, costs etc. The baseline data for CIS3 was 2000-2001, Eurostat (www.epp.eurostat.ec.europa.eu) accessed March 2013.

industrial firms. This definition incorporates elements from various authors' work (Miles *et al*., 1995, den Hertog, 2000) and stresses the 'knowledge intensity' of the service provided, and the client-centred character of the interaction (Muller and Zenker, 2001).

In terms of types of KIBS, Miles *et al*., (1995) distinguish two main categories. The 'traditional' professional services KIBS (p-KIBS) that provide professional services to the client firm are typically lawyers and accountants; whilst 'new' technology based service firms (T-KIBS) make use of science and technology related knowledge and technical activities and may include IT-related services, engineering and R&D consulting (Muller and Doloreux 2009). A third group, that of KIBS dealing with the creative industry (media, graphic design etc.), is an emerging category (Miles, 2012). In addition to the 'hard'-type technical functions of KIBS, another soft function is emerging for KIBS offering management and organizational support (Bessant and Rush, 1995). The T-KIBS are the focus of this study.

The next section provides a brief introduction on the concept of an intermediary and subsequently focuses on KIBS as a type of intermediary in the innovation process.

4.3.3 - Intermediaries and their Role in Technology Transfer and Innovation Adoption

The concept of 'intermediary' has been adopted across many different disciplines including culture, planning, welfare, media, innovation and aspects of socio-technical change (Howells, 2006; Moss *et al*., 2009). It originally gathered attention in the field of financial transactions where financial intermediaries act as 'middle-men' between the buyer and seller (Rousseau and Wachtel, 1998). This review intends to focus on a growing body of knowledge on intermediation that is rooted in the innovation systems and management literatures and the literature on socio-technical change.

Intermediaries are defined by their "in-between-ness" sitting between actors in the innovation system (Moss *et al*., 2009). In innovation management, several taxonomies of intermediaries have been constructed, reflecting a broad organizational and functional diversity within the group; for example see van Lente *et al*., (2003). Thus there is no one common definition of an intermediary. Howells (2006) provides a broad definition of an intermediary as "an organisation or body that acts as an agent or broker in any aspect of the innovation process between two or more parties" (p.720). Rogers (2003) describes intermediaries as change agents acting between a resource system and a client system and whose role is targeted at changing human behaviour.

Though very broad, these definitions incorporate both functional and relational roles of intermediaries. Thus intermediaries can be agents that act between firms in technology transfer, such as consultants and other knowledge intensive business service firms (Bessant and Rush, 1995; Miles *et al*., 1995); they include agents acting between firms and knowledge institutions (e.g. technology transfer offices, science/business parks) and others that play a more strategic

role at the interface between policy and industry (OECD 2006); the latter could include research councils, funding bodies and universities. In the 'systems of innovation' perspective, a new type of innovation intermediary is emerging whose *raison d'etre* is to facilitate and support implementation of innovation projects between the sources and users of innovation (van Lente *et al*., 2003; Klerkx and Leeuwis, 2008).

Latour (2005) distinguishes between an intermediary as a conduit of information or knowledge, "transporting meaning or force without transformation" and a mediator that 'transform[s], translate[s], distort[s] and modif[ies] the meaning or elements [it] carries" (p.39). In so far as this study intends to analyze the 'transformative' potential of intermediaries, it uses Latour's description of a mediator to describe an intermediary. Therefore the intermediary does not remain simply a 'carrier' of information and knowledge but plays an active role in the 'intermediation space' by re-aligning preferences of actors, understandings, practices and meanings (Beveridge and Guy, 2009). This turns around the perception of an intermediary as a 'neutral' mediator to one where the intermediary influences and possibly shapes actors' responses and behaviour (Moss *et al*., 2009; Randles and Mander, 2011).

4.3.4 - KIBS as Intermediaries in the Innovation Process

A broad description of the intermediation function of KIBS is provided by the OECD (2006): this may range from translating users' problems into technological solutions, providing new knowledge to deal with these problems; matching users' needs with available technology or increasing awareness and information on the benefits of particular technologies. Apart from bridging information and knowledge gaps, various authors point at the role of KIBS in overcoming managerial gaps and cultural and cognitive gaps in relation to the innovation process (Bessant and Rush, 1995; Klerks and Leeuwis, 2008).

The intermediary role is particularly fitting to KIBS because they are typically well-embedded in networks and maintain contacts with different stakeholders that may include public institutions, chambers and a vast client base; thus KIBS may act as bridges in innovation and knowledge transmission between different actors and different levels, from regional to national systems (Toivonen, 2009).

Empirical studies investigating KIBS' role in intermediation treat intermediation as an "inbuilt" function of the KIBS that arises either as part of the core business – these are the innovation intermediary KIBS - or as a "by-product" of their activities as in traditional KIBS. The innovation intermediary KIBS acts as a facilitator of the innovation process by providing support to the client in the innovation process but the innovation does not arise from the KIBS itself. In traditional KIBS, the KIBS firm acts either as a source of innovation where it initiates and develops innovations for the client or as a carrier of innovation where it transfers an innovation into the client (Miles *et al*., 1995; den Hertog, 2000).

4.3.5 - Environmental Services KIBS

As outlined in the introduction to this chapter, the research focuses on KIBS that are directly or indirectly involved in delivering environmental services. Miles (1997) analyzed a group of 100 UK-based KIBS offering environmental services. His study showed that businesses seek the use of environmental services mainly in response to regulatory pressures and in some cases to achieve sustainable development or simply in an attempt to reduce the usage of energy, water and other material resources.

Miles (1997) identified different approaches by which KIBS may facilitate technology transfer and innovation in the client firm with different levels of involvement of the KIBS in the adoption process. There are KIBS that are merely involved in choosing off-the-shelf-solutions and technologies for their clients to those with a more direct involvement in developing new knowledge that goes with defining client problems as with professional diagnostic services (e.g. environmental management consulting, audits, reports and analytical services) and problem-solving consultancy services that provide knowledge and capabilities to implement technical solutions for their clients e.g. waste management consulting, monitoring systems design, process plant design, eco-design (ibid).

There are two possible loci for innovation. One lies within the KIBS firm themselves as these pursue new environmental technologies and services in order to expand their markets. Another locus lies at the KIBS-client boundary whereby, by providing strategic inputs to their client (e.g., on choosing particular technologies or systems), KIBS may direct and inform the client's innovative efforts (Miles, 1997).

The above review on the role of KIBS in innovation has thrown light on their dual role of producing and intermediating innovation-related knowledge (Miles, 2005). Miles *et al*., (1995) describe KIBS as intermediating "between scientific and technological development ('invention') and practical innovation including diffusion and application, and leading to the change of routines in companies" (p.27). The following section looks at the client-side of the KIBS-client relation and proceeds with a more in depth analysis of the KIBS-client interface.

4.4 - Unpacking the client firm: who is the KIBS dealing with?

The client perspective of the KIBS-client relation has gained importance and academic interest (Miles, 2012). Hislop (2002) makes a case for the proactive role of the client organization in shaping its relation with consultants. In his study on four organizations implementing similar technological innovations, he shows that client behaviour influences the client's relation with the consultant such as the level of power and autonomy granted to the consultants when taking decisions on technology adoption. Clients prefer to work with consultants with whom they have established relations relying on 'reputational knowledge' in order to reduce the uncertainty of having to entrust the work to external unknown individuals in short-term projects (Hislop, 2002).

In such circumstances, the role of the consultant is no longer viewed as being 'external' to the firm but becomes somewhat 'internalized' (Sturdy and Wright, 2011).

Although the client-firm is often treated as a homogeneous unit, to some authors this seems an over-simplification. In a client organization, there may be ambiguity on who the client actually is, what the problem is and where the knowledge lies. In fact, Schein (1997) attempts to classify different types of 'client' in terms of who the contact person is, who owns the problem and who will eventually be affected by the interventions implemented; according to Schein (1997) this helps the consultant better identify and target the problem area.

Alvesson *et al*., (2009) speak of unpacking the client firm based on the "division of labour within the client and associated positions, the relations within the client system and the differentiated logics of perceiving, valuing and reasoning within groups of client people" (p.256). So, there may be actors within the client firm that identify with the goals of a project, others that may be skeptical and even hostile about implementing solutions suggested by the consultant. Likewise, Miles (2012) discusses on how the client organizes its relation with the KIBS in terms of how the interface is managed, which individuals within the firm are engaged, and how information and knowledge is shared within the client firm.

In a comparative study on IT outsourcing in the UK and Germany, Grimshaw and Miozzo (2004) identify the 'smart' client characteristics needed to manage the relation with KIBS suppliers of IT-related services. One key aspect is the nature of the interaction with the KIBS, that may be based on formal or informal relations and the level of trust and 'closeness' established therein; other client-related features that determine how much the client gains from the relation include the client's level of technical know-how and capabilities related to the management and design of outsourcing contracts.

The above points at the importance of unpacking the client firm when discussing the relation with KIBS and identifying those client characteristics that may be influencing the flows occurring at the KIBS-client interface. After having reviewed aspects of the KIBS and the client, the next section addresses both elements of the relation together.

4.5 - The KIBS-Client Interface

In this study, intermediation is interpreted as an activity occurring at the KIBS-client interface that is shaped by the characteristics of both the KIBS-intermediary and the client (after Howells, 2006). Therefore the flows and exchanges of information and knowledge about energy efficient measures and technologies are shaped by the relations established between the two entities. This means that the presence of the intermediary alone cannot account for intermediation for innovation adoption but intermediation activity lies in the dynamics of the relation between the

KIBS and its client. The following sections highlight key aspects of this interface and the knowledge flows occurring therein.

4.5.1 - Exchanges at the KIBS-Client Interface

Two criticisms are brought forward on how the KIBS-client relation has been tackled in the literature. First is the fact that this has typically been studied by taking the two entities in the relation apart and understanding how each functions in isolation. There is a research bias towards the KIBS-side and what the KIBS brings to this relation and how this may influence innovation within the KIBS. Secondly, even fewer studies have looked at the dynamics of the interaction between KIBS and their clients despite the fact that this interaction is at the base of knowledge creation and processing (den Hertog 2000; Strambach, 2008).

One such study by Webb (2002) is an in-depth analysis of the implementation of an emailing system in a major UK financial institution. Webb (2002) identifies the types, modes and direction of knowledge transmission between the client and the KIBS. He maps the type of knowledge exchange occurring at different stages of the service delivery process (codified and tacit, common and social knowledge) and the main actors involved in knowledge transmission over time. Webb (2002) highlights the importance of social knowledge, i.e. looking at the organizational culture and values of both KIBS and client, and negotiation skills, in knowledge exchange.

The study by Webb (2002) confirms previous literature that the client's ability to interface with the KIBS is an important determinant of the impacts of their use; Miles (2005) likens this to the notion of 'absorptive capacity'. Likewise the ability of the KIBS to understand the client's needs and provide adequate solutions influences the client firm's capacity to acquire and assimilate knowledge.

In organizational marketing, the relation between the client and a service provider has been described as a proactive process of "creating, developing and maintaining committed interactive and profitable exchanges with partners over time" (Harker, 1999 p.16). In a study focussing on the delivery of logistics services, Panayides and So (2005) suggest that the relational orientation of the client and its service provider creates a 'positive learning climate' which enhances the ability of the client to "develop, acquire and process market information" (p.183). They identify a positive correlation between relational exchange and an organization's ability to learn which in turn influences the effectiveness of delivery of the logistics service. Partners in the relation are better able to assess when and how to contribute and draw on each other's resources (ibid). Grimshaw and Miozzo (2004) studying the outsourcing of IT services, also suggest that the proximity and frequency of interaction between the KIBS and the client are features that determine the success of the outsourcing function.

Similarly Agarwal and Selen (2009), investigating the impact of value networks on service innovation, identify collaboration as a 'higher order' skill or dynamic capability that helps firms to

realign and reconfigure resources in the service innovation process; they describe the collaborative aspect of service networks as a dynamic capability of firms.

A recent study by Weigelt and Sarkar (2012) uses a capabilities perspective to discuss how outsourcing may impact on the client's adaptability. According to these authors, outsourcing functions to KIBS may compromise a company's ability to adapt to new emerging situations in their environment; thus limiting their ambidexterity (refer back to Section 3.5 on p. 48). There is a tradeoff between the efficiency gains from outsourcing and the adaptability of the firm. By taking the example of the introduction of internet services in the UK banking sector, the authors demonstrate that companies that pursue an outsourcing strategy when adopting new technologies are likely to be less adaptable, as they do not build internal competencies that they can deploy to adopt technological innovations. Companies with capabilities for complex problem-solving are better placed to assimilate knowledge coming from their outsourcing partners (ibid); in other words they have an enhanced absorptive capacity that enables them to build ambidexterity.

4.5.2 - Knowledge Flows across the KIBS-client Interface

Den Hertog and Bilderbeek (1998) describe the KIBS-client relation as a symbiotic relation which in biological terms is a close interaction typically evolving over the longer term. The symbiosis is a 'win-win' situation where the KIBS profits as much as the client from the knowledge flows generated during the interaction. Thus, KIBS act by speeding up knowledge creation and transfer or innovation processes in the client firm and in turn benefit from the relation (ibid).

Strambach (2008) suggests that KIBS are drivers of knowledge dynamics, thus they create, transform and transfer knowledge to the client by integrating or contextualizing different knowledge stocks or knowledge bases and adapting these to the needs of the client. The intermediary role of the KIBS is thus to bridge between the generic knowledge pool, represented as different stocks of knowledge and the specific context of the client. Similarly, KIBS can de-contextualize knowledge and the experience accumulated from a particular project with one client to develop new products with a new client (ibid).

However, the amount of learning on the client side may be limited by the client's level of interaction with the KIBS, whose specialist knowledge may be far removed from the core activity of the client (Miles, 2012); or by what motivates the client to source the KIBS' knowledge, for example knowledge sourced externally is often considered more valid than that arising internally (ibid).

Other than viewing knowledge as being embodied in individuals (as tacit knowledge) or in artifacts (explicit knowledge), Brown and Duguid (1991) describe knowledge as being situated in a particular practice i.e. it refers to knowledge that individuals or firms possess in order to perform and carry out particular tasks and solve new problems. KIBS become boundary

spanners between situated knowledge residing with the firm and new knowledge; and the process of knowledge transfer becomes one of transformation from knowledge embedded in current practices to knowledge that allows for new practices and ways of dealing with problems (Carlile, 2002).

4.5.3 - Professional Relations

One aspect of the KIBS-client relation that influences the knowledge creation and transfer process is the level of interactivity amongst the parties involved and what this means for the relation. When analysing business networks, Tordoir (1995) discusses three modes of interaction that may arise between suppliers of professional business (management) services and client firms. Tordoir's classification is based on the frequency of interaction, degree of interactivity (high-low) and the nature of the exchange among the parties involved (which actors are involved, their competencies). He describes three types of relations:

- Sparring relations are common amongst consultancies and top managers and are based on a long term relation involving mutual exchanges of information between the two parties involved; they are the most interactive type of relation where both the client and the consultant invest time and competencies;

- Jobbing relations involve the external expert, usually a professional business service provider, providing a more or less standard task specified by the client (e.g. project-based services); the extent of client-service provider relation is restricted to the beginning of the service provision process and presentation of the results at the end;

- Finally, sales relations are opposite to sparring relations where professional services are sold in a standardized format; they are often 'turnkey solutions' to problems.

In Tordoir's (1995) framework, high interactivity offers greater potential for knowledge generation and learning; thus sparring relations are assumed to have a greater impact on the client-firm in terms of the KIBS influencing the technological and strategic trajectory of the client. This assumption would benefit from further empirical evidence.

Tordoir (1995) presupposes that only client-firms having certain internal professional 'capacity' can adequately use and manage external professional services; he calls this the "compatibility" hypothesis and is similar to the notion of 'smart client' developed by Grimshaw and Miozzo (2004). According to Tordoir (1995), this internal capacity depends on the size of the client firm (employment and activity), the decision-making structure, the type of technologies used and turbulence levels within and outside the firm.

The 'compatibility' between the client firm and the KIBS can be linked back to the ability of the client to assimilate expert knowledge and thus to its absorptive capacity. Tordoir (1995) focuses

on ‘physical’ elements of the client firm (size, employment) and level of competencies as the basis for interactivity at the KIBS-client interface. Another relevant dimension is the cognitive capacity of the actors and how this affects knowledge transfer (Miles, 2012).

4.5.4 - Crossing the Cognitive Boundary: Who is Making Sense of What?

The notion of cognitive distance or the degree of alignment of ‘mental categories’ between the client and the KIBS in the KIBS-client relation is an important factor in understanding the challenges associated with transferring knowledge and making sense of this knowledge (Nooteboom, 2000). Cognitive capacity essentially relates to how actors think about things and what attention they give to particular issues or problems. Nooteboom (2000) speaks of communication as bridging cognitive distance by making ‘common’ sense of the world and bringing the absorptive capacities of two entities closer; but if cognitive distance decreases in such a way as to create overlap of absorptive capacities then this may eliminate novelty and exploration in the knowledge transfer process.

Another relevant aspect of inter-firm relations is the degree to which interacting parties share a common understanding of the phenomenon at hand, what their perceptions on an issue are or problem and how they interpret and evaluate it. This ‘cognitive proximity’ affects actors’ ability to utilize and deploy “complementary capabilities” in order to achieve “a common goal” (Nooteboom, 2000 p.71). So, the cognitive capacities of firms are deemed critical for absorptive capacity (Nooteboom, 2000). In their bridging function, KIBS may motivate the client to take their interests “at heart”, by exposing the client to new or broader choices (Nooteboom 2000 p.77); thus bridging the cognitive gap between the actors.

4.6 - New Perspectives on Intermediation: Emerging Gaps from the Literature Review

Although the literature has provided ample examples of who intermediaries are and what they do, there is a gap in understanding how the relations between KIBS, as a type of intermediary, and their client may influence intermediation activity (Howells 2006). In particular, studies addressing the role of KIBS in technology transfer and innovation adoption have tended to focus on the KIBS-side of the relation. Research contributions focusing on the KIBS-client relation show that the characteristics of both actors, in terms of their knowledge base and cognitive understanding and their capabilities for innovation, shape the interactions and flows at the KIBS-client interface (Grimshaw and Miozzo, 2004; Strambach, 2008; Miles, 2012). This aspect deserves further analytical investigation.

This research intends to contribute to current studies by building an in-depth analysis of inter-firm relations that unpacks the KIBS and client-firm in terms of how these actors interpret issues and problems, what attention they devote to particular issues over others and linking this to the level of interactivity in the KIBS-client relation. In so doing, it intends to contribute a deeper

understanding of intermediation activity which in this study relates to the potential for exchange of knowledge and learning about energy efficient technologies and measures. It focuses on the KIBS-client relation and how the interaction with the client influences the adoption of environmental innovations.

Another contribution of the study is to disentangle further the notion of absorptive capacity in a traditional service sector. The client's capability to exploit its relation with the KIBS, in terms of flows of knowledge and information, deserve further attention (after Miles, 2012).

The next chapter re-proposes the research questions and presents the research methodology designed to address these.

Chapter-5: METHODOLOGY

5.1 - Introduction

The scope of the research is to investigate how traditional service firms shift towards trajectories characterized by improved energy efficiency and the processes that enable environmental action. It develops an in-depth analysis of firm capabilities and how these may account for the heterogeneous adaptation responses in firms belonging in the same sector.

In order to investigate this research problem, a qualitative study is built that draws from interview data with hotels, engineering consulting firms and actors in the wider institutional context in Malta.

This chapter first recalls the research questions in Section 5.2 and then presents the research strategy and rationale in Section 5.3. A detailed explanation and justification for the selection of the hotel cases and knowledge intensive business service firms follows in Section 5.4 together with an outline of the methods used for data collection; as well as a discussion on the data analysis in Section 5.5. In Section 5.6 a summary of the research questions and methods of analysis is presented.

5.2 - Research Scope and Research Questions

As discussed in Chapter 3, the study focuses on adaptation at the firm level. Firms adapt to cope with change in their external environment; such adaptation can be a matter of survival or of gaining competitive advantage (Chakravarthy, 1982). In the context of this study, adaptation is understood as a process through which the firm shifts towards enhanced energy efficiency. One aspect of adaptation concerns the adoption of energy efficient technologies and measures and how these are integrated into existing activities in the firm. Another aspect of adaptation is the way the firm makes adjustments in its organizational structure and therefore how it organizes and distributes activities and coordinates these activities to achieve improved energy efficiency.

The adoption of energy efficiency measures occurs principally in the technical aspects of the hotel's operations and is investigated mainly in back-office activities. Therefore, the firm is likely to draw on a specific set of organizational resources and capabilities that may differ from those needed to implement a new service experience or solution. The empirical investigation also revealed that these hotels maintain links with engineering consulting firms, a type of knowledge intensive business service (KIBS) and this served as an inroad to analyze the role that these actors might be playing as intermediaries in the adoption of energy efficiency in hotels. The role

of factors present in the external context in influencing firm adaptation is the subject of the third theme.

Based on the above considerations and on the review of the literature in Chapters 3 and 4, the study re-proposes the three research questions that address the research problem.

Service Firm Capabilities for Environmental Action

Research Question 1: How can a capabilities-perspective explain the adaptation of a traditional service sector to achieve energy efficiency?

As discussed in Chapter 3, the dynamic capabilities approach is widely used to explain firm adaptation responses (Teece, 2007; Helfat and Peteraf, 2009). This study intends making a contribution to a discussion on capabilities in the context of traditional services and in order to do so, it proposes the following sub-questions:

- What internal capabilities do traditional services possess that enable them to adopt energy efficient measures and practices?
- How do capabilities differ amongst firms in the same sector and how may these differences account for the differential responses of firms?

Drawing from den Hertog *et al*.,'s (2010) model of dynamic service innovation capabilities, this thesis explores the *combinations* of capabilities that support the innovation process (Sundbo, 2011); specifically it looks at capabilities for the adoption of energy efficiency measures that occur principally in the back-office activities. The view is that of a 'multitasking' firm that adopts environmental innovations whilst keeping the service running (after Sundbo, 2011). In order to answer the questions posed, the analysis focuses on:

- Characterizing service firm capabilities drawing from theoretical insights on dynamic capabilities and innovation in services;
- Explaining firm differential responses by exploring whether and how capabilities differ amongst the hotels investigated and constructing different adaptation modes to reflect this diversity;
- Linking capabilities to the environmental response behaviour of firms.

These issues are addressed by drawing from interviews with nineteen hotel cases.

Intermediation Activity at the KIBS-Client Interface

Research Question 2: How does the relation of the service firm with a type of intermediary, the KIBS, influence environmental action and the adoption of energy efficient measures?

The literature review in Chapter 4 identified that intermediation activity is shaped by the characteristics of both the KIBS and the service firm (Miles, 2012). In this study, intermediation activity relates to exchanges and flows of knowledge about energy efficiency measures between the two classes of actors. Whereas many studies have focused on the KIBS-side of the relation, this research, through its second question, analyzes the dynamics at the KIBS-client interface and how these may together influence intermediation activity. The sub-questions are:

- When do KIBS take up the role of change agents in influencing the adoption of energy efficient measures and practices in their clients?
- Which aspects of the KIBS-client relation influence environmental action in the client-firm?

The question examines the client perspective of the KIBS-client relation by taking the perspective of absorptive capacity, or the service firm's ability to exploit its relation with KIBS, in order to adopt energy efficient technologies and measures.

There are two levels of analysis that help answer these questions:

- One level of analysis focuses on the KIBS as an intermediary in the adoption of energy efficient technologies and measures. This part draws from interviews undertaken with engineering consulting firms;
- Another level of analysis takes the KIBS and the hotels together and investigates the characteristics of the relation between these two classes of actors, and how these may be affecting intermediation activity. In order to do so, the analysis identifies pairs of engineering consulting firms that have a professional relation with the hotels investigated in this study.

The Influence of the External Context on Firm Adaptation

Research Question 3: How do policy and other factors external to the service firm influence the adoption of energy efficient technologies and measures?

This aspect is not well-developed from a theoretical perspective – it would have opened up a black-box of how firms respond to regulation, standards and competition etc.; and this was beyond the scope of this study. The interest is in the role that the external environment plays, with its heterogeneous signals, in shaping firm adaptation responses. A qualitative analysis of the data collected from interviews with hotels, engineering consulting firms and actors in the institutional environment is conducted to investigate this research question.

The analytical framework is summarized in Table 5.1 below.

Table 5.1 An Analytical Framework to Investigate the Research Problem: Bridging Between Theory and the Empirical Analysis

Theoretical Perspectives	Characterizing the Adaptation Response in Traditional Services	Gaps in the Literature	Research Question	Sub-Questions and Area of Investigation	Empirical Analysis
The Firm as an Adaptable Entity	Engaging in innovative activity whilst maintaining operations running (Sundbo, 2011); Taking initiative beyond day-to-day tasks (Hellmann and Thiele, 2011).	Understanding differential adaptation responses across firms in the same sector; Accounting for the role of capabilities in firms' differential responses and innovation patterns; Understanding the role of capabilities to integrate innovative environmental technologies in service delivery process;	How can a capabilities-perspective explain the adaptation of a traditional service sector to achieve energy efficiency?	*What internal capabilities do traditional services possess that enable them to adopt energy efficient measures and practices?* Characterizing service firm capabilities to adopt energy efficient innovations.	Hotel cross- case analysis to develop a capabilities framework for adaptation in traditional services.
Dynamic Capabilities to Adapt and Innovate:	Capabilities to manage and leverage resources in order to respond to change (Teece, 2007); Capabilities to support innovative activity (Sundbo, 2011) and modify aspects of the service or produce a service with a new combination of characteristics: (den Hertog, 2010; Gallouj, 2000).			*How do capabilities differ amongst firms in the same sector and how may these differences account for the differential responses of firms?* Building adaptation patterns to explore whether and how capabilities differ amongst hotels.	Clustering hotel cases according to the combination of capabilities possessed. Linking hotel adaptation patterns and environmental response behaviour.
Intermediation Activity at the KIBS-Client Interface	Recognizing the value of external information and using this to innovate (Cohen and Levinthal, 1980); Exploiting networks and relationships with external actors to innovate (Agarwal and Selen, 2009; Jimenez *et al*., 2010); Services absorptive capacity to obtain knowledge from KIBS (Miles, 2012).	Understanding intermediation as a relational activity; Deepening an understanding of the characteristics of the KIBS and client that determine the exchanges and flows at the KIBS-client interface Explicating further the notion of absorptive capacity in traditional services.	*How does the relation of the service firm with a type of intermediary, the KIBS, influence environmental action and the adoption of energy efficient measures?*	*When do KIBS take up the role of change agents in influencing the adoption of energy efficient measures and practices in their clients?* Investigating the KIBS's role as an intermediary in innovation adoption.	Exploring the role that consulting engineering firms may be playing in the adoption of energy efficient technologies and measures.
				Which aspects of the KIBS-client relation influence the adoption of energy efficiency measures in the client-firm? Investigating the relational 'space' between the hotel and the KIBS.	Analysing pairs of hotels and consulting engineering firms to identify patterns of interaction between hotels and KIBS.
Influence of External Context:	Responding to factors present in the broader context that shape firm behaviour and strategy (Hoffman, 2001) Adapting to 'environment' and 'sustainability' stimuli through internal capabilities (Berkhout *et al*., 2006);	-	*How do policy and other factors external to the service firm influence the adoption of energy efficient technologies and measures?*	Factors in the external environment that influence environmental action in service firms.	Qualitative analysis of interview data.

5.3 - Research Strategy

5.3.1 Research Philosophy

The philosophical stance adopted in this study is that of critical realism that uses the interplay between theory and observation to produce a coherent description and explanation of the 'real' world. The basic ontological assumption in critical realism is that reality exists and is independent of the observer and that this reality is stratified in three domains: the researcher operating in the empirical domain makes observations and produces explanations of observable events occurring in the actual world as a result of structures and behaviours present in the real world (Sayer, 1992).

Critical realism steers away from claims about the 'truth' that reflect a complete understanding of the real world (Sayer, 1992). Thus it does not set out to explain the events *per se* but the underling processes or mechanisms that are causal to these events and thus provides an in-depth explanation and understanding of "why things are as they are" (Easton, 2010). Applying these perspectives to this study, the empirical data about hotel environmental response behaviour, which represents the empirical domain, is taken to be the result of the presence of particular capabilities that explain the behaviour of these firms observed in the actual world. The hotels' environmental response behaviour is specific to a context of a traditional sector facing particular challenges relating to energy pricing and a growing environmental awareness (the real world).

Critical realism rejects linear causality: although mechanisms are casual to the events they trigger, they do not always produce the same outcome. Capabilities for adaptation are not the sum of individual firm capabilities but a combination of the properties of different types of capabilities that occur within a particular social context in which actors are embedded and processes take place (Blaikie, 2000). Therefore the aim of critical realism is to contribute to theory on the causal explanations of these events or behaviours and not to predict their outcome.

5.3.2 – Qualitative Case-Based Approach

The choice of undertaking a qualitative study stemmed from the need to go beyond merely establishing the presence and frequency of particular behaviours, such as the frequency of adoption of environmental technologies or the degree of compliance of firms to environmental regulation as provided by quantitative analysis, and explain the behaviour of firms in their natural setting (Creswell, 2007).

In particular, research on the topic of environmental behaviour in hospitality has amply focused on quantitative approaches, principally surveys to determine the number and types of environment measures adopted and barriers to adoption (e.g. Bohdanowicz *et al*., 2001; Molina-

Azorin *et al*., 2009); or surveys of customer attitudes towards environment strategies (see for e.g. Dalton *et al*., 2008).

Moreover since the study of capabilities in mature services is relatively under-researched compared to that in high technology sectors (den Hertog *et al*, 2010), a qualitative approach is particularly valuable in exploring processes and patterns that are not easily measureable. One of the most appealing aspects of undertaking case study research is the depth with which the research problem can be studied in a 'real-life context' using multiple sources of information (Yin, 2003). This was a particularly valuable research strategy to study the nature of capabilities and build explanations of how these can account for firm behaviour and adaptation.

The study relies on data collected from nineteen hotel cases selected from amongst hotels that were active in adopting environmental innovations. It then pairs fifteen hotels, for which data was available, with corresponding engineering consulting firms. In order to do so, the hotel respondents were asked to identify a KIBS firm with which they maintained a business relation. Selecting a single case would not have provided for a sufficiently robust method through which to develop theoretical propositions on capabilities in hotels and to make generalizations about capabilities for adaptation in traditional services as this study set out to achieve (Yin, 2003). The cases are explanatory in answering questions about "which" capabilities characterize service firms and how these explain firm adaptation behaviour and have exploratory elements in dealing with "how" these capabilities bring about adaptation.

The reporting on the cases is presented by theme i.e. by the nature of the capabilities in the firm (de Vaus, 2001); and the various cases are discussed across themes (capabilities) rather than on a case-by-case basis because this brought in better evidence the characteristics of the capabilities across firms and facilitated the cross-case analysis. Therefore elaborate narratives of each hotel-case were avoided as they were not informative for this research. A similar approach was adopted for the fifteen pairs of hotels and KIBS that were analyzed on the basis of the types of interactions between the firms other than by considering each of the pairs and building descriptive narratives about the relational dynamics.

The selection of cases was equally critical as discussed in Section 5.4.4 below. The interest was not to have a 'homogenous' set of cases that were "saying the same thing" about capabilities but to also include cases that brought to the fore divergent examples of the nature of capabilities which contributed to developing theoretical prepositions on capabilities in traditional service firms (Eisenhardt, 1989; Yin, 2003). This logic of replication, where the information from the cases is used to build and extend emergent theory, is possible when using a multiple case-based approach (Yin, 2003).

In terms of number, cases were selected until these did not produce any further discovery (Denscombe, 1998; Creswell, 2007) and until there was sufficient confidence that the data could answer the first two research questions on the types of capabilities and on the relations with

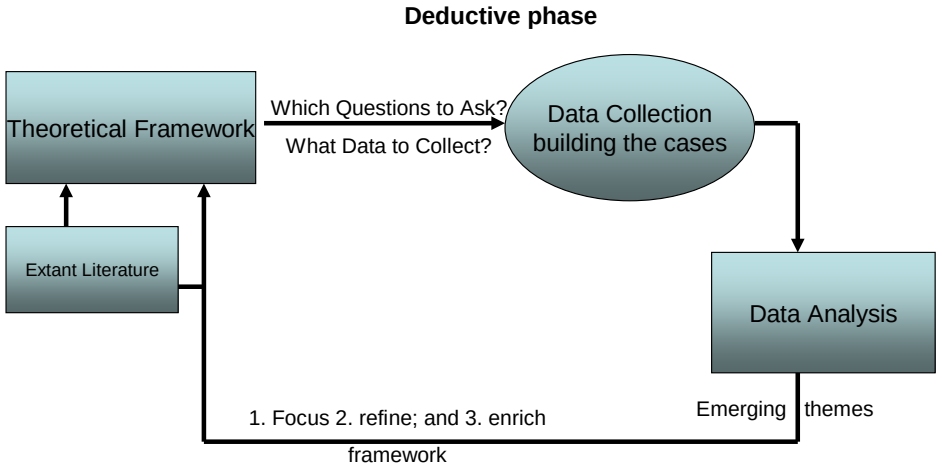
KIBS respectively (Miles and Huberman, 1984). At a practical level, time and resources constrained further case investigation.

5.3.3 - The Iterative Nature of the Research Process: Bridging between Theoretical Perspectives and the Empirical Investigation

The importance of building an analytical framework in the initial phase of the research design was strategic in order to focus the study and avoid the problem of collecting too much descriptive information that did not contribute to the scope of the study (Yin, 2003; de Vaus, 2001). Thus the analytical framework in Table 5.1 above, served to inform and guide the study in terms of providing some clarity on firm capabilities for adopting environmental innovations; hence developing relevant topics for investigation in the field and guiding the interview protocol. It represented a 'preliminary' outlook on the 'real' world and brought in deductive elements to the research (Easterby-Smith *et al*., 1991).

The multiple case-based approach enabled an iterative process between data collection and analysis and theory-building; see Figure 5.1 below.

Figure 5.1 - The Research Process Evolving through Iterative Cycles



Source: author

The scope of these iterative cycles was to refine the initial theoretical constructs about capabilities in traditional services and focus the research questions through an inductive-type analysis (Eisenhardt, 1989; Yin, 2003).

The iterative cycles conducted helped scope the study as follows:

- The iterative rounds served to focus the research problem from an industry-wide scope, that of tourism, to looking at the firm-level. Tourism 'networks' around issues of green supply chains involving Maltese hotels, tour operators and non-governmental organizations were not yet established at the time of investigation. This meant that the

boundary of the study was circumscribed to the hotel and to an analysis of the internal processes underlying adaptation.

- The above meant re-orienting the theoretical perspective towards understanding processes of adaptation occurring within the firm and exploring the factors that account for firm adaptation. It channeled the theoretical perspective towards dynamic capabilities and innovation processes in services.
- As a result of this process, the research questions did shift. This required fine-tuning the data collection methods such as the interview protocol with issues focused on the firm and capabilities for implementing environmental and energy efficiency measures. The research process involved asking at each round what led to particular events or behaviours and uncovering the processes that provided an explanation for the environment response behaviour of firms in line with a critical realist approach.
- The initial empirical findings helped scope the study towards focusing on knowledge intensive business services (KIBS) as a source of external knowledge about environmental and energy efficiency measures. KIBS were identified as intermediaries acting between the service firm and the external environment. The question became how the relation between these two entities was influencing the adoption of environmental innovations.
- The analytical framework was enriched with the themes emerging from the data analysis that helped to refine the original constructs characterizing capabilities for adaptation in traditional services.

5.4 - Research Design

As discussed above, an initial exploratory phase at the start of the empirical investigation served to map the main challenges for Maltese hotels; this was achieved through semi-structured interviews with relevant actors in tourism and beyond that served to scope the analysis to hotels and energy efficiency as being a concern for policy and for strategy. The empirical investigation also revealed that the hotels maintain links with engineering consulting firms, representing a type of KIBS.

In order to account for capabilities to adopt environmental innovations, information was sourced from the service firms (hotels); the hotels' relation with KIBS was analyzed through the perspective of the engineering consulting firm and the hotel. Actors in tourism, business support, policy and education were also considered relevant informants to determine how developments in the wider environment may be influencing hotel adaptation responses.

5.4.1 - Unit of Analysis

Within the study, two units of analysis are considered:

- The hotel: nineteen cases of hotels and their capabilities to adopt environment and energy efficient measures are investigated;
- The relation of hotels with knowledge intensive business service firm (KIBS): this aspect is studied through analyzing paired cases of hotels and engineering consulting firms.

The study focuses on processes leading towards improving energy efficiency as an example of environmental action in service firms. However, throughout the fieldwork the respondents often failed to separate initiatives towards energy efficiency from those taken to adopt other environmental measures, mentioning waste and water consumption alongside energy measures implemented. This is not considered to influence the validity of the study as this investigates the capabilities that enable environmental action; with measures towards energy efficiency being a sub-set of the environmental action in these firms.

5.4.2 - Characterizing the Hotel

A hotel is a complex organization because it provides several distinct products, services and range of facilities and this is reflected in its organizational structure which varies depending mainly on size, location and product type i.e. service level and market segment targeted (Ismail, 2001; Medlick, 1980). Although the organization of the hotel does vary, the functional departments are similar for hotels that offer full-service facilities and include six areas: sales/marketing, food and beverage, human resources, accounting and rooms division and engineering (Ismail, 2001). The functions of a unit or department reflect the tasks and responsibilities that the unit fulfills as part of the whole operations (Medlik, 1980).

5.4.2.1 - Focus on Maintenance Activities

The decision to focus on the 'engineering' or the 'maintenance' function, hereafter referred to simply as the maintenance department, stems from the role this department plays in the hotel, and the fact that the duties and functions of the maintenance department span across all other departments of the hotel as explained below. Therefore the maintenance has a 'bird's eye view' of the entire property which bears on the implementation of environment and energy efficiency measures.

Irrespective of the hotel structure, the maintenance department reports directly to the top management. In smaller hotels, the maintenance does not consist of a department *per se* but of a single technical manager reporting to the hotel manager who is concerned with most aspects of hotel operations including technical aspects (Medlik, 1980; author's empirical observations). The maintenance forms part of the middle management level between top management and the shop floor level (i.e. housekeeping staff, receptionists, etc.).

As hotels grow larger in size, the duties and responsibilities become more distributed and specialist departments are present (Boella, 1992). In such cases, the maintenance manager is part of the senior level management or the executive team that reports directly to the general

manager or managing director and interacts with mid-level managers who are heads of the various departments responsible for day-to-day operations (head housekeepers, head receptionists, restaurant managers etc., Baker *et al*., 2000; Ismail, 2001). The general manager is responsible for running the hotel: this position may be taken up by the hotel owner, or the general manager may report to a board of directors (owners) that constitutes the corporate level of management (Baker *et al*., 2000).

The responsibilities of the maintenance department range from:

a) general maintenance of all machinery and equipment including the heating, ventilation, air-conditioning system (HVAC) and other aspects of general upkeep including carpentry, upholstery, plumbing;
b) landscaping and upkeep of the grounds; and
c) renovations (Ismail, 2001).

Part of these responsibilities include controlling the costs of heating, lighting and power as well as the design and implementation of environmental programmes and measures (author's own empirical observations). Aspects of long-term planning for renovations and improvements also begin with the maintenance manager (Ismail, 2001 p.112).

A routine activity of a hotel is the implementation of the preventive maintenance (PM) programme that relies on the engagement of the hotel staff across all functional departments. All hotels have a PM programme that involves regular and continuous inspection and monitoring of the hotel facilities and plant rooms in order to identify small problems before these become bigger and more costly (Ismail, 2001). Front-office staff report problems in the common areas; the housekeeping staff identify issues related to the guest room such as in the plumbing or electrical system; and the catering staff report on problems in the kitchen and banquet areas. These issues are relayed to the maintenance department that receives information from all aspects of the hotel operations, including front office and the back-office (housekeeping and administration).

The choice to look at maintenance operations that are inherently back-office activities means that the study is mainly concerned with identifying innovations in the backstage i.e. those that do not involve direct interaction with the customer but that may involve non-visible interaction and supporting processes (Bitner *et al*., 2008).

5.4.2.2 - Energy Consumption Profile of Hotel Establishments

After staff, energy consumption makes up the largest proportion of hotel running costs (Leonardo Energy, 2008). Therefore there is the potential to decrease costs through energy savings (CHOSE, 2001). Estimates indicate a potential energy saving of between 10-15% of the energy that hotels consume, depending on the age and size of the hotel, as well as the type of equipment installed and the maintenance and operating procedures in use (HES, 2011b).

The energy balance of a hotel depends on the physical characteristics of the building including its size and location (e.g. coastal or urban), fluctuations in occupancy levels, the number of facilities and whether some services are outsourced such as the laundry. Another consideration is the hotel star ratings. Generally 3-star hotels have the requirement to provide central heating and cooling in the lobby area only and in the guest bedrooms (with individual heat control in the bedrooms); whereas in 4- and 5-star hotels a controlled thermal environment is provided across the entire premises, including the guest bedrooms (Bohdanowicz and Martinac, 2002).

About 40% of this energy consumption is electricity, of which 45 % goes for lighting, 26 % for HVAC[35], 6 % for water-heating, 5 % for food services and 18 % for other activities, such as laundry, back office administration etc. (HES 2011a). These trends in energy consumption typically take into account the energy directly consumed to run the establishment and exclude other services such as airport shuttling services or transport of goods or waste to and from the hotel (Bhodanowicz *et al*., 2001). Table 5.2 below outlines the principal energy consuming systems in a hotel.

[35] Heating Ventilation and Air-Conditioning.

Table 5.2 - The Main Energy Consuming Systems in a Hotel

Description	Flow of Energy	Energy Requirement	Energy Efficient Measures
Space Heating	Gas boilers Electricity Central heating/temperature regulation in the guestroom.	Seasonal requirement	**Good pipe insulation;** **Improved building envelope;** **Autonomous energy control systems that regulate temperature in rooms e.g. minimizing this when rooms are unoccupied**
Air conditioning and ventilation	Air conditioning units in rooms/centralized air conditioning systems	In guestrooms: required mainly at night Conference/meeting rooms: required for most part of the day General service area: required all day/night.	**Optimizing running hours;** **Optimizing temperature.**
Lighting	Electricity	All year requirement; Aesthetics and comfort	**Energy efficient light sources;** **Smart switching e.g. use of daylight sensors or timers.**
Hot water production	Accumulated system of production where hot water is stored in tanks at particular temperature; Instant water heating system;	All year requirement for hot water (different temperature levels in winter/summer); Varies depending on volume of water consumed (and thus on hotel size); Used in guestrooms; for cleaning; kitchens.	**Installation of hot water consumption meters;** **Use of thermal solar panels to heat water and store it;** **Minimization of leaks.**
Other applications	Kitchen Lifts; office equipment; Laundry (when this is not outsourced), etc.	Varies depending on hotel size and occupancy.	**Processing laundry on a large scale (offsite)**

Source: Leonardo Energy (2008)

There are different levels of intervention at which energy efficient solutions may be introduced. A distinction can be made between technical solutions that either reduce the energy needs of the hotel or improve its energy consumption profile and energy management solutions that deal with staff and guest involvement in energy conservation measures. Technical solutions may be geared at improving insulation and the building envelope or enhancing efficiency of operations

(e.g. through occupancy and daylight controls) or by replacing equipment (HES, 2011a; Jacob *et al*., 2012). Referring back to Table 5.2, the greatest opportunities for energy savings can be achieved by optimizing the HVAC and shifting to energy efficient and intelligent controlled lighting (JRC, 2012).

Regular monitoring of energy consumption across the hotel property helps reduce energy consumption losses. This can be achieved through manual inspection of electricity and water meters and sub-meters at distinct monitoring areas (such as the kitchen, restaurant, back of the house etc.) and monitoring the performance of plant room equipment (HES, 2011a). Alternatively, it can be done remotely through installation of a building management system that records utility consumption and can regulate heating and cooling delivered to each room. Continuous monitoring is fundamental in providing a detailed picture of demand patterns and energy saving opportunities (ibid). In addition, an energy audit undertaken by an assessor can serve to identify hot spots of consumption.

5.4.3 – The Hotels' Relation with KIBS

As discussed in Chapter 4, absorptive capacity in service firms can be understood in terms of how these firms exploit and derive value from their relations with external actors. Given that firms maintain relations with several different types of actors, a choice was made to focus on the engineering consulting firm, a type of knowledge intensive business service firm (KIBS). The empirical work indicated that engineering consulting firms maintain a professional relation with the hotels' top management and maintenance department in providing expert advice on energy efficient and renewable energy systems.

The term 'intermediary' needs some further explanation in relation to its use in this study. Looking back to Chapter 4, the intermediary is discussed in terms of its potential to act as an agent between the external knowledge base on environment and energy technologies and the hotel. In so doing, it can potentially influence the hotel's ability to innovate and adopt energy efficient measures. The relation of the KIBS with the client-hotel is taken as the locus where intermediation activity is taking place which, in this study, relates to the potential for exchange of knowledge and learning about environmental innovations.

5.4.4 - Case Selection

Cases are selected to meet particular requirements (de Vaus, 2001); in this study they are used to build theoretical insights on service firm capabilities for adaptation. Therefore something about the cases needs to be known before starting the field investigation and case selection is not a random process (ibid). At the same time, the choice of the cases needs to include sufficient variation in terms of representing diverse cases and multiple perspectives that characterize service firm capabilities (Denscombe, 1998; Creswell, 2007).

In this study, the strategy for case selection was to target those firms already actively implementing environment and energy efficiency measures as these were deemed to provide the best available information on capabilities for adoption.

The criteria for selecting the hotels and the engineering consulting firms are discussed below.

5.4.4.1 - Selecting and Coding the Hotels

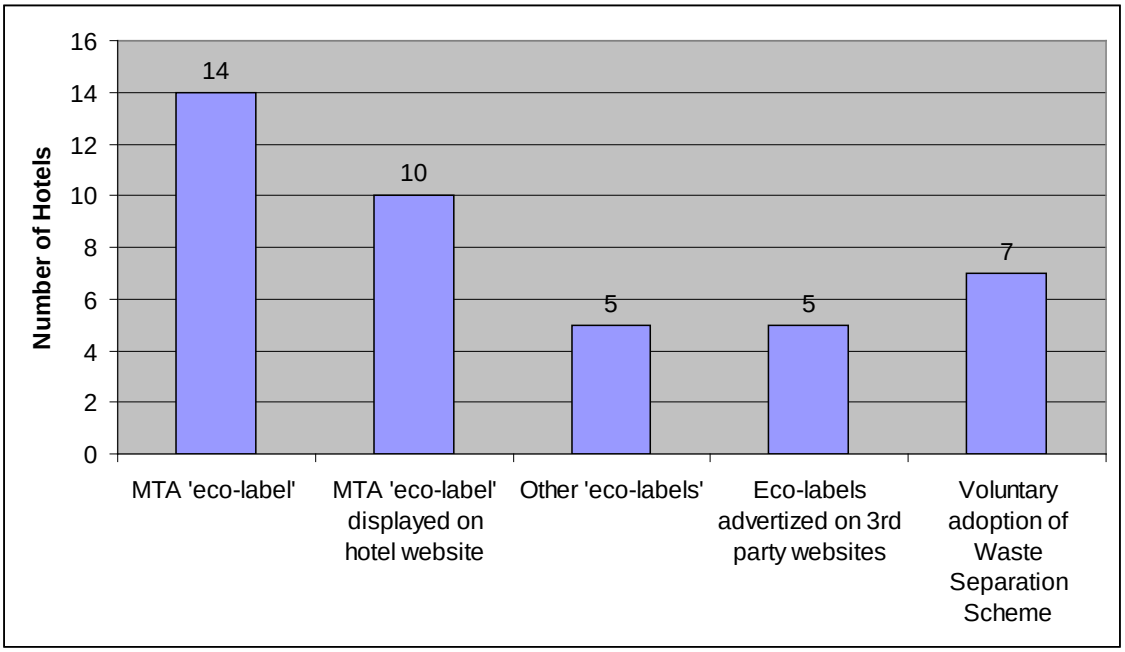
This study selected nineteen hotel cases, from the Malta Tourism Authority Hotel Directory 2010. Details of the hotel cases, in terms of market segment, ownership and size, are provided in Annex 1. The criteria on which the selection of the cases is based are:

1) *Adoption of an environment label or 'eco-certificate'*: hotels are awarded an eco-certificate by the national tourism agency (Malta Tourism Authority, MTA) based on compliance to a set of compulsory and non-compulsory criteria[36]. As seen in Graph 5.1, fourteen out of the nineteen hotel cases considered in this study possess the national eco-certificate and most exhibit the 'green leaf', which is a symbol of the eco-certification, on their website. Out of the eco-certified hotels, five also have a third party 'environmental' award (e.g. the 'TravelLife Award' and the EU 'Eco-label') and five hotel cases advertise their property as a 'green property' on major search engines for hotel bookings worldwide.

   Seven hotels adopted on a voluntary basis a waste separation scheme in 2009 before waste separation in the hotel sector became compulsory in 2010. Refer to Annex 2 for a summary of the environmental 'profile' of the nineteen hotel cases.

[36] At the time of writing, a total of twenty-five hotels based in Malta had obtained the MTA eco-certification out of a population of 108 establishments. Source: Malta Tourism Authority 'List of Eco-Certified Hotels', accessed 12th September 2012 at: http://www.mta.com.mt/eco-certification.

Graph 5.1 - Adoption of Eco-Labels and a Waste Separation Programme in the Hotels Investigated

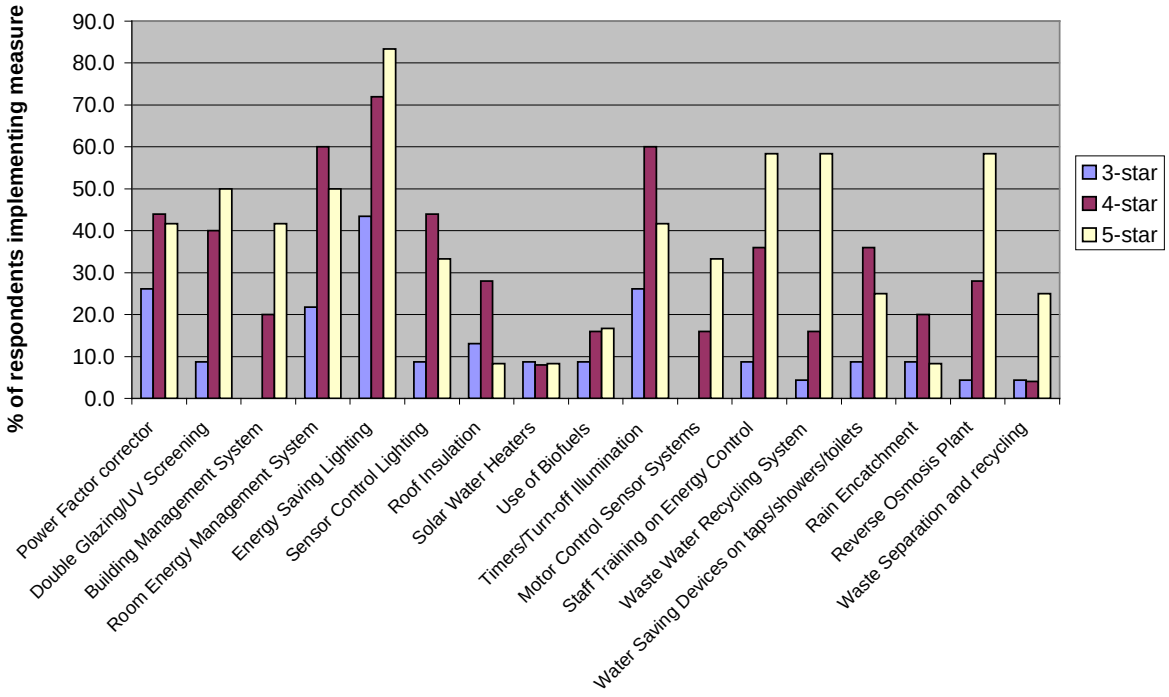


Sources: For 'eco-label' data; Malta Tourism Authority; For 'Additional eco-labels': own data; For 'Green Initiatives displayed on 3rd party websites': web search on hotels.com; bookings.com and expedia.com (July 2012); for 'Green Initiatives advertised in local/international media': web search by hotel (July 2012); for 'Voluntary adoption of waste separation': Survey on 'Environmental Initiatives undertaken by Hoteliers', Malta Hotels & Restaurants Association, 2009.

2) *Hotels active in implementing environment measures.* In order to establish the extent and type of environment-related measures implemented by the hotels, the study draws on the results of a 2009 survey on 'Environmental initiatives undertaken by Hoteliers' and conducted by the Malta Hotels and Restaurants Association (MHRA). The survey had a response rate of more than 75%. It shows that the four star hotels have the largest number of energy and water-related measures (137 out of a total of 261 measures recorded in the survey) followed by five star hotels (77 measures)[37]. The 3-star hotels are least active in implementing environmental measures (47 measures) – refer to Graph 5.2.

[37] Survey on 'Environmental Initiatives undertaken by Hoteliers 2009' made available by the Chief Executive Officer of the Malta Hotels & Restaurants Association (MHRA).

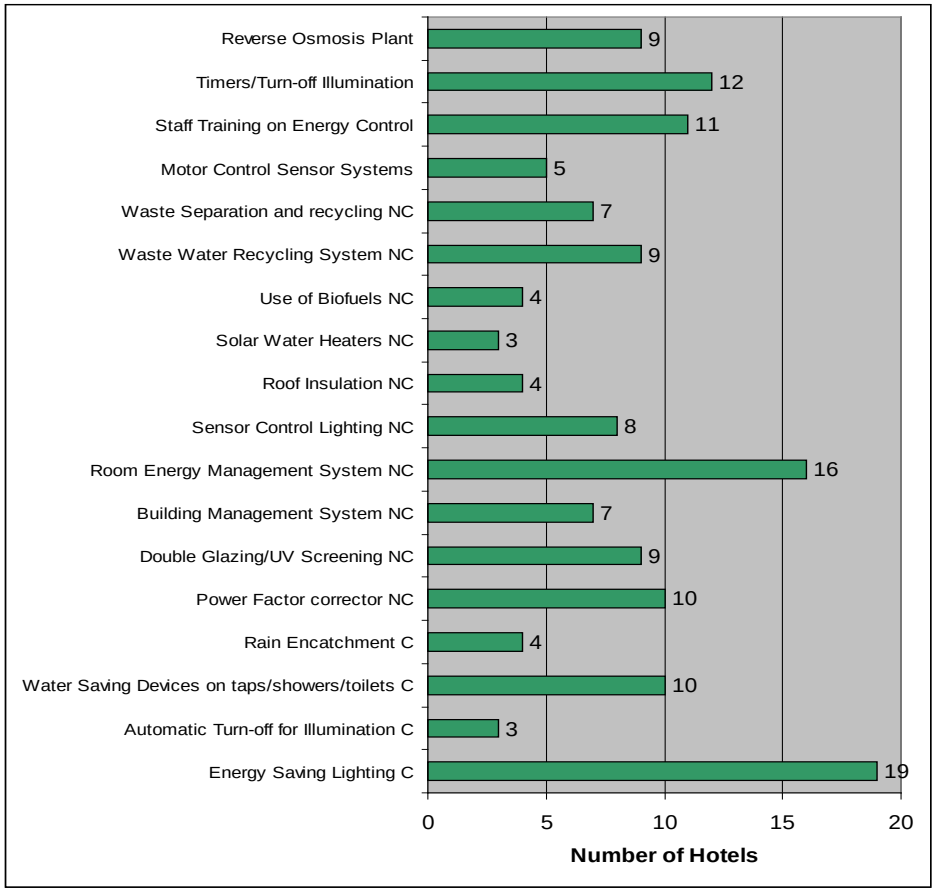
Graph 5.2 - Overview of Environment Technologies Implemented by Maltese Hotels



Source: Survey on 'Environmental Initiatives undertaken by Hoteliers', Malta Hotels & Restaurants Association (MHRA), 2009

Graph 5.3 shows the pattern of adoption of energy and water measures in the hotels considered in this study.

Graph 5.3 - Environment Measures Implemented in the Hotel Cases



Source: Survey on 'Environmental Initiatives undertaken by Hoteliers', Malta Hotels & Restaurants Association (MHRA), 2009

3) *Hotels benefiting from a government grant to implement environmental measures*: Two grant schemes were launched: the ERDF[38] Energy Scheme managed by the national business support agency (Malta Enterprise) supported investments in energy saving measures and alternative energy sources; and the 'Sustainable Tourism Projects Grant Scheme' managed by the Tourism & Sustainable Development Unit within the Office of the Prime Minister aims to stimulate the implementation of environmental practices amongst hotels. With one exception, all the hotels considered in this study had applied for one or two grants under these schemes and were either awaiting approval or had passed the first selection phase.

Characteristics of the Hotel Cases Investigated

The nineteen hotel cases selected encompass a total of twenty-five hotels because of instances of common ownership and management of groups of hotels. Although the cases were not selected to reflect differences based on market segment and ownership, an *a posteriori* analysis

[38] ERDF is the European Regional Development Fund, part of the Structural Fund allocation for Malta for the period 2007-2013.

shows that these do vary amongst the hotels investigated (see Annex 1 for the hotel categorization based on market segment, size and type of informant).

The hotels include both domestic properties (18) that do not form part of a branded chain or group and subsidiaries of multi-national (MN) hotel chains (7) that are all currently managed operations of the corporate group. All of the MN subsidiaries are owned by local businesses. Out of the 18 domestic hotels, three are local chains of two or more hotels and the rest are independent hotels. The cases cover 69% of the 5-star hotels, 24% of the 4- star and 7% of the 3-star hotels in Malta. Although the sample is representative of a variety of hotel types located in Malta, there is a sample bias towards leisure mid-scale independent hotels and upscale leisure and business chain hotels.

5.4.4.2 – Engineering Consulting Firms as a Type of KIBS

Purposive sampling was seen to be a particularly suited approach to identify the engineering consulting firms; these firms were selected based on whether they had a business relation with the hotels investigated in this study. Thus during the interviews, the hotels were asked to mention one or more engineering consulting firm with which they had contact at the time of the field investigation.

The engineering consulting firms were identified to have one of two roles in hotels: they either act as 'company engineers' to one or to several different hotels assisting in the implementation of the preventive maintenance programme. In this context they are typically contracted to oversee the operations of the hotel facilities (heating, ventilation and air conditioning systems, HVAC), and peripheral needs including energy and environmental management which cannot be sourced internally (Larsen 2000). Alternatively, they may be contracted to design building services (electricity and water plumbing systems, lift installations, air-conditioning systems, etc.) in new construction developments such as hotel extensions. An emergent group of consultancy firms is specializing in the provision of energy management services.

In order to obtain an initial characterization of the engineering consulting firms, an analysis of the firms was performed based on the mission/vision of the firm, the core services offered and energy/environmental services that the firms provide to their client base. The source of the data was information retrieved from the website of each firm and from the interviews. Three types of KIBS were identified based on the nature of the services offered - see Annex 3. These are discussed further in Chapter 7.

5.4.5 - Data Collection Methods

The research relied on the collection of data from different methods and sources – interviews, published documents, web-site analysis and participation in locally organized seminars - that enhanced the validity of the data through triangulation (Denscombe, 1998). These methods are outlined below.

5.4.5.1 - Interview Method

The principle method of data collection was through interviews undertaken with hotels, engineering consulting firms and actors forming part of the wider context.

Approach to Interviewing

The choice of one-to-one semi-structured interviews stemmed from the need for a less structured approach that allowed for in-depth discussions on the issues raised and that could not be captured in sufficient detail in official reports or documents (Arksey and Knight, 1999). Therefore, although an interview protocol was prepared based on the theoretical framework, the order of the topics was flexible and varied depending on the discussion flow with the interviewee. Space was allowed for the interviewees to 'speak their minds' and express personal thoughts and ideas through open-ended questions (Denscombe, 1998 p.113). In this way, the interview served as a tool of discovery of the interviewee's ideas on developments around the topics discussed.

Choice and Type of Informants

The informants were deliberately 'hand-picked' because they were deemed to provide the best available information on capabilities for adopting environment and energy measures (Denscombe, 1998). Such purposive sampling has the advantage of including particular attributes of interest to the study (Berg and Lune, 2012) and contributes to informing and understanding the research problem (Creswell 2007).

The informants are thus considered as 'key' informants in having some authority on the topics discussed and this increases the credibility of information contained in the interview (Denscombe, 1998). A complementary technique that of 'snowball' sampling, was also adopted wherein informants were asked to nominate one or more hotels that were active in implementing environment and energy efficient measures.

There were three types of informants:

- In the **hotels**, twenty-six interviews were undertaken with top managers and with the maintenance department to understand the capabilities for adaptation. For details on the interviewees see to Annex 1.

  Ten interviewees were in top management (owners, directors at corporate level or general/hotel managers). These provided information on the strategic orientation of the hotel and its vision on environment and energy issues. Twelve of the interviews were undertaken with the engineers or technicians in the maintenance department. As discussed above, these are involved in operational aspects of the hotel and thus in the

adoption and implementation of environment/energy efficient measures. Four interviews were with human resource managers responsible for the implementation of environment measures in the hotel.

In three of the cases (A3, E2 and E3), both the director/owner and technical manager were interviewed and this afforded for some triangulation and comparability of the accounts generated through the interviews. Due to their tight schedules, it was generally difficult to gain access to the general managers. In three other cases (A1, B5 and D1), the small size of the hotel meant that the hotel manager, who was also the owner, fulfilled both managerial and technical roles.

- In the **Engineering Consulting Firms**, fourteen interviews were conducted with either senior partners or directors/owners of the business who could provide insight on the types of environmental and energy management services they provide, and what their clients were doing in this regard (including hotels). The second research question on the type of relation with hotels and how this influences intermediation activity was investigated. Four of these firms consisted of one-person engineers (sole-owners). The details of the informants are provided in Annex 3.

- **Actors forming part of the external context**: sixteen actors that form part of a wider system in which the hotel sector is embedded were interviewed in order to scope the emerging issues in tourism vis-à-vis the environment and energy. These included policy and decision-makers in tourism and environment, education institutions and relevant associations. This information, together with that obtained from participation in local seminars, contributed to understanding how firm adaptation responses may be influenced by events and factors in the external context. A list of these interviewees is provided in Annex 4.

Three interview protocols were tailored for each of the types of informants as a guide in the interview process though they also catered for open-ended type questions in order to capture emerging themes (refer to Annexes 5-7). In total, fifty-six interviews were conducted between October 2009 and October 2010; all interviews were held on the premises where the informants worked except one that was conducted on the phone and another through email feedback. A final interview was held in July 2011 at a local seminar.

After the first few interviews, the transcribed reports were sent back to the interviewees by email for verification. The email was followed up with a reminder phone call after a two-week interval; however no responses were received. This might be attributable to the tight schedules of the informants and to the local culture that promotes verbal face-to-face interactions over written reports. Thus it was not possible to validate the reports directly from the informants.

Handling Interview Data

All the interviews were transcribed to enhance the reliability of the data set (Creswell, 2007) and the reports organized as a table with the topic/interview question making up the rows and the informant's response making up the columns of the table. Since the rows of the table reflected the main topics or categories, any new themes or topics arising from the interviews were placed as a separate entry. It also facilitated the cross-case analysis because it allowed to look across the data horizontally per topic; and within the same case a vertical analysis between different themes could be carried out more readily. The interview transcript tables were used for the data analysis discussed in Section 5.5 below.

5.4.5.2 - Other Sources of Data

In order to supplement the data from the interviews, secondary data was collected from a number of different sources as outlined below:

Web-site analysis and published documentation	An analysis of the hotel websites and published reports on the environment initiatives implemented by the hotels complemented the findings from the interviews on the firms' environment behaviour (see Annex 2).
	An analysis of the websites of the engineering consulting firms provided information on the types of engineering services, and environment-related services offered and the type of client-base. This served to produce a typology of the firms. See Annex 8.
National Survey Data on Environmental Initiatives in Maltese Hotels	The results of a 2009 survey on the 'Environmental Initiatives undertaken by Hoteliers' were made available by the Malta Hotels & Restaurants Association (MHRA). The survey measured the water and energy conservation measures and renewable energy installations implemented across 83 tourist establishments in Malta, 73 of which were hotels. The survey results were used, together with the hotel website analysis and the empirical data, to build a picture of environmental action in Maltese hotels.
Local seminars attended:	Participation in local seminars served to scope the general issues being discussed at the time around energy conservation and renewable energy and to formulate an understanding of how this context shaped actor's perceptions on issues related to environmental action and energy efficiency in particular. The list of seminars is provided in Annex 9.

5.5 - Data Analysis

Following Miles and Huberman (1984), the data from the interviews and web analyses were coded and categorized into matrices; this serves as a useful management 'tool' to condense the large amounts of data generated and facilitate its interpretation.

There were three data sets to analyze. The data from the hotel cases, the engineering consulting firms and actors in the external context were grouped into themes that were refined and categorized. A cluster analysis was performed on the hotel cases data in order to characterize the mix of capabilities for firm adaptation. Finally, an analysis of pairs of hotels and engineering consulting firms was undertaken to describe the relational dynamics at the KIBS-client interface. These steps are discussed below.

5.5.1 - Categorizing the Data

In line with the iterative research process discussed in Section 5.3.3 above, the categorization of the data involved both a deductive approach, based on the research objectives and analytical framework, and an inductive approach that identified emerging themes directly from the raw data and that were used to identify new themes and refine existing ones (Berg and Lune, 2012). This means that the categorization process draws from theory as well as from the empirical investigation.

In practice, the theory helped build a framework of firm capabilities to adopt environmental action; these capabilities were further characterized with input from the empirical data. Also, the theoretical framework guided the topics to address during the interviews and therefore the interview questions. The interviews generated a large amount of data as transcripts. A systematic coding process was employed, whereby themes identified in the interview transcripts were categorized under specific topics that characterized particular behaviours. Thus the analytical elements ‘searched’ for in the interview data were themes i.e. sentences or strings of words that conveyed relevant insights on adoption of energy efficiency measures reported by the interviewees (Denscombe, 1998).

An important consideration was the ‘unit of meaning’ of the themes i.e. the themes are meant to convey a coherent point which is ‘self-sufficient’; though its meaning cannot be inferred if taken out of context (Dey, 1993). This coherence was ensured through the use of a manual coding approach that allowed to directly reference back to the original interview transcripts.

The data from the interviews with the engineering consulting firms were systematically organized into a matrix in Annex 8. This also includes supplementary data from the analysis of the firm websites. The matrix identifies three types of firms based on the topics emerging from the interview data analysis.

The hotel interview data were also coded into a matrix; one example of this coding is given in Table 5.3 below. This table is an extract from Annex 10 that provides the categorization of all the hotel interview data. Each topic and theme characterizing the hotels’ capabilities is numbered for the cluster analysis described in the next section.

Table 5.3 - Categorizing Hotel Interview Data

CATEGORY	Approach to Coding and Categorizing Data	Example
CAPABILITY	The capability is derived from the theoretical framework and refined using insights from the empirical results.	**Implementing Environmental Action** **Making Adjustments in Routine Tasks**
TOPIC	Each topic refers to a particular set of questions in the interview protocol. The topics are numbered. The topics resulted in a number of themes being identified. (The themes are coded using letters: a, b, c etc.)	**15. MONITORING ENERGY CONSUMPTION IN HOTELS**
THEMES	The themes are identified from the interview transcripts. For each theme, the number of hotel respondents is specified.	**a) Energy data used to keep costs down** *all respondents* **b) Energy data exploited in order to Enhance Operational Efficiency** *Respondents: B5T, C1M, D2M, B4M, D1T, E1M, D3M, E2M, E3M,E4O, E5M, E6O* **(c) Energy data exploited to justify investment in energy efficient projects** Respondents: B4M, B5T, B6T, D1T, E2M, E3M, E4O, E5M **(d) 'Environment' and 'energy consumption' included as indicator of firm performance** Respondents: B6T, E2M, E3M, E4M, E5M, E6O.
QUOTE FROM INTERVIEW TRANSCRIPTS	For each theme, an exemplary quotation is provided from the raw interview transcripts. Within each quotation, terms or words are highlighted in bold script that were used to code (categorize) the data. ***Two examples of quotations are provided for themes (b) and (c) identified above.***	**b) Energy data exploited in order to Enhance Operational Efficiency** *'As maintenance team we monitor energy on a regular basis through taking regular readings. We **use these data** to try and **find ways of how to reduce consumption**; so if we find that consumption in particular operation is high, we try and see **how we can reduce this** whilst ensuring that the guest is not affected to any large extent. Naturally reduced consumption means reduced operational cost.' (D2M)* **(c) Energy data exploited to justify investment in energy efficient projects** *'We have always had **very good feedback from the Directors** regarding **investments in energy saving.** For example, we are currently refurbishing the indoor pool because it was old; the ceiling is a skylight with special glass to keep the water warm - we have a Maltese supplier who gets this glass from abroad. This glass is more expensive than standard Perspex (€21k compared to €1k of Perspex). And the solar water heaters we plan to install on the roof are going to heat the pool and contribute to central heating of the hotel. In fact **we exceeded the budget when we decided to install glass skylight** instead of Perspex. But when we went up to the directors and **showed them savings on heating sources** and presented the payback period, we got to go-ahead. The directors give us a free hand and they are quite flexible - this is one thing that I feel comfortable with.' (B4M)*

Source: Hotel Interview Transcripts

5.5.2 - Linking Hotel Capabilities and Adaptation Responses using a Qualitative Cluster Analysis

The hotels were not assumed to have one or another capability. Instead in this study, firms were characterized as possessing different types of capabilities that mediate environmental action. In order to take this into account, the hotel cases were grouped according to them possessing similar capabilities. At the same time, the analysis brought to light those cases that stood out as possessing particular combinations of capabilities.

In practice, grouping hotel cases was achieved by comparing the topics and themes assigned to the hotels for the same capability and between different capabilities and identifying patterns i.e. regularities, variations and singularities across the hotel cases as suggested by Dey (1993) when linking data. For each capability, the topics and themes were coded (i.e. assigned a number and letter respectively) and a matrix developed; this matrix is presented in Annex 11.

Using this matrix, the hotels were grouped or clustered according to similar capabilities and this led to the identification of the three adaptation modes of reactive, active and proactive hotels that reflect the combination of capabilities possessed. This grouping or clustering process is summarized in Figures 5.2-5.4 below which show how the different combinations of capabilities and hotels were linked in order to derive the adaptation modes. The three top-most circles in the diagrams represent the capabilities to sense developments about environmental awareness, translate these signals into decisions for action and capabilities to implement action. Under each of these circles, a further set of circles are drawn to represent the underlying characteristics of each of the capabilities. The arrows give an idea of how the capabilities and underlying characteristics are grouped to derive the adaptation modes that are described in detail and discussed in Chapter 6.

Figure 5.2 – Clustering Hotels into the 'Reactive' Mode

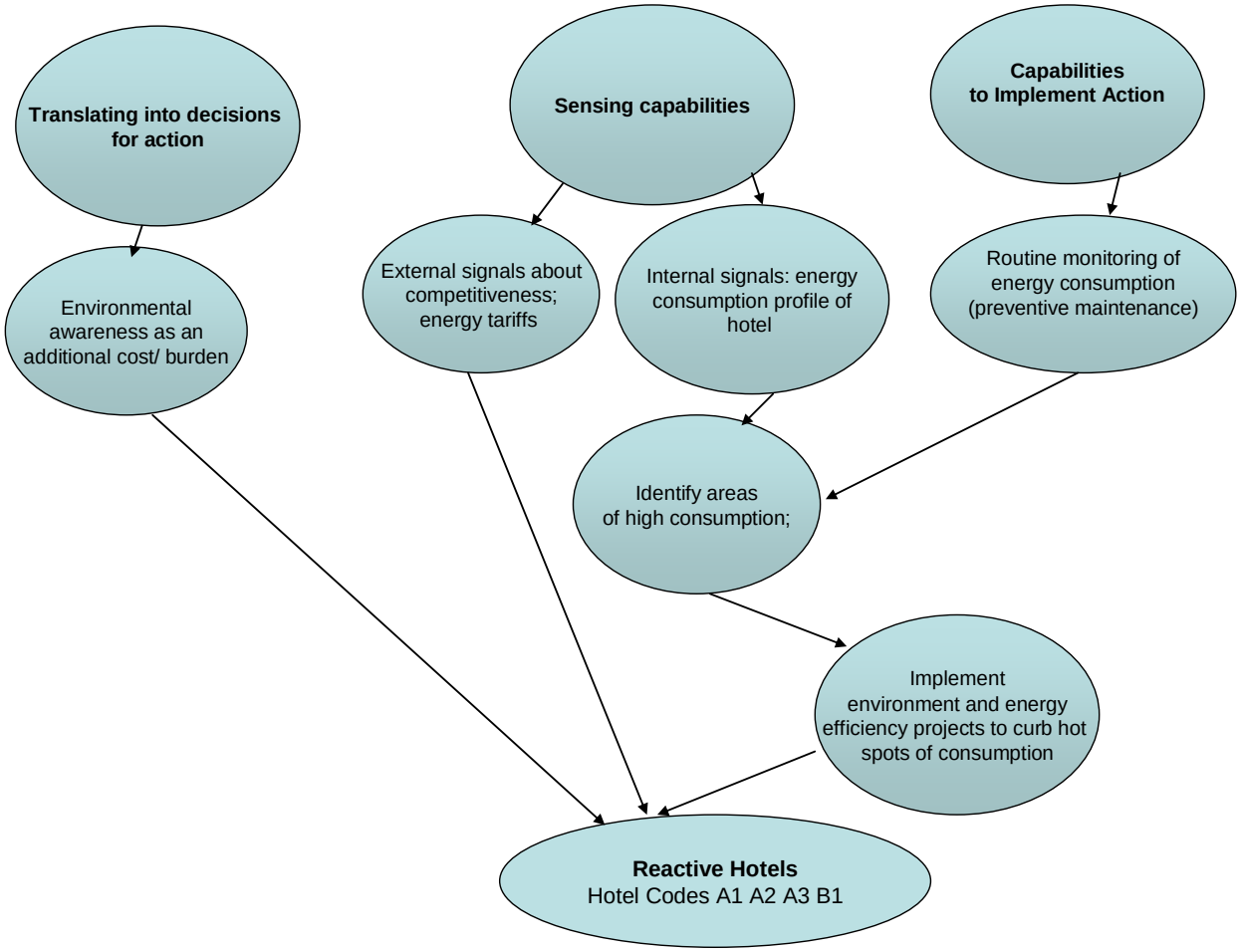
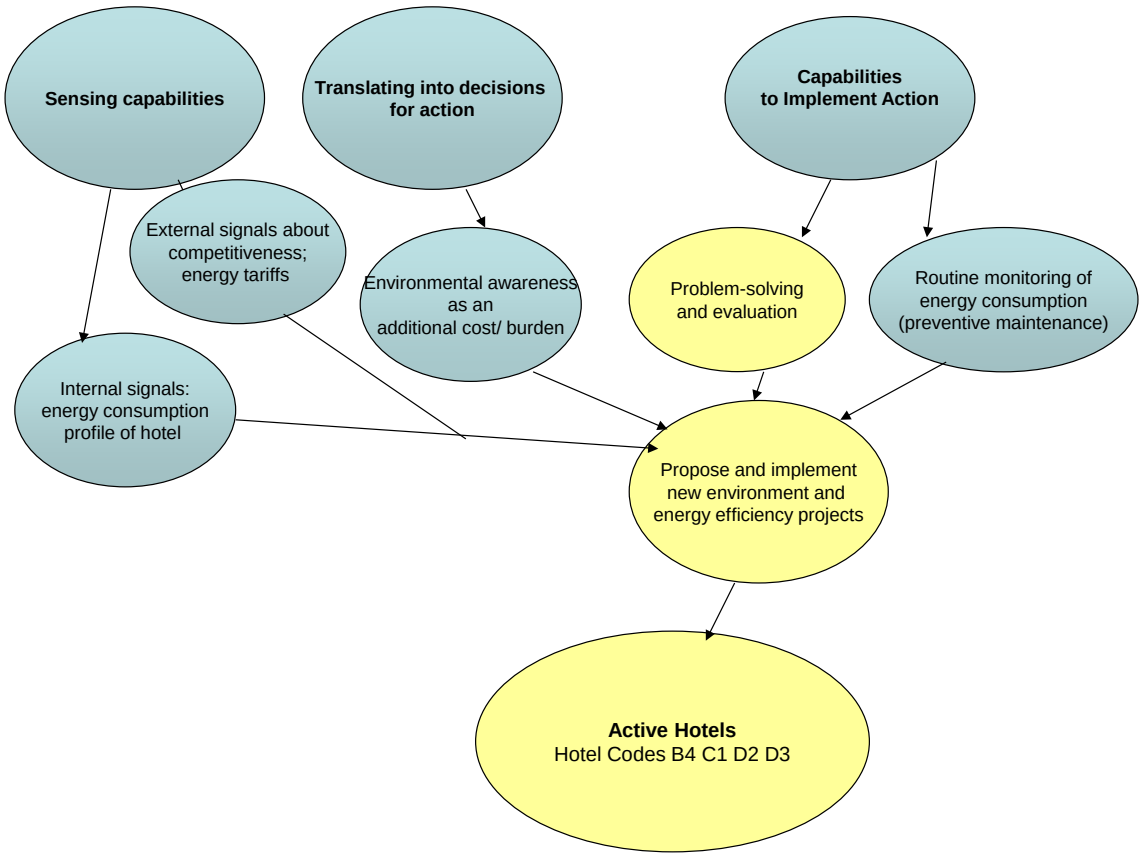
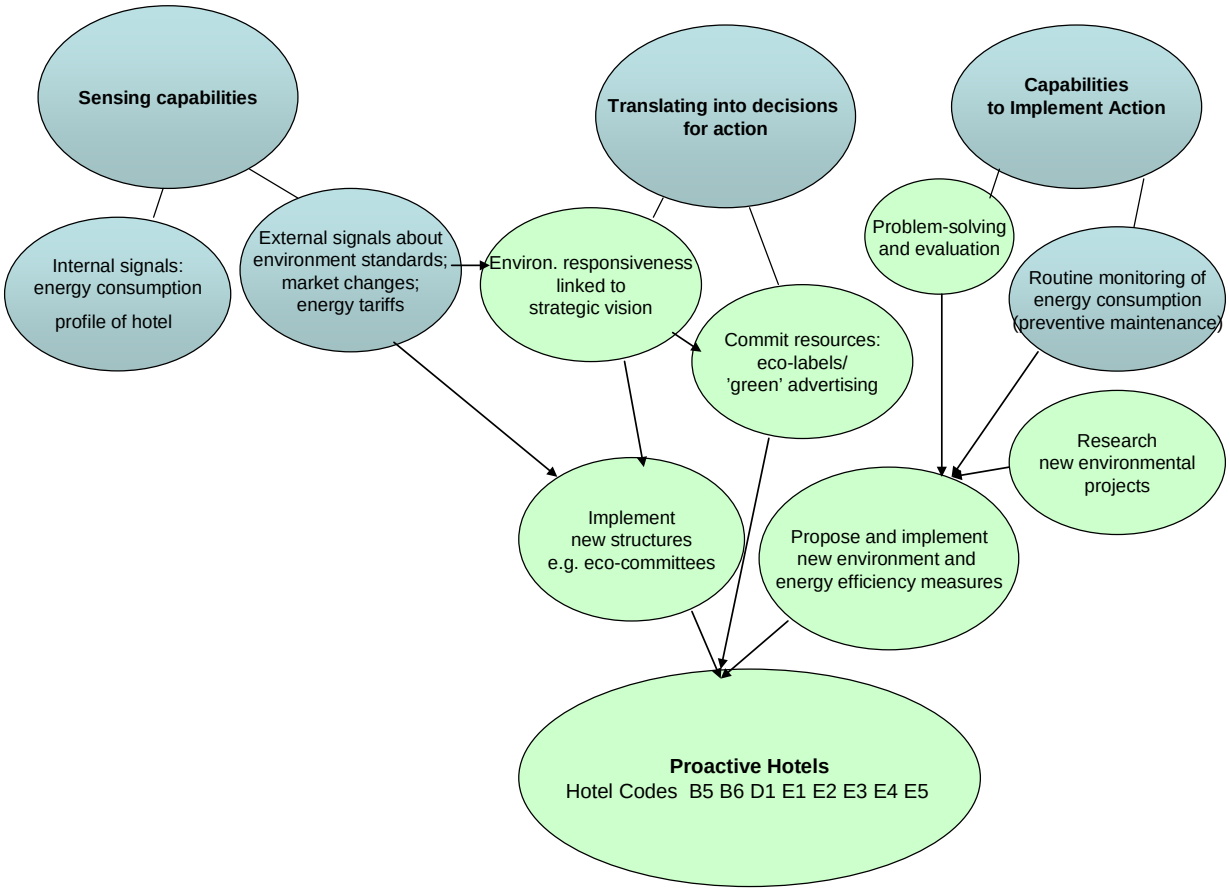


Figure 5.3 - Clustering Hotels into the 'Active' Mode



Key: the colour coding highlights the main differences between this adaptation mode and that of reactive hotels.

Figure 5.4 - Clustering Hotels into the 'Proactive' Mode



Key: the colour coding highlights the main differences between this adaptation mode and that of reactive hotels.

5.5.3 - Matched-Pair Analysis used to Characterize the Hotel-KIBS Relation

As a result of the purposive 'sampling' strategy adopted, pairs of hotel cases working with specific engineering consulting firms were identified. Out of the nineteen hotel cases, data was available to identify fifteen such pairs. A pair consists of a particular hotel (out of the three types identified in 5.5.2 above) that maintains a business relation with a corresponding engineering consulting firm. The aim of building these pairs was to investigate the relations established between particular hotels and KIBS and how and whether these relations influence the capacity of the hotel to adopt environment and energy efficient measures.

The analysis of the pairs relied on the characterization of the hotel capabilities and adaptation modes (Annex 10) and the types of engineering consulting firms (Annex 8) developed earlier to derive patterns of interaction amongst the actors along three dimensions: professional or business relations, technical know-how and cognitive capacity. The relation is studied from the perspective of both the service provider (engineering consulting firm) and the client (hotel) by drawing from the two relevant data sets and this affords for a degree of triangulation. Table 5.4

summarizes the data and categories from the two data sets considered relevant to describe the relational dynamics between these actors.

Table 5.4 - Data used to analyze the Relational Dynamics between the Hotels and Engineering Consulting Firms

Dimension of the Hotel-KIBS Interaction	Engineering Consulting Firm Data Set (Source: Annex 8)	Hotel Cases Data Set (Source: Annex 10)	
	Topics	Capability	Topics*
Professional relation	Characterization of Engineering Consulting Firm; Characterization of the service relation with hotels; Type of energy-related service supplied to client; Interactions with hotel.	Absorptive Capacity	• Pattern of Interaction with KIBS (Topics 24-26)
Technical Know-How	Sources of knowledge on energy efficiency; Approach to implementing energy-efficient solutions.	Technical Capabilities to Implement Action	• Making Adjustments in Routine Tasks (Topics 15-16); • Problem-Solving & Evaluation (Topics 17-19) • Taking Initiative Beyond Day-to-Day Tasks (Topics 20-23)
Cognitive Capacity	Factors (in the client firm and the environment) perceived to influence diffusion of energy efficient solutions.	Translating Signals into Implementable Action	• Value of Adoption (Topics 7-9) • Decision-Making to Adopt (Topics 10-11)

*The topics are numbered according to how they are listed in Annex 10.

The interaction patterns and implications for absorptive capacity are presented and discussed in Chapter 7.

5.5.4 - Issues of Validity

Qualitative research raises issues of validity that can be assessed at different levels. The validity of the constructs to describe service firm capabilities was ensured by relying on the chain of evidence about the types and nature of capabilities generated from the successive cases (Yin, 2003). The use of multiple data collection methods and data sources, both in the characterization of the hotel capabilities and the analysis of the relations between hotels and engineering consulting firms, afforded for data triangulation or internal validation (Berg and Lune 2012). The research relied on information collected from individuals at different levels of management within the same firm. The researcher's ability to interpret such rich qualitative data lies in identifying the nuances that may arise when individuals appraise the same issue in

different ways and distil what the data is saying about the dynamics of the process under investigation.

Although the interview transcripts were not validated by the interviewees due to lack of feedback post-interview, the fact that the informants were directly involved in the adoption and implementation of environment measures makes them ‘key’ informants and increases the reliability of the knowledge arising from the cases (Kvale 1996).

With regard to external validity, the aim was to seek theoretical replication as the study progressed from one case to another. Following Blaikie (2000), other than focussing on generalisability, this study instead focuses on the issue of ‘relatability’ or comparability and therefore whether the cases can be used to relate to similar contexts of mature service industries.

5.6 - Conclusion

This chapter has demonstrated how the research strategy adopted served to focus the research problem through iterative cycles between the theory and the empirics. The depth of investigation that a qualitative analysis brings to the study enables to develop a rich and detailed analysis on the nature of capabilities in traditional services and their role in building adaptation responses to the challenge of achieving enhanced energy efficiency.

Table 5.5 summarizes the research questions along with the areas of investigation, the methods used and analysis employed and the empirical chapters.

Table 5.5 - A Summary of the Research Questions, Methods and Empirical Chapters addressing the Areas of Investigation

Research Question	Sub-questions	Area of Investigation	Methods of Data Collection	Analysis	Findings
How can a capabilities-perspective explain the adaptation of a traditional service sector to achieve energy efficiency?	*What internal capabilities do traditional services possess that enable them to adopt energy efficient measures and practices?*	Characterizing service firm capabilities.	Hotel website analysis; 26 interviews within 19 hotel cases; 2009 National Survey on the Implementation of Environmental Measures in Hotels.	Hotel cross- case analysis to develop a capabilities framework for adaptation in mature services.	Chapter 6
	How do capabilities differ amongst firms in the same sector and how may these differences account for the differential responses of firms?	Building adaptation patterns to explore whether and how capabilities differ amongst the hotels investigated.		Clustering hotel cases according to the combination of capabilities possessed and how these differ amongst hotels. Linking hotel adaptation patterns and environmental response behaviour.	
How does the relation of the service firm with a type of intermediary, the KIBS, influence environmental action and the adoption of energy efficient measures?	*When do KIBS take up the role of change agents in influencing the adoption of energy efficient measures and practices in their clients?*	Investigating the KIBS' role as an intermediary in innovation adoption.	Analysis of the websites of the engineering consulting firms; 14 interviews with engineering consulting firms; 26 interviews with hotels.	Exploring the evolution of engineering services and the role that engineering consulting firms may be playing in the diffusion of energy efficiency.	Chapter 7
	Which aspects of the KIBS-client relation influence the adoption of energy efficiency measures in the client-firm?	Exploring the relational 'space' between the hotel-client and the KIBS-intermediary.		Analysis of pairs of hotels and engineering consulting firms to identify patterns of interaction between the actors.	
How do policy and other factors external to the service firm influence the adoption of energy efficient technologies and measures?	-	Factors in the external environment that influence the environmental response behaviour of service firms.	16 interviews with actors in the external context; Participation and observation at relevant seminars organized locally; Insights from interviews with 26 hotels and 14 engineering consulting firms.	Qualitative analysis of interview data.	Chapter 8

The ensuing three chapters present the main empirical findings:

- Chapter 6 discusses hotel capabilities that enable environmental action and builds adaptation modes to account for the heterogeneous responses of these firm to implement energy efficient measures and technologies (answering the first research question);

- Chapter 7 builds a detailed analysis of the relation between hotels and KIBS and discusses how this may be influencing the adoption of energy efficiency (answering the second research question); and

- Chapter 8 recalls how the external context, with its heterogeneous signals, may be influencing firm adaptation responses (answering the third research question).

Chapter-6: CAPABILITIES ENABLING ENVIRONMENTAL ACTION IN HOTELS: A FOCUS ON THE ADOPTION OF ENERGY EFFICIENCY MEASURES

6.1 - Introduction

This chapter is the first of three to present the empirical findings aimed at answering the three research questions in this study. It addresses the first research question about how capabilities may account for environmental action in hotels and the adoption of energy efficient measures. The main issues raised are about the types of capabilities that mediate firm environmental action and how these capabilities explain differential responses amongst hotels.

Section 6.2 recalls the theory on the innovation process in services and the potential of service firms to innovate based on their dynamic capabilities. Section 6.3 briefly characterizes the environmental innovations adopted in the hotels investigated and then Section 6.4 discusses the capabilities that can account for this behaviour. This serves as a backdrop to Sections 6.5 - 6.7, where these capabilities are used to construct different adaptation responses that account for variable patterns of environmental action in Maltese hotels. Building on this analysis, Section 6.8 discusses those factors that might be shaping the adaptation responses in hotels, followed by concluding remarks in Section 6.9.

6.2 - A Capabilities Perspective on Firm Environmental Response Behaviour

One of the main contributions of this research is to shed light on the nature of service firm capabilities, which is an under-developed area of research (den Hertog *et al*., 2010). In order to do so, it takes the case of hotels in Malta and investigates their capabilities to adapt and implement environmental action. The focus lies on adaptation responses that may result in the integration of energy efficient technologies into existing activities in the firm and the re-organization and re-distribution of activities and tasks that result in improved energy efficiency.

As discussed in Chapter 3, traditional service firms undertake innovative activities alongside routine tasks (Sundbo 2010, 2011). According to Sundbo (2010), employees that multitask are able to sustain innovation; whilst those that remain focussed on routine activities limit the innovative potential of the firm (ibid). This research draws on Sundbo (2010)'s interpretation of multitasking; it understands multitasking as a firm's potential to modify and adjust tasks and

activities, including through the adoption of novel technologies as a means of adapting and therefore moving towards improved energy efficiency.

Firms require capabilities in order to innovate and adapt (Teece, 2007; den Hertog *et al*., 2010). Studies about dynamic capabilities and firm behaviour have treated these as being linear: firms possessing dynamic capabilities are more responsive to change in the external environment and exhibit a proactive environmental response; whilst those firms with operational capabilities adapt by reducing costs and increasing efficiency (Post and Altman, 1994; Sharma and Vredenburg, 1998; Florida and Atlas, 2001).

Advancing hypotheses that describe a 'cause-effect' relation between capabilities and firm adaptation is an over-simplification of how firms adapt to external change. This study explains differential firm behaviour in terms of the presence of a combination of capabilities other than the presence of one or another distinct capability that defines different patterns of adaptive behaviour (after den Hertog *et al*., 2010). It builds on the capabilities framework presented in Section 3.6.5 in Chapter 3.

Another contribution lies in investigating how a firm is able to nurture a multitasking environment and therefore how it draws on existing resources and re-deploys these in order to stimulate innovative activity.

The empirical analysis relies on data collected from twenty-six interviews undertaken with the top management and hotel maintenance department of nineteen hotel cases in Malta; see Annex 1 that summarizes the hotel codes and interviewees.

6.3 - Characterizing Environmental Action in Maltese Hotels

Den Hertog *et al*., (2011) develop a framework to characterize innovation in the hospitality sector that takes into account the diverse types of innovations, both technological and non-technological innovations, occurring in the primary business processes and in those activities that support service development and delivery.

In order to account for this diversity of innovation types, the respondents in this study were asked to report on novel environment technologies and measures implemented with the staff and hotel guests. These included measures addressing general environmental concerns such as water conservation and waste management as well as measures aimed specifically at enhancing energy efficiency. Table 6.1 gives an overview of the principal measures adopted.

Table 6.1 - Environmental Innovations Adopted in the Hotels Investigated

Type of Innovation	Description of Measures	Hotel Codes*	Total Number of Measures
Technological Innovations	**Energy Efficiency Measures**	A1(3) A2(2), A3(2), B3(3), B4(3) C1(3), B2(6), B6(6), B5(7), D1(4), E1(4), E2(2), E3(7), E4(4), E5(3)	59
	Renewable Energy Installations	B3(1), B4(1), C1(1), B2(1), B5(1) D1(1), E5(1)	7
	Water Conservation Measures	A3(2), B3(2) B4(1), C1(2) D3(1), B2(1), B6(1), B5(3), D1(3), E1(1), E2(1), E3(4), E4(1), E5(3)	26
Organizational Innovations	**Eco-Certification**	A2, A3 B4, D1, D2, D3, B5, B6, E1-E6	14
	Waste Management Strategy	D3, B5, B6, D1, E2-E6	9
	Green Committee	B6, D2, E1-E5	7
	Staff Training	A2, B4, C1, D2, D3, B6, B6, D1, E1-E5	13
GRAND TOTAL:			**135**

* The letter/number refers to the Hotel Case – see Annex 1; the Number in (brackets) refers to the Total Number of Measures Implemented per Hotel.

Sources: For Technological and Organizational Innovations: Survey on 'Environmental Initiatives undertaken by Hoteliers', Malta Hotels & Restaurants Association, 2009; own empirical data. For Eco-Certification Data: Malta Tourism Authority.

In the following section, the capabilities of firms to adopt energy efficient measures are discussed. Although the focus of the analysis is on the adoption of energy efficiency, it also makes some reference to the implementation of renewable energy technologies and to a smaller extent to waste management, as these were bundled together by interviewees when discussing the firm's environmental action.

6.4 - Hotel Capabilities to Adopt Environmental and Energy Efficient Measures

This section discusses the hotels' capabilities to adopt environmental and energy efficiency measures. The analysis is based on a capabilities framework presented in the literature review in Chapter 3 and which was then refined and enriched with evidence from the empirical findings. It includes the capabilities of firms to detect or sense external signals, translate and interpret these signals into the firm in terms of resources committed for innovation adoption; and capabilities to implement environmental action. The combination of these capabilities is what defines a hotel's potential multitask i.e. to adopt environmental technologies and measures whilst maintaining the service (after Sundbo, 2010). The capabilities framework, together with the topics addressed in the empirical investigation and exemplary quotations arising from the interviews with the hotels, is presented in Annex 10.

6.4.1 - Where do Opportunities or Pressures for Change Arise?

This section explores how hotels gain awareness about environmental action and responsiveness i.e. where signals for change arise. Unlike their well-developed capability to scan for market-related knowledge about customers and trends in holiday-making, hotels do not have formal scanning mechanisms to obtain information on issues related to environmental technologies, energy efficiency measures and renewable energy technologies. As a result, in order for related signals to appear on a hotel's radar, they need to be picked up through interactions with third parties[39], or through feedback from the front office and back office operations.

The study distinguishes between signals arising from within the organization i.e. from staff members and managers' perceptions on those issues that need to be given priority, and signals or problems encountered on the job, such as during the preventive maintenance programme undertaken by the maintenance department that may identify faulty or inefficient equipment. This distinction is relevant because it reflects the extent to which the firm is 'thinking' about environmental action, or is simply reacting to problems of inefficient operation arising through routine monitoring activity.

When asked about challenges facing the hotel sector in Malta, the responses reflect a mix of long-standing challenges, such as seasonality and maintaining high occupancy levels, and new emerging issues. Seven hotel managers identify environmental issues around tourism as an emerging challenge; other unrelated developments mentioned by the respondents include the diffusion of online booking systems and the introduction of low cost airlines.

Corporate policy and standards have a strong bearing on the environmental measures implemented by multinational subsidiaries (seven in total); whilst signals from the market,

[39] In Chapter 7 the relation of hotel firms with knowledge intensive business service firms is discussed in terms of how this may be acting as a source of knowledge about energy efficient technologies and practices.

namely from tour operators and customers, appear not to be significant, with three out of the nineteen cases suggesting that tour operators are pushing ahead environmental objectives in their health and safety audits of the hotel. The empirical results about guest participation in environmental measures are in line with those of a study by the national tourism agency on tourists' perceptions of environmental issues: tourists appreciate the environmental measures implemented though they may not necessarily be aware of them nor do they look out for environmentally-friendly hotels when booking a holiday[40]. Thus guest demand is not acting as a significant factor inducing hotels to implement environmental action.

In the cases considered, more than half of the respondents are not yet tuning to issues related to environmental goals in tourism. Instead they are reacting to signals in the external environment about rising utility tariffs, environmental regulation (such as the mandatory waste separation bill), and institutional developments that are putting more pressure on hotels to adopt environmental measures. These external signals and their influence on firm environmental response behaviour are discussed in Chapter 8. The motive of a small 3-star hotel to implement a waste separation strategy provides evidence of firms reacting to such external pressures:

> "*Since* [government has] *increased the charge for waste-collection from hotels by 20%, we are trying to separate waste; that is our main objective vis-à-vis the environment."* (Respondent A1T)

The above means that hotel managers frame their response to "environment" and "greening" signals principally as a requirement to reduce the costs of operations. Therefore, in line with Bhave (1994), the hotels are responding mainly to "internally stimulated" signals about energy and water consumption, as well as waste disposal.

The awareness and need to improve efficiency of operations arises largely within the maintenance department since this is responsible for monitoring the consumption of resources, mainly energy and water, and oversees the implementation of environmental measures. Eleven out of the twelve maintenance managers interviewed claim they are involved in initiating ideas and preparing proposals for energy efficient measures and presenting these to the director or hotel owner.

Being aware of change in the external environment or having the capability to signal opportunities for making internal improvements requires firms to interpret signals about the environment and translate these into the firm, as discussed in the following section.

---

[40] A Report on 'Tourists' Perceptions on Environmental Issues', Malta Tourism Authority Research Unit, Survey Results October 2009 accessed September 2012 at: http://www.mta.com.mt/loadfile.ashx?id=d14ff4b1-7527-42fd-997d-37713e9da6a0.

6.4.2 - Translating Signals into Decisions for Action

The literature suggests that the ability of hotel managers to respond to external signals depends on how these interpret and assess the impact of these signals on the firm or in other words, how they translate signals into something meaningful or of value (Arnell and Delaney, 2006). This research identifies the presence of multiple interpretations of the developments in tourism discussed in Chapter 2 and how these are affecting Maltese hotels. The translation process depends on three factors, namely:

- The 'value' or urgency attributed to these signals i.e. whether they are perceived as an opportunity or cost-burden;

- The role that an employee plays within the firm and how this affects the interpretation of signals;

- The attributes that are considered important when assessing the impact of these signals.

The Value Attributed to External Signals

Signals that are interpreted in relation to their perceived value have the potential to transform into an opportunity other than being viewed merely as a cost-bearing factor. The respondents were asked about the importance of environmental action in tourism in Malta.

Hotels that interpret environmental issues merely as an additional cost, set 'environmental' targets to cut down on electricity and water consumption; these are mainly small independent properties (codes A1, A2 and B1). These hotels have very strict utility budgets on which they operate in order to meet profit forecasts as exemplified by the following quotation:

> "*Often the Directors come up with targets for cutting costs - they may claim that in a particular year they want to cut electricity expenditure by 5%. This is reflected in the budget and you have to see how you are going to reach that target.*" (Respondent B4M)

Apart from cost, nine out of the nineteen hotel cases investigated consider issues around waste separation, energy and water conservation to be playing an increasingly important role for tourism in Malta to remain competitive; these are mainly multinational (MN) subsidiaries and a small group of independent hotels. Four others justify their motives for implementing environmental measures in terms of gaining enhanced marketing exposure in the media and with tour operators (codes B2, B5, E2, and E6).

Signal Interpretation by Different Individuals within the Firm

Individuals occupying different positions in the firm emphasize different attributes or characteristics of an external signal i.e. their interpretation of the potential impact of the external signal is conditioned by the role they occupy in the firm, as suggested by Hertin *et al*. (2003). In this study, two levels of management are considered: top managers who are involved in decision-making and strategy and maintenance managers that oversee the operations and interact closely with the top managers.

The capacity to recognize value from a particular response behaviour is largely a function of top management and how this perceives or labels the issue as providing value, that may be in the form of additional marketing exposure in national tourism brochures, the branding of a green image or the attraction of a niche market of 'green' tourists. Ten hotel cases advertise their hotel as 'green', i.e. as carrying an eco-certificate, on the hotel website and third party websites (such as expedia.com and hotels.com)[41].

The maintenance department interprets signals related to the environmental goals and targets principally based on technical considerations and therefore on how environment technologies are likely to impact operations in terms of gaining efficiency and enhancing performance.

Assessing the Impact of Environmental Measures on Service Delivery and Guest Comfort

The findings indicate that maintaining a standard of service has a bearing on the implementation of environmental action since guest satisfaction is the focal point of the service in hotels. This was the case in eight out of fifteen respondents answering about the perceived impact of environment measures on the hotel and its operations; and is particularly relevant for upmarket hotels. Thus an important consideration is ensuring that energy efficiency measures are compatible with the ambient environment in a hotel, such as providing adequate thermal comfort in the guestroom and a lighting experience that is consonant with the ambience in the hotel. The following quotation from the maintenance manager of a MN hotel illustrates this point:

> "*Aesthetics may play a role in influencing energy efficient measures especially in a five star hotel. For example, although the hotel adopted energy efficient lighting, we have not used this in the lobby area which still runs on halogens that are dimmable. The reason is that in the lobby we need to create a certain environment that is not possible with current energy efficient equivalents; or at least the technology does exist but it is a big capital investment. There are around 400 halogen lights just in the lobby*." (Respondent E2M)

In another example, the chief engineer of a MN subsidiary describes the drawbacks of implementing a research project collaboration to purify water from the hotel's sewage treatment plant since:

[41] Annex 2 provides information on the environmental 'profile' of the hotel cases in terms of eco-certificates and the environmental measures implemented in the hotels.

"*Our main concern was that the guests would not perceive positively the fact that the water used for washing or in the pool originated from waste water*". (Respondent E3M).

This research project led to the construction of a prototype system that produced potable water; however the hotel had no plans to take this further and implement on a large scale. As a result of their perceived impact, energy efficient and other environmental measures are adopted principally in the back-office so as not to compromise guest comfort; in this way they may go 'un-noticed' by the guest and the hotel does not fall short of meeting guest expectations:

"*We implemented systems such as energy efficient systems that do not have any significant impact on the guest; I would say that the guest does not even realize about certain measures. We ensure that the measures we introduce do not compromise the quality of the service offered*." (Respondent E5M)

The maintenance department may interact with the front-office and with the customer in order to obtain feedback on the impact that environment technologies may have on the quality of the guestroom. Two of the MN subsidiaries investigated (Codes E4 and E5) stated that before implementing a new system, they carry out trials and feasibility studies involving the guest to determine the suitability of the technology across a number of parameters including functionality and the comfort of the thermal environment. The technical manager of an MN subsidiary describes his approach with the implementation of a room management system:

"*At the moment, we set up a sample room with the room management system; we did this for at least four rooms because we have four suppliers we are considering. This helps us decide which system best suits our needs. On paper, every system looks great but I do not want to end up with a situation where the guest gets into the room and he is left in the dark because the system didn't work! So we test functionality and complaints from guests. Some guests were saying that the system was switching off at night; so we found there was a wrong setting in the software*." (Respondent E4M)

In order to move from building awareness about environmental action to becoming responsive, firms need to make sense of multiple interpretations coming from different individuals and sources. The capability to translate across these multiple interpretations requires making a trade-off between individuals' perceptions of what the signals mean and their value and their likely impact on the firm. The study identifies the importance of having leverage points such as through the maintenance department or through maintaining relations with external actors that serve to bring the attention focus of the top management towards the potential value of environmental measures for the hotel. The influence of engineering consulting firms, as a type of external actor, is discussed in Chapter 7.

The following section discusses capabilities for adopting environmental technologies, with a focus on energy efficiency.

6.4.3 - Technical Capabilities to implement Environmental Measures

When discussing energy efficiency, this study focuses on those activities in the back office relating to the maintenance of the hotel's operations and practices undertaken with the staff. As discussed in Section 5.4.2.1 of the methodology (p. 87), the hotel maintenance tasks range from monitoring equipment in the plant rooms, general upkeep and landscaping, interactions with the staff on the preventive maintenance programme and front-office aspects in the direct or indirect interaction with the client, for example when addressing guest complaints on various aspects of functionality of the guestroom (such as air-conditioning or the keycard system).

In the context of this study, action to implement energy efficient measures rests on the hotel's technical capabilities to make adjustments in daily operations whilst at the same time maintaining the service. It is also linked to a capability for problem-solving and on taking decisions about those measures that have a minimal impact on the service value proposition. These aspects are discussed below.

6.4.3.1 – Making Adjustments in Routine Tasks

Hotels modify day-to-day activities when they start thinking of new ways of how to exploit the information and knowledge collected through these routine tasks. One example lies in the activity of monitoring energy consumption.

Energy consumption is a common concern in all the hotels investigated; more than half of the respondents interviewed claim that they spent more time on energy management in the past five years due to the rise in energy tariffs. The maintenance department is typically concerned with monitoring energy consumption on a regular basis in order to identify high-energy consuming equipment and improve operational efficiency to maintain profit margins. The findings indicate that the scope of the energy consumption monitoring activity may be shifting. In eight out of the nineteen hotel cases, the energy data are also being used as 'evidence' to base new investments in environmental technologies; these include mid-scale hotels and multinational subsidiaries.

As data on energy consumption are collected and organized by month and year, the maintenance managers are thinking of how to exploit these data to propose and implement new investments in energy efficient systems as part of the preventive maintenance programme or during refurbishments on the hotel property. Such a 'goal re-framing' exercise was observed to occur in four independent hotels (codes B4, B5, B6, D1) and four MN subsidiaries (codes E2, E3, E4 and E5). The owner of an independent hotel said:

> "*Since we have been in the business for over thirty years now, we have our own* [energy] *records. We have a fuel meter in every boiler so that I know how much energy I am consuming down to every individual boiler. This gives me the background to work and base investments; I am not working on fictitious figures but on actual figures*." (Respondent B5T)

Information collected from routine monitoring of energy consumption can serve as an input to making adjustments in the way the hotel operations are managed. The maintenance manager or the general manager (in small hotels), has the role of making 'sense' of these data and taking decisions about how to modify management practices in order to achieve higher efficiency of operations. The maintenance manager of an MN subsidiary describes how the management of the heating and ventilation system is based on energy data and on information collected from a building management system:

> "*The up-keep of these* [plant rooms] *is being recorded on spread sheets. I have introduced this and we monitor the operation of every system on a daily basis. This allows us to build a history of every piece of machinery; thus this helps do better follow-up on performance and also efficiency. Also it is not sufficient to say we have a building management system that regulates consumption. When it is cool outside and there are north-westerly winds, I switch on one chiller and not two*." (Respondent E4M)

In five MN subsidiaries and one independent hotel chain, energy and water data are logged into an environment reporting system and the data used to assess the performance of the various hotel departments. In the MN subsidiaries, these data are transferred to the corporate headquarters and used to rank the subsidiaries according to their environmental performance. The Owner-Director of an independent hotel chain claims:

> "*The performance of each department is also being benchmarked against environmental performance - 30% is allocated to energy*." (Respondent B6T)

The findings show that maintenance managers who are modifying maintenance tasks in order to incorporate new energy management practices, tend to undertake active searches for new environmental technologies and propose new project ideas to the top management, as well as being involved in the implementation phase; this approach is observed for six MN subsidiaries (E1-E6) and a group of independent hotels (Codes B3-B6, D1-D3). Whilst in cases where the attention is towards maintaining the efficiency of current operations, the maintenance managers are mainly involved in the execution of environment-related projects, being tasked with obtaining quotations from trusted suppliers and leaving decisions on which technology to adopt, to the hotel owner or external consultant (Case codes A1-A3 and B1).

Another factor that bears on the implementation of energy efficient measures is the problem-solving approach when implementing technologies and measures that are new to the firm.

6.4.3.2 - Problem-Solving and Evaluation

Problem-solving is about combining knowledge accumulated 'on the job' to find solutions to new identified problems; these solutions may lead to modifying current practices and implementing new ones. This problem-solving characteristic is often used as an indicator of a firm's innovative potential (Sundbo, 2010). The findings show that hotels may use a problem-solving approach when choosing amongst various available technologies and evaluating which is the best

available option; and when assessing how these technologies may affect the standard of the service.

Evaluating Technology Options

As discussed in the methodology in Chapter 5, a hotel has a complex organization being made up of several functional departments and offering a range of facilities depending on size and market segment. Energy efficient technologies and renewable energy technologies adopted in the firm need to find a fit with existing engineering services and with features of design and architecture in the hotel. Therefore adopting such energy efficient systems requires firms to evaluate between technology options and figure out what works best for the firm thus shifting away from a "one-size-fits all" approach.

This capability for problem-solving requires hotels to assess technology options based on a number of considerations including:

- Identifying technologies and measures that result in significant energy savings e.g. this may involve deciding between installing renewable energy systems or insulating the piping systems;
- Determining the extent of disruption to day-to-day activities that goes with implementing environmental technologies in the hotel; e.g. changing the air-conditioning system to more energy efficient systems is considered a major disruption as this would involve work in the guestrooms;
- Assessing the compatibility of environmental technologies with the characteristics of the hotel property such as features of design and architecture. One example mentioned in the interviews is the availability of land-area for the installation of solar water heating and renewable energy technologies and the corresponding energy savings accrued from implementing such systems.

The findings show that thirteen out of the nineteen hotel cases have a capability for problem-solving; though this may be present to different degrees in these hotels. The hotels accumulate detailed knowledge on the characteristics of their firm in terms of the energy consumption profile of the property and the main problem areas with regard to energy consumption; they carry out an active search for technologies and systems that represent the best available option. This requires a certain resource commitment (in terms of time for monitoring and researching new available technologies). One of the respondents explains the problem-solving approach used in the hotel when implementing solar water heating:

> "*Locally we have very strict* Legionella[42] *rules. This means that at any time throughout the building hot water must be at a minimum of 55 degrees Celsius. This is a major challenge*

[42] *Legionella* bacteria grow in water tanks; they may become airborne and penetrate the Heating, Ventilation and Air Conditioning System of buildings. They are the cause of Legionnaire's disease that is

for solar heating since temperatures on the roof tend to go higher than that; so the engineer, and rightly so, was a bit sceptical at the beginning as to whether we could achieve this with solar heating systems. So we had a fair number of discussions and meetings [with the engineer] *before we decided that this alternative energy* [system] *is the way forward and engineered a system that could achieve the desired temperatures*." (Respondent B3T)

A small group of economy and mid-scale independent hotels rely on implementing *ad hoc* solutions to address hot spots of high energy consumption (Codes A1-A3 and B1). They typically lack a problem-solving capability and instead curb hot spots of consumption by replacing out-dated equipment, or implementing energy efficient equipment as a one-time solution, for example motivated by the availability of grants subsidizing renewable energy installations. These hotels tend to be routine-oriented and therefore focused on day-to-day activities; environmental action is characterized by a 'technology replacement strategy'.

Rethinking Thermal Comfort in the Guestroom

Another inroad to analyzing the problem-solving approach is that of understanding how firms assess the impact of energy efficiency technologies on the thermal environment in the hotel and on guest comfort.

The findings show that some hotels are identifying new ways of delivering a comfortable stay to the guests; they are moving away from the view of the guest having full control over the thermal environment in the guestroom, which traditionally embodied the concept of providing a comfortable stay to the customer. Instead, in eight of the cases investigated, the hotel management has 'taken over' control of the thermal environment that is regulated remotely using innovative technologies such as room and building management systems. These technologies are changing the way in which the firm interfaces with the client, by shifting the decision-making power on what constitutes a comfortable environment towards the firm.

This study hints at the fact that the concept of thermal comfort may be changing also in light of global developments (including climate change): the idea that the guest may be required to adapt to new ways of experiencing thermal comfort, may lead to rethinking how hotels provide a comfortable or luxurious experience to their guests. The chief engineer of an MN subsidiary discusses a future view of what thermal comfort could look like:

"*Whereas in a five star hotel you would normally expect to have air-conditioning in the rooms on all the time in the summer; in the future this will change both because of the cost and also because of the environment*." (Respondent E1M)

---

transmitted through inhalation of bacteria-laden water droplets such as from air-conditioning systems. Source: Mayo Clinic, accessed 15th April 2013 at: http://www.mayoclinic.com/health/legionnaires-disease/DS00853/DSECTION=causes.

The level of customer engagement in the hotels' environment policies shows a mixed picture. In fourteen out of the nineteen cases, the respondents claim to be implementing environment policies with guests, through for example, a linen reuse policy, and a waste separation strategy. However most do not monitor the success of uptake of these measures and do not consider these as being in high demand by the guest. The Health and Safety Manager of an MN subsidiary explains how, following failed efforts to implement a waste separation system in the guestroom, the onus of waste separation was left in the hands of the room-cleaning staff:

> "*Guests do not really engage in waste separation when they are on holiday. Thus I decided to keep one bin in the guest rooms - this is in any case a small bin - and I told the maids to separate out the plastic bottles which they can throw away in the laundry room*." (Respondent E4O)

Thus, modifying aspects of the service that require direct guest involvement may not always work; hotels modify those aspects of the service, such as functionality and comfort, that have a minimal effect on aspects of delivering a comfortable stay.

In summary, the ability of firms to implement action depends on their propensity to modify existing routine work and their capability for problem-solving. These characteristics are seen to be a precondition for hotels to implement new initiatives that go beyond their day-to-day activities.

6.4.3.3 - Taking Initiative beyond Day-to-Day Tasks

Apart from modifying existing tasks that result in improved energy efficiency, hotels are also implementing new initiatives that enable environmental action. The findings show that hotels with capabilities for problem-solving are more likely to initiate new environment-related projects compared to those focused on routine activities.

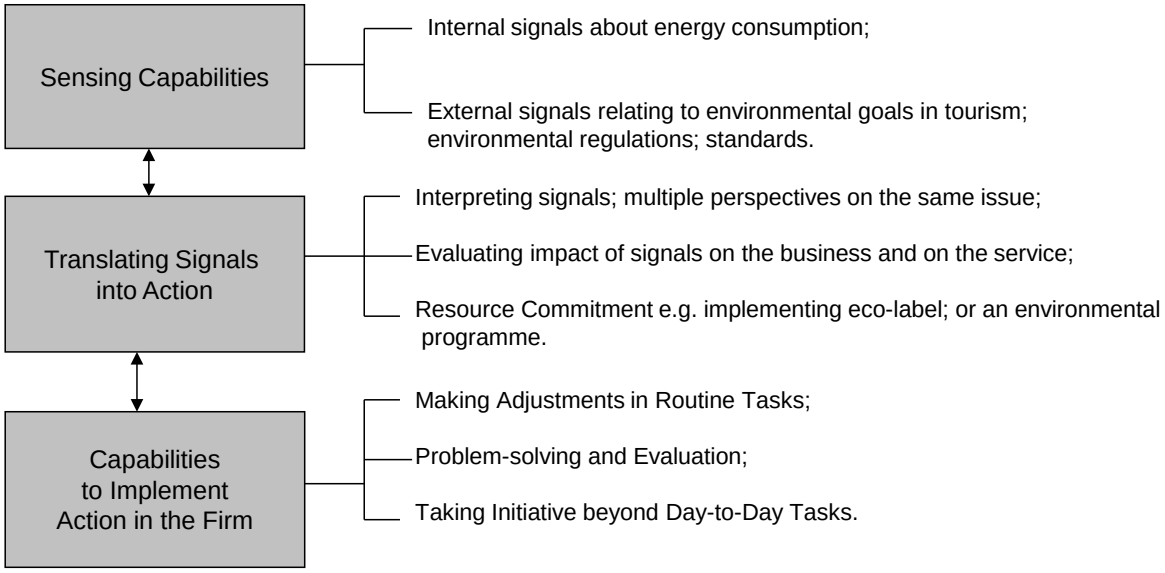
In addition to raising awareness about environmental measures amongst the staff, ten out of the nineteen hotel cases provide regular training to staff on issues related to waste management, energy and water consumption. These cases include five independent hotels and five MN subsidiaries. Eight of these hotels also implement new environmental initiatives that fall outside the routine tasks of monitoring operations; one such initiative includes regular meetings of an eco-team or committee to discuss and coordinate environmental policies and projects with other departments in the hotel. In more than half of the cases where new environmental measures are introduced, the hotel maintenance managers are spearheading these initiatives, being responsible for the staff training and strategies related to waste separation and energy efficiency and taking up additional tasks over and above maintenance duties.

Therefore the problem-solving capability has a 'ripple' effect on the capability of the hotel to undertake new initiatives that may result in new ways of distributing activities (such as those related to implementing a waste management strategy) and new structures for coordinating environmental initiatives (such as an eco-team).

6.4.4 - Synthesis on the Capabilities for Environmental Action

The chapter has thus far explored the capabilities that enable environmental action with particular reference to the adoption of energy efficient technologies and measures and has contributed to describing the underlying characteristics of these capabilities, thus enriching the literature on dynamic capabilities in services (den Hertog *et al*., 2010; Kindström *et al*., 2012). Based on this analysis, a refined framework outlining the components of the capabilities to implement energy efficiency and environmental measures in hotels is proposed in Figure 6.1.

Figure 6.1 - Capabilities Framework to Adopt an Environmental Response Behaviour



Source: author

A firm may possess different combinations of these capabilities and their underlying characteristics, determining its orientation towards enhancing operational efficiency or otherwise its capabilities to adapt along trajectories characterized by making 'deeper' adjustments in the way of adopting new structures and environmental initiatives. This means that hotels have different potentials to multitask. Recalling the review of the innovation process in traditional services in Chapter 3, firms multitask when they adopt environmental technologies and measures and at the same time keep the service running.

The findings show that the capabilities present in the firm can account for differential environmental responses amongst the hotels. The following sections discuss how these capabilities can explicate the multitasking potential of the hotels and patterns of environmental action. Section 6.5 below builds different adaptation responses of hotels based on their particular combination of capabilities and then section 6.6 links these capabilities with the innovation patterns of hotels.

6.5 - Patterns of Firm Environmental Response Behaviour - Building Adaptation Responses

Following from the discussion on the capabilities of firms to adapt, this section uses these capabilities to characterize different patterns of firm adaptation responses. The empirical findings indicate that hotels do not innovate in the same way and that combining the capabilities described in the previous section can explain different innovation patterns observed.

An important finding is that firm capabilities are not linear i.e. hotels do not possess one or other capability that results in the implementation of environmental innovations and actions; rather they possess a combination of capabilities to sense external developments and manage resources to take decisions for action; and technical capabilities to adopt an environmental response. The combination of capabilities is what defines the potential of a firm to multitask i.e. to engage in innovative activity alongside routine tasks. Secondly, different degrees of multitasking potential present across the hotels can explain the different patterns of adaptation responses.

The research builds three patterns of adaptation responses identified on the basis of the combination of capabilities found in the hotels; these include:

- **Reactive Adapters:** Hotels possessing capabilities to implement *ad hoc* technology solutions and maintain operational efficiency;
- **Active Adapters:** Hotels possessing capabilities to modify maintenance practices to enhance energy efficiency;
- **Proactive Adapters:** Hotels possessing capabilities to implement new practices and organizational structures for environmental action.

In order to combine the capabilities and analyze how they result in firm adaptation, a series of set diagrams are drawn - see Figures 6.2 to 6.4 in the sub-sections that follow. These diagrams group hotels according to similar types of capabilities following a clustering approach discussed in the methodology; see Section 5.5.2 on p. 104 that shows how the capabilities and their underlying characteristics are grouped to derive the adaptation modes.

In the set diagrams, each capability is represented by one circle and each circle is populated by the hotel codes that possess the particular capability. The areas of overlap between circles are representative of those hotels sharing similar capabilities: the area corresponding to the highest degree of overlap is that which characterizes the combination of capabilities and resultant adaptation mode of the firm. The analysis is based on seventeen out of the nineteen hotel cases investigated. Cases B3 and E6 were not considered since there was insufficient data to build corresponding adaptation modes. The value of these diagrams is descriptive and the diagrams do not attempt at quantitative accuracy or statistical correlations.

The adaptation responses are discussed below.

6.5.1 – Reactive Hotels

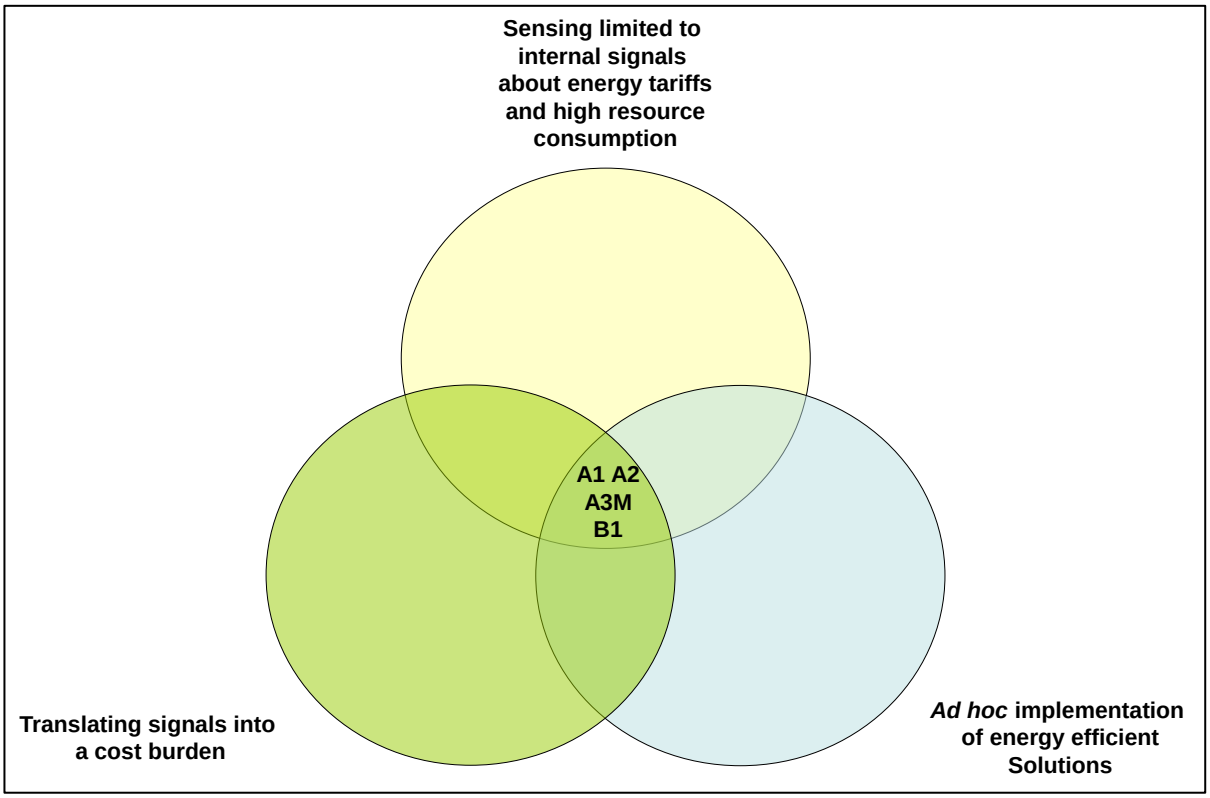
Reactive hotels implement technological innovations in the short-term in order to comply with environmental regulations or to cope with energy price hikes; generally they translate signals about environmental awareness simply as a burden i.e. as representing an additional cost to the firm. The principal strategy of reactive hotels is to adapt by doing things the 'old way' and solving problems of high energy consumption in the short-term, such as through replacing high-consuming equipment or installing renewable energy systems that are part-subsidized by government schemes[43].

Whilst this adaptation response brings advantages of enhanced operational efficiency, it is considered a short-term approach. The firms exhibit a low-level of multitasking because of the combination of a narrow sensing capability about developments in tourism and technical capabilities to implement environmental action. The hotels accumulate limited internal knowledge about how to assess the energy requirements of the hotel property and therefore they have limited problem-solving capability. Thus even though signals about environmental awareness may be on the radar of the top management, this sensing ability may not be matched by the firm's technical capabilities to evaluate choices about the best available solutions.

Four cases of small independent economy and midscale 3- and 4-star hotels are representative of this adaptation mode (Figure 6.2).

[43] The government schemes supporting the installation of energy efficient measures and renewable energy systems are described in Section 2.4.3 of Chapter 2.

Figure 6.2 – Cluster of Reactive Hotels and their Combination of Capabilities for Environmental Action



***Key**: Each entry in the circles refers to a Hotel code (see Annex 1)*

6.5.2 – Active Hotels

Similar to the previous group, active hotels have limiting sensing abilities about developments in tourism and environmental objectives and are responding principally to internal signals about energy price hikes. However unlike the reactive hotels, these possess well-developed technical capabilities to adjust or modify routine activities related to energy monitoring and energy management and for problem-solving. They exploit these capabilities in order to implement energy efficiency measures that result in considerable energy savings in the hotel and that find a good fit with the features of the hotel in order not to impact on the guest or on the hotel's ambience.

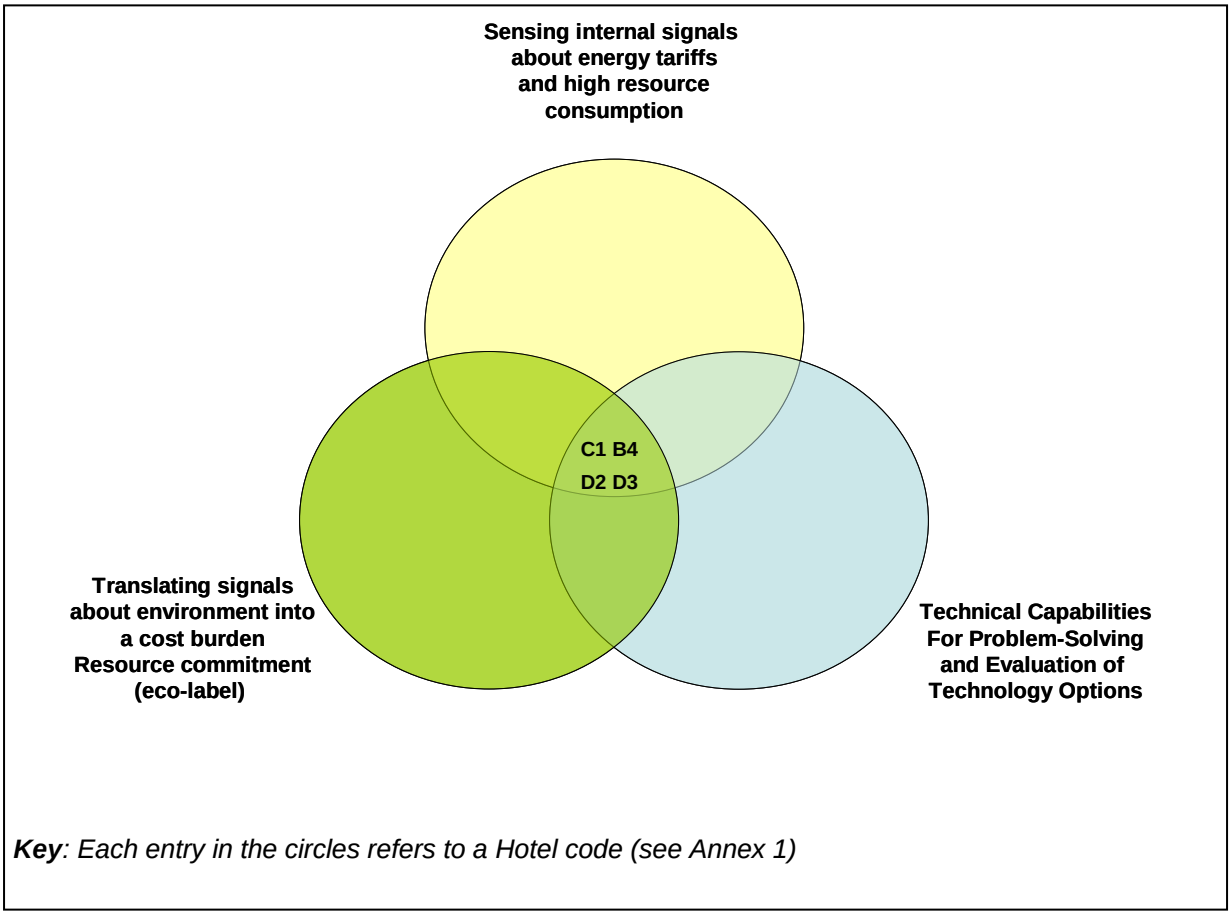
This adaptation mode is interesting because it shows that a firm's response is not dependent solely on the firm's capability to sense and interpret external signals; the technical capabilities to implement novel environmental measures play an important role in shaping the firm's environmental response behaviour.

Active firms are characterized by their keen multitasking potential i.e. they are engaged in adapting day-to-day tasks to improve energy efficiency and in addition undertake new environmental initiatives as part of the preventive maintenance programme or during renovation projects. The firms' multitasking potential is influenced mainly by the propensity to continually find new ways to improve the energy consumption profile of the hotel's operations whilst

maintaining a comfortable thermal environment in the hotel; as opposed to adaptation in reactive hotels which proceeds through adopting *ad hoc* technological solutions to reduce energy consumption in particular hot-spots of energy consumption.

This mode (Figure 6.3) is observed in a group of midscale and upscale 4- and 5-star hotels; it provides an example of how hotels may shift from enhancing operational efficiency to developing a multitasking potential to adapt. This is mainly achieved through nurturing a problem-solving capability in the firm.

Figure 6.3 – Cluster of Active Hotels and their Combination of Capabilities for Environmental Action

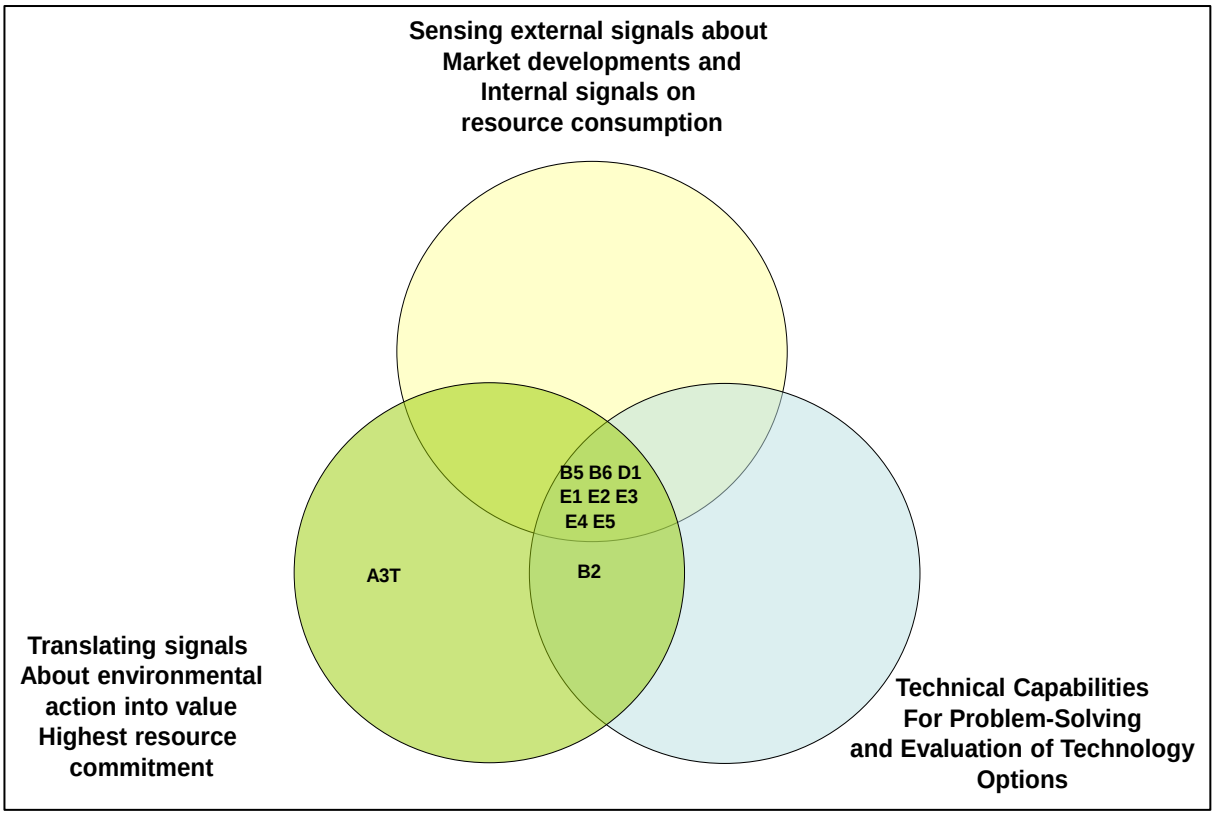


***Key**: Each entry in the circles refers to a Hotel code (see Annex 1)*

6.5.3 – Proactive Hotels

Unlike active hotels, the proactive group are sensing a broader range of signals about emerging developments in tourism and the relevance of environmental goals as an opportunity for the firm (Figure 6.4 below). This opportunity may translate into advertising in national brochures or gains in market share of tourists. These are firms with a pro-environment strategy

Figure 6.4 – Cluster of Proactive Hotels and their Combination of Capabilities for Environmental Action



***Key**: Each entry in the circles refers to a Hotel code (Refer to Annex 1)*

This adaptation response is consistent with Helfat and Peteraf's (2003) claim that firms invest in capabilities development according to their interpretation of external factors as providing a strategic advantage. This study adds to this claim by describing the combinations of capabilities that are likely to bring this advantage. The capabilities mix of these firms reflects a high multitasking potential. Thus, their well-developed sensing and translational capabilities strengthen the environmental response in these firms by motivating the commitment of resources to achieve environmental goals and standards and adopting new structures.

Proactive firms undergo 'deeper' changes in the way they organize the maintenance activities such as through the setting-up of green committees and the implementation of an environmental management strategy, or the provision of staff training on environmental aspects such as waste management and engage the staff when implementing environmental measures and strategies. This drives the firms along trajectories that may result in greening aspects of the service i.e. these hotels are more likely to introduce environmental innovations in the front office through interaction with the hotel guest as shown by the findings for the multinational hotels that fall in this adaptation mode. Moreover, these firms show an enhanced propensity towards taking initiative beyond day-to-day tasks compared to active firms, being engaged in some research activity and undertaking trials on novel environmental technologies.

This adaptation mode is exemplified by a wide diversity of hotel types and includes three independent 4-star midscale and upscale hotels and five 5-star MN subsidiaries.

In summary, the findings show that the combination of capabilities does matter in shaping environmental action in hotels with particular reference to energy efficiency. It results in heterogeneous responses of hotels within the same sector as reflected by the three adaptation modes proposed in this study. The adaptation modes also provide insight on the types of hotels, in terms of the star-level and market segment, possessing particular types of capabilities. These capabilities combinations equip the hotels with a different potential to multitask or to adopt environmental technologies and measures whilst maintaining the service value proposition. The next section links the three adaptation modes with the innovation patterns observed in the hotels.

6.6 – Linking Hotel Capabilities and Patterns of Innovation in Traditional Services

This study has focussed on technical aspects of the innovation process and on how service firms adapt to challenges about environmental responsiveness by innovating mainly in the back-office. The empirical findings corroborate den Hertog *et al*.,'s (2011) observation of innovative activity in the Dutch hospitality industry taking place 'behind the scenes' and that is largely 'hidden' to the customer because it is designed to cause minimal disruption in order not to compromise the standard of service.

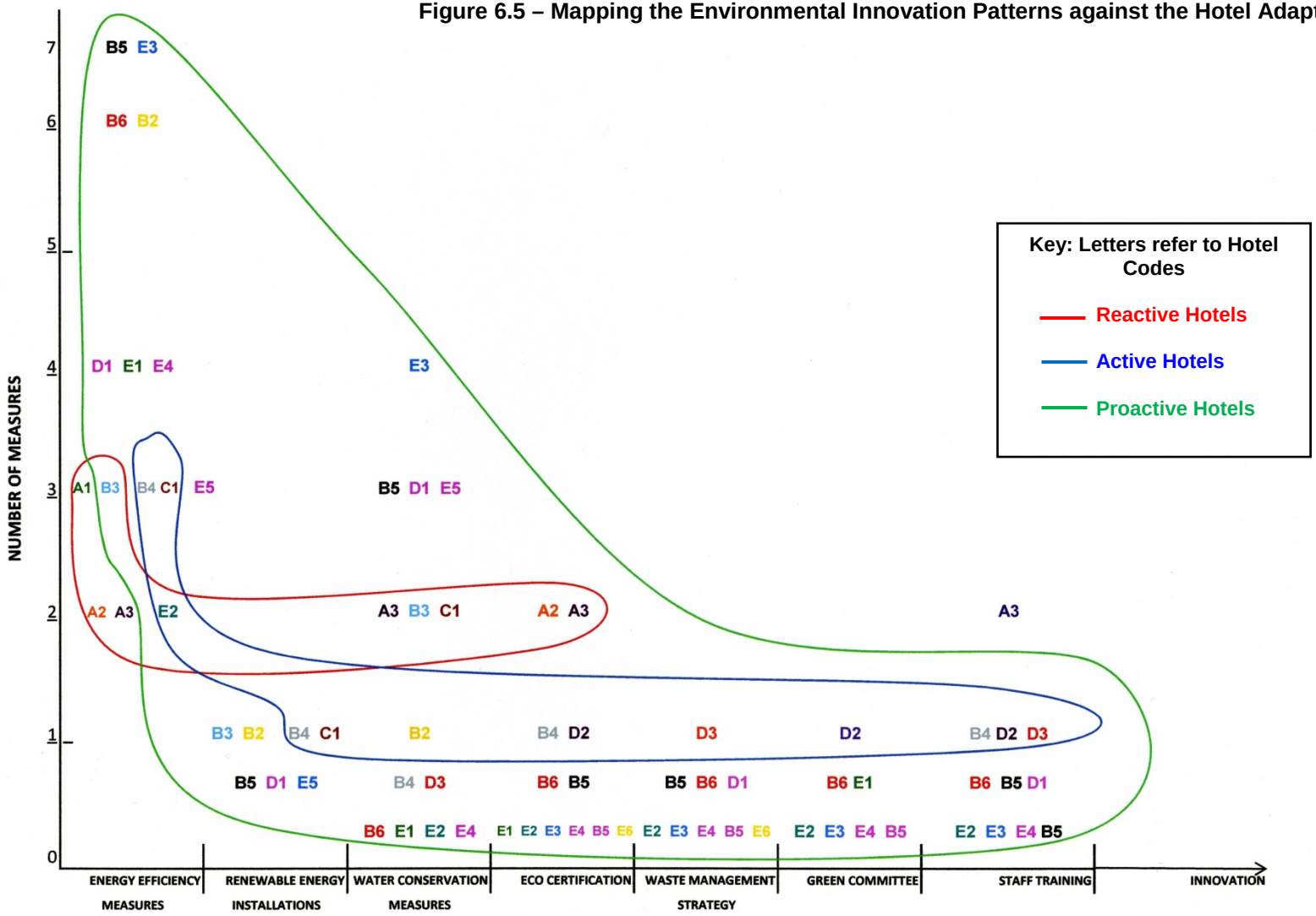
The analysis shows a relation between the adaptation mode, and therefore the firm's combination of capabilities and the pattern of innovative behaviour in the firm. The three adaptation modes identified in Section 6.5 are placed against the types of environmental innovations, described in terms of the adoption of technologies new to the firm, and the adoption of organizational innovations. The results of the analysis are summarized in Table 6.2 and Figure 6.5 below.

Table 6.2 - Hotel Adaptation Modes and Patterns of Environmental Innovations

Innovation Pattern	Description of Measures	Number of Measures Implemented (Classified by Hotel Adaptation Mode)			Total Number of Measures
		Reactive	Active	Proactive	
Technological Innovations	**Energy Efficiency Measures**	10	6	43	59
	Renewable Energy Installations	1	2	4	7
	Water Conservation Measures	4	4	18	26
Organizational Innovations	**Eco-Certification**	2	3	9	14
	Waste Management Strategy	-	1	8	9
	Green Committee	-	1	6	7
	Staff Training	1	4	8	13
GRAND TOTAL:		18	21	96	**135**

Sources: For Technological and Organizational Innovations: Survey on 'Environmental Initiatives undertaken by Hoteliers', Malta Hotels & Restaurants Association, 2009; Own empirical data; For Eco-Certification Data: Malta Tourism Authority, accessed September 2012.

Figure 6.5 – Mapping the Environmental Innovation Patterns against the Hotel Adaptation Modes



Source: Empirical Data

The innovation pattern of reactive hotels, mainly 3- and 4-star level, is to adopt technological innovations. These firms are considered the least adaptable since they deploy their capabilities to implement a technology-replacement strategy where energy efficient technologies are brought in to replace old and inefficient systems. These are firms that adopt technological innovations without undergoing adaptation in other aspects of the service delivery.

4- and 5-star hotels exhibiting an active adaptation response adopt a similar number of measures as the reactive hotels; however they have a larger spread of innovation types, with a higher representation of organizational innovations adopted compared to reactive firms. They exhibit an enhanced adaptability compared to reactive hotels as shown by the diverse innovation pattern; this is linked to the combination of capabilities for problem-solving and evaluating technology options.

Multitasking firms that link their adaptive response to a pro-environment strategy (proactive hotels) are more likely to introduce organizational innovations other than merely technological innovations; these include principally multinational subsidiaries and also a small group of independent 4-star hotels. Proactive firms adapt by implementing a combination of technological and organizational measures, with the highest number of measures adopted in the hotel cases investigated (96 out of a total of 135 measures). The innovative pattern is the result of 'mutual adjustment', using Tether and Howells' (2007) terminology, between technological and organizational change. Their adaptability is linked to the combination of capabilities to translate or interpret emerging signals about environmental responsiveness in tourism and technical capabilities to adopt diverse types of environmental innovations.

The analysis has linked the differentiated adaptation responses of firms to the presence of a combination of capabilities that in turn accounts for the innovation patterns observed. The next section discusses further how the firms' capabilities enable these to engage in particular innovative behaviour.

6.7 - Accounting for the Variable Adaptation Response in Hotels

The hotel adaptation modes constructed are not the sum of the individual capabilities; rather they reflect a more complex dynamic where the capabilities interact to give rise to a particular innovation pattern. The capabilities also indicate the potential of hotels to multitask i.e. to engage in environmental action alongside activities and tasks related to delivering the service. Adding to Sundbo (2011), the findings indicate that there are different levels of multitasking potential in these traditional service firms.

The construction of adaptation modes provides a non-linear model of how to understand the role of capabilities in hotels i.e. these firms do not move from sensing to translating signals

about environmental responsiveness and then develop technical capabilities to implement environmental action. The multitasking potential comes from the combination of these capabilities; this is consistent with den Hertog *et al*.,'s (2010) argument about service firms possessing combinations of dynamic capabilities for innovation.

Proactive hotels are considered to be more adaptable compared to reactive and active hotels. They possess the 'richest' or most diverse combination of sensing and translational capabilities and capabilities for problem-solving and are more likely to implement changes that result in environmental action; they have a high multitasking potential. In contrast, reactive firms with a restricted combination of capabilities that leads to improving operational efficiency are considered less adaptable in the sense of making fewer adjustments or changes in the way of organizing maintenance and back-office operations that could have a significant effect on energy efficiency.

The empirical analysis also illustrates specific cases of hotels with a high sensing ability but with limited technical capabilities to adopt environmental action; these adapt along an efficiency trajectory (reactive hotels) and are equipped with a low multitasking potential. It also provides examples of active hotels with low sensing and awareness about developments in the external environment but with technical capabilities for problem-solving and evaluation and therefore with a keen multitasking potential (active hotels).

A number of cases stand out as providing additional insight on how the combination of capabilities may be shaping firm adaptation responses. These are singled out from the hotel cases investigated in order to highlight particular phenomena emerging from the observations.

6.7.1 - A Mismatch between Sensing External Developments and Capabilities to Adopt Environmental Measures

Hotels may build high awareness about environmental goals in tourism; however this awareness may not translate into responsiveness for action because the firms have limited technical capabilities to adopt environmental technologies and measures. One case of an reactive hotel (Code A3) shows how sensing abilities were not matched by the capabilities for problem-solving and evaluation of energy efficient measures. In this case, the adaptation mode was not clearly identifiable: the top management adapts along a proactive mode by considering the environment as an opportunity and investing in 'green' advertising and the adoption of an eco-certification (A3T); whilst the limited technical capabilities reflect a reactive adaptation mode that is typical of routine-oriented activity hotels (A3M).

This case illustrates the fact that the adaptation response needs to be assessed on the basis of a combination of capabilities and is not solely based on what appears as a pro-active environmental approach (or 'green wash').

6.7.2 - A Firm's Environmental Attitude and its Potential to Adapt

Studies on firm environmental behaviour have linked the adoption of environmental measures to the proactive attitude of the management to endorse an environment strategy (e.g. Sharma, 2000). The empirical findings show that some hotels have a potential to adapt without exhibiting an explicit pro-environment attitude as shown for active hotels.

Active hotels respond mainly to internal signals about reducing operational costs and invest minimal resources in advertising their property as 'green' (i.e. possessing an eco-label) or implementing a formal (written) environmental strategy. Nonetheless they deploy capabilities for problem-solving and technology evaluation that enable them to modify practices of energy monitoring and maintenance operations towards enhancing the efficiency of these activities. Environmental initiatives arise mainly from the maintenance department through an active search for novel technologies and solutions, and are supported by the hotel owner or director.

In these firms, adaptation is taking place in the day-to-day operations and in the firm taking initiative to implement novel environmental projects; however this does not translate into an explicit environmental strategy.

6.7.3 - Capabilities Development and Prioritizing Response Options

The study shows that hotels deploy capabilities following a choice about which response or task to prioritize. As a result, the presence of a capability may not always be indicative of the adaptation response adopted by a firm as indicated by Berkhout *et al*., (2006). Rather, the adaptation response depends on the prioritization or re-direction of resources and capabilities to what are perceived as important activities.

The empirical data indicate the case of an independent 4-star active hotel that was one of the first to obtain the national eco-certification label but did not renew this commitment. The chief engineer explained the motivations below:

> "*For a number of years we were involved in the eco certification…..we pioneered that system……now I didn't continue it. The simple reason was that I was going through a few large refurbishments last year and the year before and I didn't have time to commit*." (Respondent D3)

Thus the deployment of a firm's capabilities, at any one time, depends on the activities that are given priority and therefore on the strategic orientation of the firm, in line with Helfat and Peteraf (2003).

In summary, the findings show that technical capabilities to adopt energy efficient measures strongly determine the type of adaptation mode in the hotels investigated; whereas the capability to sense signals about environmental goals and objectives in tourism is currently less

important in shaping the adaptation responses and consequently environmental action in these hotels. This is demonstrated by the active hotels that are 'inward-looking' in sensing principally internal signals about energy prices and yet having similar technical capabilities as the proactive hotels to adopt energy efficiency measures and exhibiting similar innovation patterns.

The sensing capability, which in reactive and active hotels is limited to that of detecting internal signals about energy consumption, is enhanced in proactive hotels to scanning signals about emerging developments in tourism; the latter are mainly MN subsidiaries. According to the findings, proactive hotels are more likely to leverage technical capabilities and take initiative on new environmental projects since they translate these signals into something meaningful or of value (for marketing purposes or to attract a particular type of 'green' tourist or otherwise to comply with the corporate environmental policy).

6.8 - Nurturing a Multitasking Environment in the Hotel

As discussed above, a firm's multitasking potential is related to the capabilities for sensing and translating signals into the firm and technical capabilities to adopt environmental measures. This section asks about on how firms are able to valorize this multitasking potential or in other words it analyzes those conditions or factors in the firm that favour the development of particular combinations of capabilities. The empirical findings indicate that these factors relate to the way that hotels organize the maintenance tasks and activities and through creating spaces for innovative activity.

6.8.1 - Characteristics and Organization of Maintenance Tasks

A firm's multitasking potential can be traced to the type of 'on the job' experience and to the exposure to diverse contexts and situations that generate practice-based knowledge about environmental solutions. This aspect is seen to vary amongst the hotels investigated and is linked to the characteristics of the hotel in terms of how this organizes the maintenance tasks. Refer to Annex 12 for a summary of the characteristics of the maintenance department based on the interview data.

Organizing Maintenance Tasks

A distinction is made between maintenance tasks related purely to monitoring and maintaining equipment and those that involve management duties. In the reactive hotels, the maintenance department consists of a single technician carrying out principally monitoring activities; these hotels tend to be small (between 90-200 bedrooms) and also have a modest staff size of between 20 to 100 full-time employees.

In twelve of the cases, the hotels organize their maintenance department as a team, where the manager's role is that of taking decisions on how to distribute the tasks of the maintenance

department and this requires building a capability for problem-solving. These hotels tend to be larger (with >100 to 400 full time staff and between 250-400 bedrooms) and represent a variety of midscale to luxury independent hotels and MN subsidiaries; these are the active and proactive hotels. The tasks of the maintenance department are varied in terms of attention focus dedicated to different aspects of engineering and management as illustrated by the following quotation:

> "*We start with a management meeting with the heads of department. I distribute the work to my team of technicians, painters and gardeners, pool attendants etc. We take care of the water treatment…….we monitor the equipment. Essentially the work is different every day because something always crops up in the rooms, or on the premises. Mostly the job is about taking decisions and solving problems*". (Respondent E2M)

The information and knowledge obtained through managing different aspects of the hotel property gives the 'bigger' picture on the operations; this also means that the firm is able to use this information to solve problems by adjusting routines where these are functioning sub-optimally or where improvements can be made. The managing director of an independent 4-star proactive hotel describes how they coped with the challenge of installing environmental technologies new to the firm:

> "*When we had installed half-flush system in the toilets to save water, we found then we had a problem with the sewage becoming too concentrated and blocking the drains so we had to see to that. Another example: when we installed the card-switch systems in the bedrooms, they proved to be effective to save on electricity. However a bigger problem arose in winter months as the rooms tend to get cold; so we had to get a 'lights manager' to go round the rooms and place the key cards in before the guests arrived*." (Respondent B5T)

Maintenance managers, whose tasks involve both management, as well as monitoring responsibilities, are more likely to make adjustments and modify day-to-day maintenance tasks in order to improve energy efficiency and to take initiative on new environmental projects. Apart from the organization of maintenance tasks, another aspect influencing the 'on the job' experience of the firm relates to personal search processes undertaken by the hotel maintenance department and the interaction with customers about environmental and energy technologies.

Accumulating Practice-Based Knowledge on Environmental Measures

Acquiring knowledge on the subject matter through 'search' processes and through interaction with external actors influences the ability of the hotels' managers to make an assessment on technology choices and therefore enhances their capabilities for problem-solving and

evaluation. The interaction of hotels with engineering consulting firms is the subject of the next chapter.

The owner of an independent 5-star proactive hotel describes the search processes undertaken ahead of implementing energy efficient measures:

> "*I spent one year and a half collecting and sourcing information on energy technologies from fairs, international contractors and built a knowledge base on various aspects (energy, materials, finishings, etc.)……I implemented those systems I could myself understand. I did a lot of background work and research which I then discussed with the engineering consultant…The familiarity with the subject matter enabled me to be able to interact better with suppliers i.e. not purchase simply what was being sold on the market but be more critical of which systems were suited for the hotel*." (Respondent D1T)

An active search for information and knowledge contributes to building a practical knowledge-base about environmental technologies and feasible solutions that can then be applied to new tasks. The engineer of an MN subsidiary describes the approach when investigating the feasibility of setting up a wind turbine on the hotel property:

> "*We did our own investigation and then bounced our ideas with* [building services engineering] *experts. The wind option seems to be most viable in terms of payback which is about 4-5 years; you need a small footprint (surface area) but the main problem is lack of sufficient data on wind and weather conditions in the site we have earmarked. Our director gave us the go-ahead to start collecting such wind data*." (Respondent E3M)

Most of the maintenance managers interviewed have years-long experience working in the hotel sector (over ten years' experience for seven of the cases); they accumulate practical knowledge through implementing environmental measures and energy solutions in the workplace. In the MN subsidiaries (proactive hotels), the firms also accumulate knowledge by sharing information on environmental initiatives and technologies with sister subsidiaries around the world, as described by the health and safety manager of a MN subsidiary:

> "*We share at a Starwood level through an intranet where we find a library of comments and photos that all environment champions at Starwood can see. If the environment champion of Abu Dhabi wants to know what we are doing at Le Meridien Malta, there is a link through the corporate head office through which he can access the information. So this intranet links all the Starwood - Le Meridien hotels. Starwood encourages sharing of best practice even in environment issues*." (Respondent E4O)

Interaction with the Client

Apart from technical knowledge, hotels may obtain information on the functionality of environmental and energy efficient systems through interaction with the customer, such as through carrying out trials on novel technologies. These trials serve to increase the hotels' knowledge on the customer's expectations which enables them to better meet the customer's expectations; in the case of energy this refers to the delivery of an optimal thermal environment in the guestroom. This confirms Sundbo's (2010) claim that acquiring an in-depth knowledge of the customer enhances the firm's capabilities to implement innovative solutions.

6.8.2 - Creating an Environment Conducive Towards Multitasking

Another aspect of building a multitasking potential relates to how firms are able to establish an environment that is conducive towards experimentation and taking new initiatives beyond day-to-day activities.

The Role of Top Management in Fueling a Multitasking Potential

The data show evidence of environmental measures initiated by both the top management (ten cases) and the maintenance department (eight cases). Generally, the independent hotels see a more active participation by the owner in the introduction of environment measures, perhaps due to the limited availability of maintenance staff; whilst in the MN subsidiaries, the maintenance managers take the initiative to prepare project proposals sometimes in consultation with an external engineering consultant and present this to the top management.

The support provided by the top management to implement new environmental projects and ideas appears to fuel the multitasking potential of a firm. In such firms, the maintenance department is motivated to carry out trials or experiments on novel environmental technologies and tends to be pro-active in bringing forth ideas for the introduction of energy efficient solutions during refurbishment projects. This was the case for active and proactive firms. The comments of the maintenance manager of an independent 4-star active hotel illustrate this point:

> "*When I was at* [another hotel], *I felt that the director was less ready to invest; then the job became too much of a routine, of doing the same thing. So that is when I said that I have to move on because there is no chance of improving in my area of work.* [In the current hotel]*, the Directors push a lot for new projects to be implemented and are keen on making new investments which makes our job more dynamic and interesting. The staff is more motivated to work……We have always had very good feedback from the Directors regarding investments in energy saving*." (Respondent B4M)

A higher level of engagement of the maintenance manager in the adoption process i.e. involvement in idea generation, procurement and implementation of environmental technologies, also drives these managers to take initiative beyond day-to-day tasks, such as

undertaking research on feasible environmental projects and investigating novel energy efficient solutions, as evidenced by the following quotation of a maintenance manager from a proactive hotel:

> "*I present the* [environment] *project to the Board which includes the owners. In my presentation I make a case for the project by highlighting the rise in energy costs which are affecting the operations of the hotel…. I have introduced many systems without having to make a case with the owners (e.g., energy efficient lighting); but when it comes to making a capital investment which is substantial then you need their approval*." (Respondent E4M)

The findings confirm the notion that support coming from the top management about decisions to invest in environmental projects has a positive influence on the adoption and diffusion of energy efficient practices in the firm (Sandberg and Soderstrøm, 2003). In seven cases, environment measures are accounted for in the annual budgeting exercise. In addition, the findings show that the promotion by top management of a culture for change and adaptation through encouraging new projects and ideas from the maintenance department appears to fuel the latter's aptitude towards multitasking.

Staff Awareness and Training

In all the hotel cases considered, awareness-raising is used as a means to reduce the consumption of utilities during day-to-day operations. The room attendants and staff receive periodic reminders from their heads of department, by means of newsletters and canteen notice boards, to economize on electricity and water usage.

In ten cases, the staff is exposed to formal training on aspects related to environmental awareness; often external experts are brought in to offer this training or a 'train the trainer' approach is used. The training may address aspects of waste management or environmental policies in the hotel. Although this is a compulsory requirement for hotels bearing the eco-certificate of the national tourism authority, training also occurs in non eco-certified hotels. For example, through its 'Responsible Business Programme', the Rezidor group which is a multinational brand of hotels, provides training to all new employees within affiliated hotels and a detailed handbook on waste separation, energy management and green purchasing; the aim of the programme is to "*touch the work routines of all employees*"[44]. This training serves as a route to inculcate the corporate group's environmental goals into the employees.

The maintenance managers of MN subsidiaries have an opportunity for exposure to training and learning on environmental practices by attending specialized seminars or in some cases visiting sister subsidiary hotels abroad:

---

[44] Rezidor Sustainability Report 2007 accessed 13th April 2013 at: http://www.rezidor.com/phoenix.zhtml?c=205430&p=respsustainabilityreports.

"*I attended quite a number of seminars and went abroad to Spain because they are advanced on energy technologies there. For example I attended a 'Green Advantage' seminar together with our training manager and an Environmental Management Implementation Workshop; so I became interested in energy efficiency*." (Respondent E2M)

The high staff turnover that is typical of the tourism industry creates the need for constant training in order to ensure that the standard on environmental practices is maintained and written rules and procedures are included in the hotel's operations as exemplified by the following quotation:

"*Lack of awareness by staff and management is a problem many times. I had to educate staff and sell the idea to the managers to increase awareness……the staff in a hotel changes quite fast….so this affects the awareness on the environment and the need to conserve energy. There needs to be constant training*." (Respondent E2M)

Staff mobility may also be a factor accounting for transfer of knowledge amongst firms; most of the maintenance managers interviewed have previously worked in the white goods sector (as electricians or refrigeration technicians) and have experience working in other hotels beforehand.

Engagement in 'Green' Committees

In this study, the setting up of a green or environmental committee is interpreted as an innovative organizational structure to stimulate idea generation about environmental projects and overcome the compartmentalized approach by which environment issues are tackled in the firm. The onus of implementing environment programmes typically rests with the maintenance department; however because of the modular organization of hotels, these initiatives may be detached from what is going on in other departments such as the reception, food and beverage, administration etc. The purpose of the green committee is to share ideas amongst different departments about environmental initiatives. The following quotation illustrates this point:

"*The aim of bringing all department representatives together is because each department tackles the environment issue from his department's own point of view."* (Respondent B6T) and *"every department has its own best practice in terms of environment initiatives since certain practices that may apply in an office do not apply to the kitchen for example*." (Respondent E5M)

Six MN subsidiaries and two independent proactive hotels have set up a green committee that involves the participation of top management (often also the owner-director), all heads of department and staff at supervisory level who meet regularly to discuss the environmental performance of the departments. The green committee acts as a "vehicle" through which the knowledge and experience coming from different departments is pooled and current practice is

challenged to identify improvements. This process stimulates the generation of new 'ideas' that may result in new routines being established. The maintenance manager of an MN subsidiary talks about how communication with the front office affords for more efficient energy management across the hotel floors:

> "*We communicate with reservations and front office so that we close particular floors when these are vacant; rooms in these particular floors are not allocated. In the meantime, maintenance switches off* [the entire] *floor completely……There will not be a need to allocate room attendants to these floors either. These ideas come from staff and management. The departmental managers discuss with the staff what types of measures can be implemented and obviously the head of departments discuss this in our weekly meetings and we issue a memo on particular measures making sure to continuously remind staff about such measures*." (Respondent C1M)

Reward Mechanisms for Staff

Previous studies about the adoption of environmental programmes in hospitality have shown how keeping staff motivated is key to integrating these programmes in the hotel's operations (Bohdanowicz *et al*., 2011). The findings provide indirect evidence of how the introduction of reward mechanisms may be stimulating staff to improve the environmental performance of their departments. This was observed in a minority of hotel cases investigated, mainly upmarket and luxury proactive hotels, as exemplified by the following quotation:

> "*Every month an audit is carried out within each department based on a number of criteria, one of which is energy. The information is shared in the annual staff party and those departments that excel in environmental performance are rewarded whilst those that haven't done so well are 'penalized' in the sense that they are made aware they could do better.*" (Respondent B6T)

6.8.3 - Synthesis

In summary, the above analysis suggests that a hotel's practice-based knowledge and experience acquired on the job, help develop particular combinations of capabilities for sensing and scanning environmental technologies and for problem-solving that in turn fuel the firm's potential to multitask and engage in innovative behaviour.

Managers working in teams tend to engage in more problem-solving and decision-making. The fact that active and proactive firms have a team supporting the monitoring tasks could mean that there is more time for thinking about how to solve problems and about what works best over reactive firms with one maintenance manager who is engaged on the property in monitoring operations. However the results show that the multitasking potential is not solely a function of the size of the hotel staff. Firstly the findings indicate that hotels acquire a propensity for multitasking when they establish an environment that encourages and facilitates the introduction

of new technologies and projects through the active participation of managers and more generally employees.

Secondly the study has shown how hotels with minimal or limited resources in terms of staff, are also nurturing a multitasking potential. In this study, these firms include small hotels with a limited number of employees and maintenance support but which build capabilities for problem-solving by providing an environment where managers are exposed to novel contexts and situations to innovate. In the adaptation modes constructed in Section 6.5, active and proactive firms characterized as having a multitasking potential, include examples of such firms. Similarly, there are examples of hotels with a higher availability of resources and which are poor multitaskers such as in the reactive group of hotels. These are shown to have accumulated limited practice-based knowledge and as a result problem-solving about environmental technologies and do not nurture an environment for innovative activity.

6.9 - Conclusion

The aim of this chapter was to address the first research question of this study that asks about how capabilities may explain the adaption of a traditional service sector to achieve enhanced energy efficiency. Adaptation may involve integrating environmental technologies into existing activities in the firm and it may also result from the reorganization of existing activities and the implementation of new ones.

The principal contributions to the literature on dynamic capabilities and innovation in services are two-fold. Firstly, the findings show that firms within the same sector exhibit differentiated adaptation responses. Secondly, they demonstrate how different combinations of capabilities residing in the firms account for the diversity of responses and innovation patterns in firms within a traditional service sector. These findings add to previous contributions linking capabilities with innovation behaviour in services (Tidd and Hull, 2003; den Hertog *et al*., 2010).

This study shows that there are different ways in which firms adapt and it identifies three adaptation modes in which hotels are adopting different types of environmental technologies and measures and have different combinations of capabilities to do so. Adding to Sundbo (2011), the findings indicate that there are different levels of multitasking potential in these traditional service firms.

Underlying the service firms' multitasking potential is a combination of capabilities to scan and translate signals about emerging challenges in the sector and their technical capabilities to implement a response. The 'dynamic' component of the capabilities refers to how the hotel is able to maximize its resource-base in order to adjust and modify day-to-day tasks and operations with minimal disruptions to the service delivery process. This outlook accounts for the fact that the environmental innovations discussed in this study refer mainly to processes and

practices in back-stage activities that involve no or at best indirect interaction with the customer and the service experience (as discussed by Bitner *et al*., 2008).

In order to investigate the relation between capabilities and firm adaptation, the hotels were grouped according to the combination of capabilities they possess. This resulted in the construction of three adaptation modes summarized below:

- **Reactive Adapters:** Hotels possessing capabilities to implement *ad hoc* technology solutions and maintain operational efficiency;
- **Active Adapters:** Hotels possessing capabilities to modify maintenance practices to enhance energy efficiency;
- **Proactive Adapters:** Hotels possessing capabilities to implement new practices and organizational structures for environmental action.

The analysis revealed a complex dynamic between the firms' internal capabilities and the adaption response.

The study identifies different motives for environmental action that vary across the three adaptation modes. Reactive hotels introduce measures to increase energy efficiency thereby reducing operational costs and improving guest occupancy rates. In the multi-national hotels, part of the proactive group of adapters, compliance with the corporate group's environmental strategy drives the introduction of 'greener' modes of service delivery (with flexibility for the subsidiary hotels to devise what these' 'greener' measures should be). Some are responding to a niche-market of environmentally conscious consumers. Active hotels are responding to policy incentives (subsidies) to install new energy systems or technologies. The adaptation responses would cover a greater spectrum of adoption strategies and behaviours (including water usage, waste reduction, etc.); though this study has primarily focussed on energy efficiency.

Reactive hotels are poor at multitasking since they are essentially focused on solving 'hot-spots' of high energy consumption by adopting measures on an *ad hoc* basis and in this way maximizing operational efficiency. In these firms adaptation is about doing things the same 'old' way and requires minimal resource investment.

Hotels described as active adapters are those where environmental action occurs through modifying day-to-day activities of maintenance operations and developing capabilities for problem-solving and evaluating technology options. These hotels are described as keen multitaskers since they undertake an active search to identify new energy efficient measures and technologies that may result in significant energy savings whilst keeping the service standard. Adaptation results from modifying maintenance practices and adopting novel energy management approaches. Active adapters include independent mid-scale hotels.

In comparison to active adapters, proactive hotels also implement innovative organizational structures such as setting up green/eco-teams and environmental training programmes with staff. There is also a higher investment of resources in researching and experimenting novel technological solutions that go beyond day-to-day tasks of maintenance operations. Thus adaptation occurs through 'deeper' structural changes compared to the other two groups in the way the firm organizes and distributes activities related to environmental and energy management. The group of proactive hotels is the most diverse in terms of types of hotels, encompassing both multinational subsidiaries as well as independent hotels.

From the above, service firms do not possess either one or another capability to adapt confirming the notion of dynamic capabilities as being a multi-dimensional construct (den Hertog *et al.,* 2010). The study emphasizes a non-linear model of capabilities and accounts for the diversity of adaptation responses of firms in the same sector. The findings indicate that hotels with a more diverse combination of capabilities are more adaptable and likely to implement environmental action over those with capabilities for enhancing operational efficiency. The three adaptation modes – reactive, active and proactive - are part of a continuum of adaptation modes other than being necessarily distinct categories. Reactive hotels lie at one end of the spectrum having a low multitasking potential; active and proactive hotels lie at the other end with a higher multitasking potential.

According to this study, firms may cultivate or develop a multitasking potential by nurturing an environment that favours particular activities and capabilities-development. The study accounts for the diverse nature of the hotels' capabilities by focusing on particular characteristics of the firm including the size and facilities offered (market segment) and how the maintenance tasks are organized and distributed across the hotel.This means that firms may acquire a multitasking potential that could influence adaptability and environmental action.

This chapter has discussed extensively the internal capabilities of firms to adapt to emerging signals about energy pricing policies and policies about environmental responsiveness in tourism. As the next chapter intends to demonstrate, these internal capabilities determine the firms' capacity to exploit their relation with external actors in order to obtain information and knowledge about energy efficiency measures. The relation of hotels with knowledge intensive business service firms (KIBS) is analyzed also to further an understanding of how exchanges at the KIBS-hotel interface may be influencing environmental action in hotels.

Chapter-7: EXPLORING RELATIONAL DYNAMICS AT THE KIBS-CLIENT INTERFACE AND THEIR INFLUENCE ON ENVIRONMENTAL ACTION

7.1 - Introduction

The previous chapter discussed the hotels' capabilities to adopt environmental innovations, with a focus on measures towards enhancing energy efficiency. This chapter broadens the analytical lens in order to investigate the second research question about how hotels make use of external knowledge sources in order to innovate. For this purpose, it examines the relation of hotels with knowledge intensive business services (or KIBS) and how this may be influencing the hotels' environmental response behaviour. KIBS represent one out of many possible sources of information on environmental and energy efficiency measures. The choice to focus on a type of KIBS which is the engineering consulting firm, stems primarily from the empirical investigation that showed how these firms may be acting as an intermediary between an external knowledge on environmental and energy technologies and the hotel.

The analysis is also of interest in furthering an understanding of the relational dynamics at the KIBS-client interface and how these shape intermediation activity which in this study relates to the potential for exchange of knowledge and learning about environmental innovations. A novel approach adopted in this study is to focus on the characteristics of both the KIBS and the client-firm and how these may be influencing intermediation activity.

The study intends making two contributions. First is the fact that intermediation activity is dependent on the interface between the KIBS and the client-firm and this study provides a practical demonstration of these dynamics. The second contribution is a deeper understanding of the determinants of absorptive capacity in services.

This chapter draws from empirical data obtained from pairs of engineering consulting firms that had a business relation with corresponding hotels. Section 7.2 briefly recalls the relevant theory discussed in Chapter 4 on intermediation and Section 7.3 outlines the approach to the data analysis. The chapter then characterizes the group of engineering consulting firms as a type of intermediary in Section 7.4. This is followed in Section 7.5 by an in-depth analysis of the relation between KIBS and the hotels that provides a basis for developing patterns of interaction amongst the KIBS and the hotels in Section 7.6. These interaction patterns are used to link intermediation activity at the KIBS-client interface with the adaptation responses in hotels in Section 7.7. Concluding remarks follow in Section 7.8.

7.2 - The Relational Dynamics between KIBS and the Client

As discussed in Chapter 4, exchanges of knowledge and information occur within a space which is the professional relation established between KIBS and the client. Recalling Miles (2012), exchanges between KIBS and the client depend on a mutual understanding of need and the provision of adequate solutions. In order to gain fully from the interaction, the exchanges amongst the two classes of actors must be seen as 'profitable' in terms of the value derived to both parties. Thus the successful transfer of knowledge at the KIBS-client interface becomes contingent on both the KIBS and client characteristics as suggested by Grimshaw and Miozzo (2004). This study provides a practical demonstration of the relations at the KIBS-client interface and how these work to influence the adoption of energy efficient measures.

KIBS have emerged as an important source of knowledge for services (Tether and Tajar, 2008); however the relation with the client is not sufficiently explored from the perspective of both the KIBS and the client. Apart from focusing on the KIBS as an *entity*, this study explores the knowledge intensive service *activity* as a locus of where these 'exchanges' occur. One consideration is that clients require the capability to successfully exploit their relation with KIBS in order to adopt environmental measures; or in other words they need to mobilize absorptive capacity (Agarwal and Selen, 2009; Jimenez *et al*., 2010).

The term absorptive capacity is adapted from Cohen and Levinthal (1990). In this study, it is understood to refer to how hotels gain from their relation with KIBS in order to adopt environmental innovations, including the adoption of energy efficient technologies.

In order to operationalize the research, this study uses Tordoir's (1995) classification of professional relations established between KIBS and their client that is based on the frequency and level of interactivity amongst the parties involved. The three types of relations are discussed in Chapter 4 of the literature review (Section 4.5.3 on p. 76) and summarized below as follows:

- Sparring relations are characterized by high interactivity and mutual exchange of information amongst actors;
- Jobbing relations involve the provision of a standard task or job by an external professional whose specifications are typically defined by the client; and
- Sales relations involve the transfer of standardized off-the-shelf solutions to the client.

7.3 - KIBS-Hotel Pairs

One of the main challenges encountered in this study was that of measuring the impact of intermediation activity. In classical innovation studies, the impact of KIBS is measured in terms of the innovation performance of the client, for example as reflected in the R&D expenditure and innovative products brought to market (e.g. Muller and Zenker, 2001). In a traditional service

sector, this aspect may be less relevant to explore because of the limited R&D effort compared to other innovation types, such as organizational innovations. Here the attempt is to build an in-depth qualitative investigation on the KIBS-client relation and how this may be influencing environmental action in the hotel which is the client in the relation (hereafter the hotel-client).

Although the study investigated nineteen hotel cases, there was sufficient data to identify fifteen pairs of hotels and corresponding engineering consulting firms. The pairs were identified by asking the hotels to nominate an engineering consulting firm with which they maintained a business relation at the time of the investigation; see Table 7.1 below. An important point to recall is that the pairs are derived from the interview data; what the analysis adds is a characterization of the relation between these actors in terms of how this shapes the adoption of energy efficiency.

Seven of the hotel cases established a business relation with energy services consultancies and innovative building services engineering firms; whilst eleven hotels had a working relation with traditional building services engineering firms. In three of the cases, the same hotel had a working relation with all three types of KIBS (Hotel Cases A3, C1 and E3).

Table 7.1 - Pairs of Engineering Consulting Firms and Hotel Cases

Type of Engineering Consulting Firms	**Hotel Adaptation Responses**		
	Reactive Adapters	**Active Adapters**	**Proactive Adapters**
Energy Services Consultancies and Innovative Building Services Engineering Firms	**A3**	**C1, D3**	**B6, E1, E3, E5**
Traditional Building Services Engineering Firms	**A1, A3, B1, B3**	**B4, C1**	**B2, D1, E2-E4**

Source: Annex 3 for the Types of Engineering Consulting Firms; Annex 1 for Coding of Hotel Cases

Following from the analysis in Chapter 6, the hotel cases are grouped into three adaptation modes defined by the particular capabilities to adopt environmental innovations. These adaptation modes are reproduced in Table 7.2 below for easier reference throughout this chapter.

Table 7.2 - Summary of the Hotel Adaptation Responses and Corresponding Capabilities

Hotel Adaptation Response		Characteristics	Hotel Cases
Reactive adapters	Hotels possessing capabilities to implement *ad hoc* technology solutions and maintain operational efficiency.	Firms focused on day-to-day service delivery with capabilities to solve 'hot-spots' of energy consumption by implementing a technology-replacement strategy.	A1, A2, A3, B1
Active Adapters	Hotels possessing capabilities to modify maintenance practices to enhance energy efficiency.	Keen multitaskers with capabilities for problem-solving and evaluation of technology options that result in the modification of routine maintenance tasks to accommodate energy management practices.	B4, C1, D2, D3
Proactive Adapters	Hotels possessing capabilities to implement new practices and organizational structures for environmental action.	Good multitasking firms with capabilities to implement new environmental initiatives that go beyond day-to-day maintenance tasks and jobs. Adopt innovative structures such as staff training programmes and eco-teams.	B2, B5, B6, D1, E1-E5

Source: empirical analysis

The strength of the analysis is two-fold. Firstly the KIBS-client interaction is studied from the perspective of both the hotel as the client in the relation and the KIBS, an approach that is not often adopted in studies about KIBS and intermediation more generally. Secondly, data from multiple hotels and engineering consulting firms are sourced in order to substantiate the claims made and to provide for triangulation.

7.4 - Characterizing the KIBS

In this study, the KIBS firms are engineering consulting firms that fulfill an outsourcing service function, which may be a short term project-based assignment (such as a new building services contract or refurbishment project), or a long-term service management contract supporting the preventive maintenance programme of the hotel. The preventive maintenance programme involves regular and continuous inspection and monitoring of the hotel facilities and plant rooms in order to identify problems before these become bigger and more costly (Ismail, 2001).

The following sub-sections provide a description of the types of KIBS and their role in acting as an intermediary between a body of knowledge on energy efficient and environmental technologies and the hotel.

7.4.1 – Three Types of Engineering Consulting Firms

All of the engineering consulting firms investigated offer energy management services that may range from energy auditing, designing energy-efficient building management systems and assessing renewable energy installations according to technical specifications. The analysis identifies three types of engineering consulting firms out of the fourteen firms investigated in this

study. These were derived from an analysis of the firms' characteristics in terms of size, mission and portfolio of services; see Annex 8.

- Three traditional building services engineering firms (α firms) are tasked with designing building services for new extension projects and assisting the hotel with the implementation of the preventive maintenance programme. The firms maintain long-lasting relations with their hotel-clients and are often referred to by the hotels as 'company' engineers. The characterization of these KIBS as 'traditional' stems from them remaining within the 'tradition' of offering building services design as their core service. In these firms, energy efficiency may arise as a one-activity within preventive maintenance operations.
- Three innovative building services engineering firms (β firms) that are incorporating energy management and other environmental services as one of their core functions alongside building services design. These are innovation-oriented firms, researching new environmental technologies and solutions. They are typically well-established firms with a strong reputation in the sector; or are organized as a sole-owned self-employed consultancy with the engineer having previously worked in the manufacturing industry.
- A group of eight energy services consulting firms (δ firms) whose core service is that of providing energy management and energy efficient solutions to their clients; and providing advice on renewable energy installations. The mission of many of these companies is to improve the competitiveness of their clients through increasing efficiency of operations. Three of the energy services consultancies are one-person firms.

An analysis of the company profiles shows that traditional building services engineering firms have been established for many more years compared to innovative building services engineering firms and energy services consultancy firms and are typically larger in terms of number of employees; whilst energy services consultancies are smaller and younger firms having been set up in the 1990s by engineers who previously worked in industry and branched out as self-employed experts in the field of energy management.

Energy services consultancies and innovative building services engineering firms appear to be accumulating a more diverse knowledge-base relating to engineering, architecture, design and environmental management also as a result of being involved in energy-related networks, such as the Malta Energy Efficient & Renewable Energy Association (MEEREA) as illustrated by the following quotation:

> "*For me MEEREA is a very important platform because I really learn from it and I meet a lot of people. I am always there when they do seminars at university and government departments etc. ….. We have ideas flowing from people with different backgrounds. It is working."* (Respondent δ5)

This means that they are better able at combining these different knowledge stocks and potentially can provide comprehensive energy solutions for their clients by combining aspects of building services design, environmental design, and energy management in renovation projects or new construction developments (after Strambach, 2008).

The resources for staff training are higher in the energy services consultancies and innovative building services firms compared to traditional building services that rely principally on on-the-job training. Six out of the eight energy service consultancies and two innovative building services engineering firms undertook formal training on new technological applications such as building management systems, building energy simulation models and designing low carbon buildings; whilst none of the traditional building services firms claimed they invested in formal training. The training is specific to energy-related issues such as obtaining the accreditation for the certification of energy performance for buildings, training on new energy efficient systems and obtaining relevant international standards accreditation (such as ISO14001[45]).

This initial characterization shows that the engineering consulting firms are incorporating aspects of energy management and energy efficiency in their portfolio of services, albeit to different degrees. This is expected to influence the extent to which they intermediate for the introduction of environmental and energy efficient measures in the client as discussed further below.

7.4.2 - The Intermediary Role of Engineering Consulting Firms in the Adoption of Energy Efficiency

The empirical findings show that intermediation activity and therefore the exchange of knowledge about energy efficiency measures is contingent on the business function of the KIBS. Depending on their business orientation, the KIBS are able to direct the client's innovation trajectory by providing input into the service delivery process, as discussed by Miles (1997).

Traditional building services firms do not see it as their role to take the lead in making the hotel-client aware of the latest energy efficient technologies and solutions available on the market; they are focused on preventive maintenance management. In turn, the hotel as the client in the relation often has limited access to the engineering consulting firm, typically because of cost factors, or the hotel may not be aware of the KIBS' competences in energy management.

The energy services consultancies and innovative building services engineering firms (eleven out of the fourteen firms investigated) are more likely to act as an intermediary in the adoption of environmental measures in hotels. The data show that these KIBS may be 'sensitizing' the hotel-client to energy efficiency and renewable energy solutions by being proactive in identifying

[45] ISO14001 is an international certification accrediting the implementation of an environmental management system within an organization. It is a standard developed by the International Organization for Standardisation (ISO). Source: http://www.iso.org/iso/home/about.htm accessed 28th February 2013.

problem areas of energy consumption where these perhaps are ‘hidden’ to the hotel, or where insufficient attention is given to particular hot-spots of energy consumption. They repackage the same solutions differently, such as incorporating an energy audit as part of routine preventive maintenance, or prompt the client to rethink current practices, for example by assisting with energy consumption monitoring approaches through the design of sub-metering systems. Seven out of the eight energy services consultancies package energy efficiency as a product to sell to their clients.

One of the energy services consultancies describes how first an audit or survey is undertaken to assess the state of energy consumption in the client’s property, and subsequently solutions are designed to meet the client’s particular needs, such as through the introduction of room energy management systems, smart controllers, and renewable energy installations:

> “*So basically when we are called by the prospective client or we approach the prospective client, we undertake an energy audit of the refrigerating equipment because that is what we are interested in, that is the solution that we can provide to the client. Based on the information that we gather from the client, from the equipment, from the consumption data that the client has - based on this we prepare our proposal. We also indicate in the proposal the initial capital requirement, the savings payback and the impact of implementing the solutions on the environment in terms of carbon emissions*” (Respondent δ6)

Alternatively, KIBS may offer new customized solutions altogether as part of their portfolio of services, incorporating environmental management services in designs for new construction development and operations maintenance, and resulting in potentially more radical solutions. One of the innovative building services engineering firms describes how the firm ‘creates’ opportunities and spaces to expose the portfolio of environmental/energy services to the clients. This is achieved through workshops organized with prospective clients as exemplified by the following quotation:

> “*We may also approach clients who we know are preparing tender documents for a new development to gauge their interest in sustainable design, low carbon features etc. ……We involve the directors in the client firm in vision workshops; and negotiate with directors when discussing the feasibility of projects. We give our advice and the client is free to take it or not. We try to guide clients on which investments make sense, not simply in terms of capital expenditure but on which expenditure gives the best return over the life of the equipment. It is then up to the client to choose from the various options we provide.*” (Respondent β1)

This section has discussed the business orientation of the engineering consulting firms and the types of services offered and how this may determine their intermediary role. The remainder of the chapter focuses on discussing the KIBS-client relation as a space for the introduction of energy efficiency and subsequently extrapolates patterns of KIBS-client interaction to show how these may be influencing adaptation responses in hotels.

7.5 - An In-Depth Analysis of the KIBS-Client Interface as a Locus for Intermediation Activity

KIBS-client relations are characterized by different levels of interaction that depend on the type of relation established between the actors and the stage in the service delivery process (Miles *et al*., 1995). The question examined here is whether and how the relation may be influencing intermediation activity and the introduction of energy efficient measures. The KIBS-client relation is studied from three perspectives: the professional relation established; the knowledge transfer between the two actors and their cognitive capacity to adopt energy efficient technologies.

7.5.1 - Professional Relations as Spaces for Energy Efficiency Adoption

Tordoir's (1995) sparring, jobbing and sales relations are used to describe different professional relations between the KIBS and the hotel-client (refer back to Section 7.2). The elements of the empirical data used to describe these include the nature of the service contract between the two entities and the type of energy management services offered, as well as the relation with the hotel owner and maintenance department.

The cases of the energy services consultancies and innovative building services engineering firms provide examples of the versatile relations established between these KIBS and different types of hotel-clients. Sparring relations, characterized by collaboration and co-production of customized solutions, are likely to be established with hotels actively pursuing environmental and energy solutions, in the context of particular projects such as refurbishment and new construction developments. These are the proactive hotels identified in the previous chapter as having a diverse combination of capabilities to implement new practices and structures towards environmental action and with a high multitasking potential.

In addition, the energy services consultancies and innovative building services engage in Tordoir's (1995) 'sales' relations with active and proactive hotels, where they sell a professional service as a package based on client specifications such as an energy audit report or the commissioning of new equipment for heating and ventilation. In this type of relation, the KIBS actively searches for clients that are 'thinking' about energy efficiency to reduce operational cost or to gain a 'greener' image. In both sparring, and to some extent sales relations, the KIBS raises awareness with the client on opportunities for reducing energy consumption mainly through marketing their solutions directly with the client.

This diversity of business relations provides different opportunities for intermediation activity. The traditional building services engineering firms maintain business relations with all three types of hotels. They engage in a 'jobbing' relation with reactive hotels as part of the preventive maintenance programme. Reactive hotels are characterized by their low multitasking potential and therefore are dependent on KIBS for outsourcing energy efficiency problem-solving; reactive hotels generally do not have a business relation with energy services consultancies and

innovative building services engineering firms. 'Jobbing' and 'sales' relations also occur between traditional building services and active and proactive hotels that are characterized by varying levels of interactivity and customization of energy efficient solutions.

The KIBS meets with different aspects of the day-to-day management and operations of the hotel-client, and may be involved in decision-making about which technologies to adopt and other technical aspects related to operations in the plant rooms. In line with Alvesson *et al*., (2009), the hotel-client can be deconstructed into several units that interact at different levels with the KIBS. The study shows that the KIBS takes up an advisory role in interacting with the owner at a strategic level; whilst being involved at a technical level with the hotel maintenance manager. Therefore the KIBS 'meets' with different types of clients within the hotel that may have different expectations about environmental innovations and capabilities to adopt environmental action as discussed below.

7.5.1.1 - KIBS-Top Management Relation

Reliance on the KIBS as an Expert Source on Energy Efficiency:

In jobbing relations involving traditional building services firms and reactive hotels, the hotel-client tends to depend on the KIBS when it comes to taking decisions on the adoption of environmental technologies and measures. The role of the KIBS becomes that of legitimizing the choice made by the top management on which system constitutes the best available technology, as illustrated by the following quotation:

> "*When deciding to implement power factor correction[46], the* [engineering consulting firm] *gave us advice on which was the best system to implement. His advice on technical specifications was important as the technology was new and we were not sure what sort of savings the technology would bring. Most of the information is technical*." (Respondent Hotel Case A1T)

The quotation reveals that the reliance on external expert knowledge can be attributed to the hotel's limited technical capabilities for problem-solving and evaluating technology options. The empirical findings confirm Hislop's (2002) observation that hotels prefer working with engineering consulting firms on the basis of pre-established trust when this means reducing the risk and uncertainty of working with unknown organizations. In line with a study by Sturdy and Wright (2011) on the relation of management consultants with client-firms, this study shows that long-standing relations result in the KIBS gaining an 'insider' position in the client. This means

[46] Power Factor Correction is a measure of how effectively electrical power is used to convert electrical current into work. A high Power Factor means that electrical energy is being used more effectively. Source: Energy Action Australia accessed 15th May 2013 at: http://www.energyaction.com.au/australian-energy-market/power-factor.html.

that the KIBS participates, together with the hotel top management, in decisions about the adoption of novel environmental technologies by providing an expert opinion.

The advantage of well-established relations is that the KIBS acquires in-depth knowledge of the hotel property and is well placed to evaluate the client's needs. However these relations may not always provide the ideal conditions to promote the adoption of energy efficient technologies as they may lead to "lock-in" to particular technological solutions (after Miles *et al*., 1995). In jobbing relations that are established over the long-term such as is the case for preventive maintenance contracts of service, the engineering consulting firm is likely to be focused on routine tasks and may not seek to make improvements beyond maintaining existing operations.

From the KIBS perspective, the opportunities to introduce energy efficiency measures are limited unless a specification for this is made by the client as suggested by the following quotation of a traditional building service (α) firm providing preventive maintenance services to a reactive hotel:

> "[During] *scheduled preventive maintenance, we discuss upcoming problems, we give our engineering advice and then we report to management on a monthly basis.* [Energy efficiency] *is not a topic that* [we] *discuss per se. It is a topic that is discussed around cost. So for example, the hotel will discuss with us on its fuel cost in a particular month and therefore the manager tells me: shall we look into this? We see how to cut down on cost which is essentially about cutting down on energy*." (Respondent α1)

From the client perspective, the KIBS is often perceived as 'unapproachable' on issues related to energy efficiency, as illustrated by the comments of the managing director of an independent group of midscale hotels within the group of reactive adapters:

> "*The services of engineering consultants come at a cost naturally. The consultant is not really going to go out of his way to help the hotelier; which means that the consultant must be employed specifically to deal with energy matters. Not all hotels have means to be able to afford this, I am being realistic*." (Respondent Hotel A3T)

As a consequence, a jobbing relation based on routine preventive maintenance monitoring tends to promote the introduction of incremental innovations such as replacing equipment with more energy efficient alternatives with minimal disruption to existing systems and operations.

Hotel-Client as the Driver of Energy Efficiency Adoption:

When the need and intent to adapt and innovate stem from the hotel-client, the relation with the KIBS acquires a different dynamic. The fact that the hotel is actively pursuing the introduction of energy efficient systems creates the conditions for intermediation activity. This is observed in four of the KIBS-client pairs and involves principally proactive hotels with a multitasking potential

and that undertake new environmental projects. In line with Rogers (2003), the adoption of novel environmental technologies is positively related to the client's propensity towards adopting innovations; other than being reliant solely on the presence of the intermediary.

From the interviews held with proactive hotels, it appears that the engineering consulting firm is called to play a more active role in searching and scanning for environmental solutions, making contact with suppliers and designing environmental systems that are compatible with the design of the hotel property. The KIBS-client interface thus becomes a space where flows and exchanges of information about environmental innovations and energy efficiency measures take place. The maintenance manager of a multinational hotel subsidiary, part of the group of proactive adapters, describes the relation with the engineering consulting firms as follows:

> "*We refer to specialized engineers and other* [engineering consultancies] *when we require expertise on specific topics or projects. They carry out research on new technologies and undertake feasibility studies to determine whether particular systems are compatible with our property. For example, we sought expert advice from a consultant when we embarked on our reverse osmosis plant project; we asked for advice on what type of plant to install and how to operate this…... So we worked with* [α1] *to determine the types of technologies available on the market, how they operate, what difference they could make for the hotel etc.*" (Respondent Hotel Case E5M)

The empirical data show that when adopting energy efficient technologies and measures, the group of active and proactive hotels engage in a business relation with all three types of KIBS, including traditional building services whose service portfolio does not typically include energy management; six such cases are identified. This demonstrates the role of the client in creating a need for specialised services that fall outside the typical services offered by these KIBS. It also shows that intermediation activity may be influenced by the type of client, in this case the type of hotel and that traditional engineering services are being driven to search for energy efficient solutions in order to meet the client's specifications.

7.5.1.2 - The Relation of the KIBS and the Hotel Maintenance

The hotel maintenance department and the KIBS interact to discuss energy efficiency and environmental measures during routine preventive maintenance meetings or during short-term assignments such as an energy audit or a refurbishment project.

In their interaction with the hotel maintenance, the KIBS facilitate the translation of a need for change into action by bridging the gap between the diagnosis of a problem, such as a high energy-consuming area in the hotel, and adopting energy efficient technologies and measures. The data show that although the traditional building services engineering firms (α firms) are found generally not to motivate the adoption of environmental innovations in the hotel-client as discussed above, they do have a role in facilitating implementation.

Gaps between the detection of hot spots of consumption and implementation of energy efficient measures are traceable to the limited technical capabilities of the maintenance managers to implement environmental technologies. The perception amongst half of the engineering consulting firms interviewed is that the vast majority of hotels have limited technical knowledge to implement energy efficient systems, as the following quotation from an interview with an innovation building services firm exemplifies:

> "*Some* [hotel maintenance managers] *may go ahead and employ certain technologies without prior consultation with us. Others might be aware of some things but not aware of the bigger picture, of more detailed things. In other cases, you find that the engineer in a factory for example, would not normally have access to technologies for energy conservation or renewable energy technologies. He may not have the knowledge…. Often factory engineers are employed to work on a production line and they do their own thing without perhaps worrying about or thinking about energy consumption;* [we] *are specialized in this field and therefore we can do the job quicker, cheaper and better; we have the expertise to do just this in fact.*" (Respondent β1)

More than half of the hotel maintenance managers interviewed could not quantify the amount of time spent on energy monitoring; though nine out of the nineteen hotel cases stated that they integrate energy matters with day-to-day duties. Five out of the fourteen engineering consulting firms interviewed suggest that the hotel maintenance manager often has an unclear picture of where energy is being consumed, especially in the absence of a sub-metering system. The managing director of a proactive hotel describes the role of the KIBS in identifying these hot spots of energy consumption:

> "*We had an energy audit done independently by an energy services consultancy…… We used to think that* [the biggest energy consumer] *was our A/C* [air-conditioning]. *In fact it turns out from the* [energy] *audit that refrigeration is the biggest energy consumer. 25% of electricity was going for refrigeration.*" (Respondent Hotel Case B5T)

Three engineering consulting firms suggest that the potential of energy technologies to facilitate operations is often under-estimated. For example, systems such as are building management systems (BMS) or smart refrigeration systems may facilitate, in their view, the tasks of the hotel maintenance department by allowing for remote monitoring of equipment from the office as opposed to manual 'switch-on and switch-off' operations. An innovative building services firm describes the inertia that may arise when the maintenance manager is 'comfortable' with the systems that are currently operational in the hotel and does not extend the search process beyond these systems, as exemplified by the following quotation:

> "*The maintenance manager is often less enthusiastic - he has a system that he knows how to run and operate and he is getting into a situation where he might have to install and work with a new system and new equipment that may need more attention and maintenance. So*

normally many, not all, maintenance managers do not show much enthusiasm - they resist change. So if there is a system or equipment that is giving a lot of problems, then yes, they look at change positively not as extra work but as a means of improving on current systems." (Respondent β2)

The KIBS is not necessarily the sole expert in the relation with the maintenance. Hotels with capabilities to multitask see an active participation of the maintenance managers in the adoption and implementation of new environmental measures; these include proactive hotels that accumulate practice-based knowledge through the environmental initiatives they adopt in the hotel and through trials and experimentation with novel technologies and measures; and to an extent active hotels that accumulate this knowledge through their own problem-solving and modifying maintenance tasks. The information and knowledge flows at the KIBS-client interface are topic of discussion in the next section.

7.5.2 - Knowledge Transfer across the KIBS-Client Interface

Although knowledge transfer may not always be a formal objective of the interaction, the study shows that the KIBS-client interface is a locus where knowledge transfer about environmental and energy technologies is taking place. The empirical data indicate that the modes and direction of knowledge transmission at the KIBS-client interface depend not only on the stage of the service delivery process as shown by Webb (2002), but also on the level and degree of interaction between the KIBS and the client.

The type of knowledge discussed is not linked to research and development-related activities. The hotel is more likely to have knowledge about the technology at user level and mainly harbours specialised knowledge related to its core business in the hospitality sector about market and economic trends, seasonality of arrivals etc. which is not discussed here.

Unidirectional Flow of Knowledge from KIBS to the Hotel:

As discussed above, reactive hotels with a low multitasking potential and that are engaged principally in routine-oriented activities are dependent on the KIBS as the source of expert information and knowledge on energy efficient and renewable energy systems. The type of 'jobbing' relation established is characterized by a 'one-way' flow of knowledge on energy efficiency from the KIBS to the client. The traditional building services engineering firms, with which reactive hotels principally interact, are often required to train the hotel maintenance because of lack of sufficient competences and knowledge on energy efficiency (two out of three cases).

The characteristics of the hotel, in terms of how this organizes the maintenance tasks, appear to influence intermediation activity and therefore the knowledge flow occurring at the KIBS-client interface. In reactive hotels, the maintenance manager or technician is typically focused on the many components of routine operational tasks, and is marginally involved in searching for and

assessing novel environmental solutions. These hotels typically lack practical knowledge about energy efficiency measures and their potential savings that is accumulated through problem solving; this fact can often act as a barrier to adoption as exemplified by an excerpt from an interview with an energy services consultancy firm:

> "*We had* [maintenance managers] *who literally and outright refused to implement our* [energy efficient] *systems, on the basis of ignorance, not knowing the technology, not wanting to know about it and not wanting to be responsible for any failures which could be attributed…..But still we find people saying: 'No we will not take that responsibility'. They just shut themselves out and the client of course.*" (Respondent δ6)

Two-way Flow of information and Knowledge Exchange at the KIBS-Client Interface:

In those relations characterized by higher interactivity and based on mutual collaboration, such as sparring relations, knowledge flows from the KIBS to the client and vice-versa. These relations are characterized by high 'compatibility' between the KIBS and the hotel-client or what Tordoir (1995) describes as communication occurring at the same level in terms of information exchange and competencies. These are active and proactive hotels that develop capabilities for problem-solving to implement environmental and energy efficient measures.

A pre-condition for the two-way knowledge exchange is for the hotel to have accumulated technical knowledge on the subject and is able to contribute background information on energy consumption hot spots, and feedback on trials and validation tests in its interaction with the KIBS. The results indicate that in line with Grimshaw and Miozzo (2004), clients with technical know-how or specialized knowledge are more likely to gain from their relation with KIBS.

These contexts create spaces for discussions and negotiations amongst the actors – the owner, hotel maintenance and the engineering consulting firm - on how to integrate energy efficiency into design features and building services in development projects and hotel refurbishments.

In the case of the conversion of a 16th century palazzo to a 5-star boutique hotel, the owner of a proactive hotel claimed:

> "*I did a lot of background work and research which I then discussed with the engineering consultant and together decisions were taken on which systems to implement. Any system that made sense and was a 'sensible' solution was accepted; the consultant I worked with was not strict in the sense of wanting to force his own way*." (Respondent Hotel Case D1T)

Likewise, the traditional building services firm engaged to design the building services of the same palazzo describes the relation with the hotel-client when it came to choosing particular technology systems:

"*As I discuss with the customer, he comes up with suggestions and I provide technical advice; though ultimately it depends on the customer.*" (Respondent α3)

In another example relating to the construction of an eco-hotel complex, the findings demonstrate how the owner and the maintenance manager of a proactive hotel accumulated knowledge and experience on novel energy technologies which fed into the discussions with an innovative building services engineering firm on feasible options for design.

The owner of the eco-hotel describes his interaction with the KIBS:

"*We asked* [engineering consulting firm β2] *to get the* [energy simulation model] *so we could model the project. This model allows to input weather data and input the model of the construction project; so if I rotate or tilt or bring shades out in the building; if I increase the vegetation; change the walls from wood to stone, use carpets or not, if I use marble, double glazing etc. Every change that is made gives an output on heat intensity in the building level of cooling and heating in the building, the level of lighting". …The project started with four different design options and the design options were submitted by the foreign partner and the Maltese partner* [β2] *who is now taking care of the project management. It was a very mature discussion that led to the choosing of one of the designs.*" (Respondent Hotel Case E3T)

The hotel maintenance manager acquired experience through being involved in the tendering phase of the building services design of the eco-hotel:

"*When the* [eco-hotel] *was being designed, I took interest and involved myself in the designs of the building services. I asked the Director to be involved in the design of the project and was consulted on the tender documents and the specifications. I went through all of that. I didn't do the designs myself but I did involve myself with the engineering consultant firm.*" (Respondent Hotel Case E3M)

The innovative building services firm engaged in designing the building services described the relation with the hotel owner and the hotel maintenance manager:

"*Everything has its feasibility. We are asked to do feasibility; if the client is investing so much more in glazing, we tell the client how much energy saving he gets from that investment. We do energy calculations for a year, with energy savings and payback ……..In most hotels in Malta you start off by talking to the Director, who is one of the shareholders and once you convince him that a project is viable, this goes down to the maintenance manager…….. Many times, once you prove that the project is viable, the director will want to go for it. …….The most important is to specify that the decision takes place at higher level i.e. at the level of directors.*" (Respondent β2)

The high interactivity between the KIBS and the hotel (owner and maintenance department) creates a space for the flow of knowledge and therefore for intermediation activity.

7.5.3 - Translating Meaning across the KIBS-Client Interface

This section discusses how the actors' cognitive capacities and therefore the meanings and interpretations they attribute to environmental innovations may influence intermediation activity. For this part of the analysis, a broader understanding of energy management is used, as it emerged from the interview data, to include the adoption of energy efficient and renewable energy technologies and practices.

On the one hand, the engineering consulting firms focus on technical attributes of energy technologies, prioritizing those solutions that result in the reduced wastage of electricity first, such as replacing inefficient equipment in the plant rooms and promoting the adoption of behavioural responses amongst the staff. They identify the 'best available technologies' that are compatible with the infrastructures existing in the hotel such as the heating, ventilation and air-conditioning system.

On the other hand, the findings identify that the hotel-clients may be emphasizing other attributes of energy technologies. Most hotels focus on the opportunity cost and therefore the immediate perceived savings. One example relates to the uptake of the incentive scheme launched by the government to part-finance environmental and energy-efficient projects. The owner of an independent 4-star reactive hotel describes his decision to invest in a photovoltaic system as being based on the opportunity of benefiting from the subsidy on the purchase price:

> "*In the case of the photovoltaic panels which I hope to install and for which I applied for a grant; when we did the calculations we found that [they] will only yield 10,000kW of electricity which does help vis-à-vis electricity consumption though it is not very significant compared to total consumption. But the grant would help a lot with the capital investment*." (Respondent Hotel Case B1T)

In addition, some of the active and proactive hotels, consider the marketing advantages of appearing 'greener' or more 'environmentally friendly'.

These multiple interpretations may result in the adoption of energy technologies that are not aligned with the hotel's current needs, as exemplified by the following quotation from an interview with an energy services consultancy:

> "*Now most chillers in Malta, or a lot of them, are low technology which means they run at low efficiency. I know that the best investment would be to replace that chiller which would enable the hotel to use half the consumption. So hotels can get funding to put up* [photovoltaics] *whilst having an inefficient chiller; so they have to spend double for the PV to run a very inefficient system. ….First we need to get efficient equipment and then invest in*

renewables…. I think it is a mistake not to give attention to energy efficiency." (Respondent δ1)

Nine out of the fourteen engineering consulting firms consider that the hotels are receiving inaccurate technical information about the performance of environmental technologies. For example, photovoltaic systems are often portrayed by the suppliers as providing faster payback periods because this is what the suppliers claim that the client 'wants to hear'. Some KIBS consider renewables as an 'inappropriate choice' when issues of inefficient equipment and energy losses are not addressed in the first instance. One of the energy services consultancy firms explains this fact:

"*What I am sure of is that* [suppliers] *project things to be better than they actually are. One thing I came across: how can a supplier propose to a big manufacturing plant surrounded by dust* [to install] *a PV panel? I have come across* [this]*; it is crazy.*" (Respondent δ1)

Recalling the literature, one of the functions of intermediaries is to translate the meaning of energy efficiency into something that the client can relate with or as Rogers (2003) puts it, seeking to pursue a solution that is compatible with the client's needs. The role of the KIBS becomes that of translating the information that the client is receiving from external sources into more accurate paybacks based on technical specifications of the equipment and the amount of maintenance that is required to ensure optimal performance. In this bridging function, the cognitive capacities of the KIBS and the client are brought closer and this enhances the knowledge flows at the KIBS-client interface.

The findings show that the KIBS does not necessarily act as a neutral agent in this bridging function; there may be cognitive barriers that slow down or hamper intermediation activity. One case provides evidence of a traditional building services engineering firm that acted as a gatekeeper, preventing access by the other KIBS to its hotel client-base, and keeping these competitors at 'arm's length'. Although this represents only one case, it provides an interesting example of an apparent conflict arising between conservative engineering approaches and those practices promoting the adoption of energy efficiency and renewables that is based not on technical criteria but on power and agency issues. The traditional building services firm appeared to resist the introduction of new technological products which did not form part of its portfolio of solutions and with which it lacked familiarity. The following quotation expresses the concern of an energy services consultancy (δ firm) when meeting with this type of cognitive 'barrier':

"*I once worked with a four star hotel that had roped in an external consulting engineer and when I presented my* [energy efficient] *technology, he went up to the hotel board saying: 'I don't believe in this energy saving technology'. So the client valued the engineer's advice in that case. The engineer knew the owner of the hotel for quite some time and they had a very good relationship and he didn't want me to get into his field. I had some problems with*

engineers in the smaller customers. If there is something [the engineer] *cannot understand* [that] *is the technology*." (Respondent δ5)

In summary, the empirical findings highlight examples where multiple interpretations around environmental innovations may not necessarily result in action to adopt energy efficiency measures. By acting on behalf of the client, the KIBS may be proposing solutions that do not reflect the client's present needs or otherwise block out technologies that may match the requirements of the hotel. Likewise the hotel's interpretation of the 'value' of adopting environmental technologies may be motivated by factors other than seeking to enhance energy efficiency. These differences in the cognitive capacities of the actors contribute to shaping the exchanges and flows of knowledge and learning at the KIBS-client interface.

The following section uses the relational dynamics discussed in order to draw out patterns of interaction between the KIBS and the hotels, the latter being grouped according to their adaptation mode. The aim is to bring out the characteristics of both types of actors in terms of how these may be shaping intermediation activity.

7.6 - Emerging Patterns of KIBS-Client Interaction

The findings have demonstrated that the KIBS-client interface is characterized by diverse relations and capabilities for environmental action. These findings are used to build different interaction patterns between the KIBS and the hotel-client. The value of these interaction patterns is that they explicate how the relational dynamics observed may be shaping intermediation activity addressing the second research question of this study. This analysis adds to den Hertog and Bilderbeek's (1998) description of a KIBS-client relation as being a win-win situation in that it considers how this relation may both provide opportunities and otherwise create barriers to the adoption of energy efficiency and environmental measures. Three patterns emerge, these are the: 1) client-led pattern; 2) KIBS-led pattern; and 3) collaborative pattern of interaction. These are discussed below and summarized in Table 7.3.

In order to derive these patterns, the analysis draws from the KIBS-client relations discussed so far as well as the analysis of the hotel adaptation modes elaborated in Chapter 6. The methodology discusses the approach used to build these patterns that draws from relevant data from the engineering consulting firms and the hotels (refer back to Section 5.5.3 'Matched Pair Analysis' on pp. 107-108).

Table 7.3 - Patterns of KIBS-Client Interaction: Combining Professional Relation, Technical Know-How and Cognitive Capacities

Type of KIBS-Client Relation	Knowledge Flows	Dimensions of the KIBS-Client Interaction		Types of KIBS and Hotels (from Table 7.1)
Client-led pattern	One-way flow of knowledge into the hotel: The hotel-client makes specifications for energy efficiency measures; The KIBS is the source of expert knowledge on energy efficient and renewable energy technologies.	Professional Relation	Sales relations: KIBS provide standardized energy efficient solutions.	**Hotel Types:** Active and Proactive Adapters **KIBS-types:** Energy Services consultancies and Innovative Building Services Engineering Firms
		Technical Know-How	Knowledge on environmental/energy efficient technologies resides both within the hotel and the KIBS.	
		Cognitive Capacity	Similar cognitive capacities amongst KIBS and hotels.	
KIBS-led pattern	One-way flow of knowledge into the hotel: KIBS provides technical advice about energy efficient technologies and renewable energy systems.	Professional Relation	Jobbing relations; long-term trusted relations based on routine preventive maintenance tasks.	**Hotel Types:** Reactive and Active Adapters **KIBS-types:** Traditional Building Services Engineering (α firms)
		Technical Know-How	Hotel is routine-oriented with limited problem-solving capabilities; KIBS acts as the 'expert' source of knowledge on energy efficiency measures.	
		Cognitive Capacity	Hotel has limited cognitive capacity about environmental awareness and energy efficient measures.	
Collaborative pattern	Two-way flow of knowledge: Client and KIBS co-produce solutions that result in adoption of customized environmental measures.	Professional Relation	Sparring relations: high level of interaction.	**Hotel Types:** Proactive Adapters **KIBS-types:** all three KIBS types
		Technical Know-How	Hotel accumulates knowledge through problem-solving and adopting novel environmental measures; KIBS responds to client's needs by developing highly customized solutions.	
		Cognitive Capacity	Hotel and KIBS have similar cognitive capabilities in pursuing similar goals about environmental action.	

Source: **empirical analysis**

7.6.1 - Pattern 1: Client-led Interaction

In this pattern of interaction, the initiative to implement environmental and energy efficiency measures stems from the hotel, either from the hotel maintenance manager or the owner. The hotel establishes business relations with energy services consultancies (δ firms) and innovative building services (β firms). The business relation is that of a fixed-term project-based contract, where the KIBS provides environmental and energy efficient solutions based on the identified needs of the hotel. This is characterized as a 'sales' relation following Tordoir's (1995) classification. The KIBS is not considered to gain from the relation, in terms of new knowledge acquired about energy efficiency, as it provides pre-packaged solutions according to client specifications. The hotel acquires knowledge about novel energy efficient systems and how to implement these in the firm.

The types of hotels that engage in client-led interactions are those with a multitasking potential and that are typically searching for novel environmental solutions and projects; these are proactive and active hotels identified from the analysis in Chapter 6. This interaction pattern assumes the hotel has a knowledge-base on energy efficiency that resides mainly within the hotel maintenance department that develops through active scanning for novel environmental technologies and measures. Moreover proactive hotels acquire this knowledge through carrying out research on the performance of energy efficient systems, such as gathering data from trial experiments set up in the hotel property.

The pressures or opportunities to implement environment initiatives may originate from factors external to the hotel, such as head-quarter policy and standards (for multinational subsidiaries), demand from tour operators and regulatory compliance (as in the case of waste separation). The sensitization of the hotel to changes in the external environment means that the hotel is responsive to the energy efficient solutions put forward by the KIBS.

7.6.2 - Pattern 2: KIBS-led Interaction

The KIBS-led pattern is characterized by the hotel's dependence on the expert knowledge of the KIBS to adopt energy efficient technologies. This interaction pattern involves traditional building services and two groups of reactive and active hotels. It is characterized as a relation where the KIBS gains by enriching its knowledge base on energy efficiency through identifying adequate technology solutions to curb energy costs for its client. Reactive hotels show a minimal gain in terms of new explicit and tacit knowledge acquired since they outsource energy efficiency problem-solving to the KIBS. In contrast, active hotels that develop problem-solving capabilities are able to gain more from the interaction with the KIBS with which they establish a more level discussion.

In reactive hotels that are focused on enhancing operational efficiency, the relation with the KIBS is oriented towards routine maintenance tasks that include overseeing the preventive

maintenance programme and designing building services for new property developments in what are mainly jobbing relations. Well-established ties between the reactive adapters and the KIBS carry the weight of trusted relations that often lack the necessary momentum to introduce energy efficiency during the fulfilment of routine tasks.

Energy efficiency is addressed to solve problems of 'hot-spots' of energy consumption. Here the KIBS takes up the role of technical advisor, guiding the top management and the maintenance department on which technologies to implement and how to integrate these with existing infrastructures and equipment. The hotel maintenance manager or technician has limited autonomy in the choice and adoption of energy efficient measures, being involved mainly in the execution phase of a project, and relying on external sources (suppliers and the KIBS) for obtaining information on energy efficient solutions.

7.6.3 - Pattern 3: Collaborative Interaction

A third pattern of interaction arose from the identification of 'outliers' that did not fit into the above two categories. It is collaborative in being characterized by a high intensity of interaction as described by Tordoir's (1995) 'sparring' relations and by the two-way flow of knowledge about energy efficient technologies between the hotel and the KIBS. This pattern is observed in small and large hotels that are proactive adapters and interacting with all three types of engineering consulting firms.

The interaction exhibits a strong element of negotiation on those energy efficient solutions considered feasible for the particular hotel in the light of aesthetic, economic, and operational considerations. The hotel-client develops ideas for new environmental projects and these are then shaped and brought to implementation through discussion with the KIBS.

Although the KIBS retains the role of 'technical advisor' in providing expert opinion on which technological solutions best to opt for, the hotel-client also acquires a knowledge-base on the subject, that arises through experience or personal research. Thus the hotel becomes at par with the KIBS in developing an understanding of the technological "jargon" related to energy efficient and renewable energy technologies. In this interaction pattern, both the KIBS and the hotel-client acquire new knowledge about energy efficiency through collaborative interactions.

This patterns also brings to the fore the fact that that traditional building services can be moved beyond their core service to identify new solutions aimed at enhancing energy efficiency in order to meet the needs of the client. Also, this collaborative pattern involves innovative building services that are integrating environmental services and energy management in their core services, beyond the preventive maintenance support.

Sparring relations create opportunities for change beyond incremental improvements in line with the argument by Miles (2003). However such intense interactions are liable to arise in specific contexts which in this investigation are exemplified by new construction development and

refurbishment projects and with specific types of clients, mainly proactive hotels, characterized by their diverse capabilities for sensing new technological developments and for problem-solving.

7.6.4 - Trends on KIBS-Client Interactions

The patterns of interaction between the KIBS and hotels identified above highlight a number of trends:

- Hotels with a diverse combination of capabilities to adopt environmental innovations, exemplified by proactive firms in this study, establish a relation with all three types of KIBS; whilst those with capabilities to maintain operational efficiency (reactive hotels) engage in long-term relations with traditional building services. This implies that proactive hotels employ broader search processes for information and knowledge about environmental technologies as part of their problem-solving approaches;

- The hotel-KIBS relation exhibits different levels of 'dependence' of the hotels on the KIBS' expert knowledge. Proactive and to some extent active firms are less dependent on the KIBS when adopting novel environmental technologies. They engage in collaborative and client-led interactions with the KIBS, where knowledge about environmental technologies flows from the client to the KIBS and vice-versa. In contrast, reactive hotels that are focused on achieving operational efficiency and with limited internal capabilities, are more reliant on the KIBS for expert advice on environmental technologies and engage in a KIBS-led type of relation.

- Intermediation activity is linked to the absorptive capacity of the hotels. Proactive hotels with broad sensing capabilities and problem-solving around energy efficiency mobilize their relation with all three types of KIBS to obtain knowledge about technologies and measures to enhance energy efficiency and to implement environmental action more generally. At the other end of the spectrum, hotels with limited internal capabilities– these are mainly reactive adapters - are less likely to exploit their relation with KIBS for this purpose and therefore intermediation activity is constrained.

The next section takes stock of the findings from Chapter 6 about hotel adaptation modes and the relational dynamics at the KIBS-client interface discussed in this chapter to discuss how these interplay to influence the adaptation responses of hotels for environmental action.

7.7 – Intermediation Activity and the Implications on Hotel Adaptation Responses

This chapter has built an in-depth analysis of the relation between hotels – reactive, active and proactive adapters - with a type of KIBS, the engineering consulting firm. The relation is shaped

by different levels of dependence of the hotel-client on the KIBS for problem solving about energy efficiency that may as a result constrain or enhance intermediation activity. In this study, intermediation activity relates to the potential for exchange of knowledge and learning about environmental innovations at the KIBS-client interface.

This section uses these findings in order to discuss their implications on hotel adaptation responses. The discussion unfolds at two levels:

- First, the link between a hotel's internal capabilities and the extent to which it mobilizes absorptive capacity to obtain information about energy efficiency measures from KIBS is discussed. This reflects the extent of intermediation activity taking place at the KIBS-client interface (Section 7.7.1).
- Subsequently, an appraisal of how the relational dynamics may be influencing the adaptability of hotels is carried out in Section 7.7.2.

7.7.1 - Hotel Absorptive Capacity and Intermediation

As outlined in the literature review in Chapter 4, absorptive capacity in services is interpreted not solely in terms of the hotel's prior stock of technical knowledge, as described by Cohen and Levinthal (1990). After Miles (2005), it is understood in terms of how the hotel derives value from its inter-relations with KIBS. Here the absorptive capacity of interest is that which enables hotel to obtain information and knowledge from KIBS about energy efficiency measures.

The internal capabilities characteristic of the hotel adaptation modes identified in Chapter 6 reflect different degrees of absorptive capacity to exploit the KIBS' expertise about environmental innovations generally and energy efficiency measures. Following from this, in a KIBS-client relation where the client is equipped with absorptive capacity, intermediation activity is more likely to occur; compared to interactions where the hotel has a limited absorptive capacity. The value of these findings is that they confirm the role of the client in shaping exchanges at the KIBS-client interface (Hislop, 2002; Miles, 2012) and the extent to which intermediation activity is taking place at this interface.

Proactive and active hotels with capabilities for problem-solving and evaluation utilize the 'practice-based' knowledge arising from modifying maintenance operations and adopting novel environmental measures in their interaction with the KIBS to obtain information and expertise about energy efficiency and exploit this in the firm. They have a good absorptive capacity.

In addition, proactive hotels that are scanning external signals about incentives to adopt energy efficiency and signals relating to environmental objectives in tourism, are more likely to recognize the value of the KIBS' energy-related services or to make specifications for introducing energy efficiency in building design services. They have a higher absorptive

capacity compared to active hotels in searching for novel technologies and measures to enhance energy efficiency and exploiting their relation with KIBS for this purpose.

The internal capabilities of proactive hotels enable these to have a level discussion with the KIBS on energy efficient solutions, whether this occurs through highly interactive sparring relations or even one-off sales-type relations. The maintenance manager of a multinational subsidiary, part of the group of proactive adapters, describes the relation established with a traditional building services firm:

> "*More recently, we have been in contact with the* [engineering consulting firm α1] *on the potential of installing combined heat and power. So we worked with* [α1] *to determine the types of technologies available on the market, how they operate, what difference they could make for the hotel etc….. There were cases when* [α1] *came up to us with particular proposals; for example I remember the one on photovoltaics and we turned this down because we felt at the time that it was not feasible for the hotel. In this case the return on investment was too long and so instead we went for solar water heaters which gave a more immediate return on investment*." (Respondent Hotel Case E5M)

As shown by the empirical findings, episodes of intermediation activity may arise when proactive hotels interact with both energy services consultancies and with traditional building services firms.

In the reactive hotels, characterized by limited internal capabilities, the interaction with the KIBS tends to focus on aspects of day-to-day operations. Therefore the range of interventions of the KIBS remains largely within the realm of preventive maintenance support and addressing hot spots of energy consumption. Intermediation activity is constrained by the characteristics of the KIBS-client relation. This might be the reason why reactive hotels do not interact with energy services consultancies; rather they maintain long-term trust relations with traditional building services engineering firms.

The KIBS' competencies on energy efficiency and energy management are often perceived as coming at an extra cost. At best, the KIBS is brought into the firm simply to act as an arbiter of the best technology available that provides energy efficient alternatives to replace inefficient or outdated equipment. The managing director of an independent reactive hotel describes the relation established with a traditional building services firm:

> "*Like with other issues, if the hotel has to invest in new energy technologies, the company engineer is called in to give advice on technical specifications, assist with choice of technology etc. The* [engineering consulting firm] *also gives an idea on the payback period of the product - they are competent to do this work. They have a 50% say on suppliers but the directors ultimately decide what to go for.*" (Respondent A3M)

The study distinguishes different levels of absorptive capacity in hotels based on the firms' particular combination of capabilities and how these are deployed in the hotels' relation with KIBS. The findings are in line with Weigelt and Sarkar (2012) who link a service firm's absorptive capacity to its capability for complex problem-solving and they demonstrate that the firm's absorptive capacity determines the extent to which this gains from its relation with the KIBS.

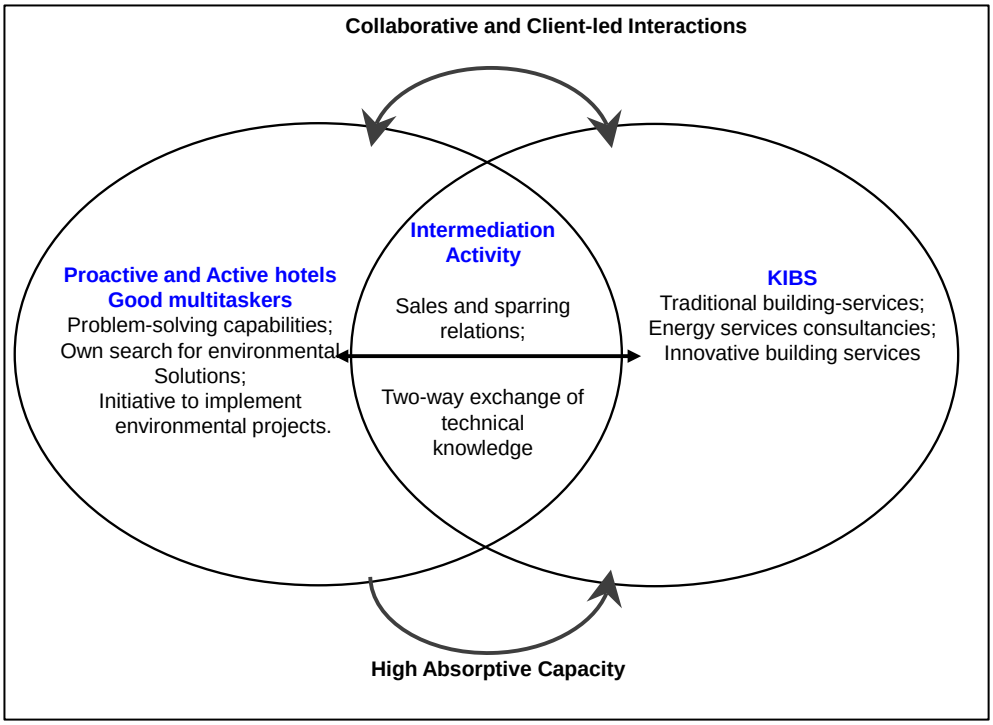
7.7.2 - Linking Absorptive Capacity, Intermediation and Adaptation Responses

Building on the previous section about absorptive capacity and intermediation, this section discusses the implications on adaptation and environmental action in hotels. It basis the discussion on the hotel adaptation modes identified in Chapter 6. However, it considers the two extreme ends of the adaptation responses by looking at hotels with a good multitasking potential at one end and those with a poor multitasking potential at the other end of the scale.

7.7.2.1 – Good 'Multitasking' Hotels with Enhanced Absorptive Capacity and Adaptability

The empirical analysis indicates that hotels with an good multitasking potential are less dependent on the KIBS when adopting environmental innovations. These include mainly active hotels that nurture capabilities for problem-solving internally and proactive hotels that take initiative to implement environmental measures and new structures towards environmental action. In turn, the KIBS are adapting in terms of the types of services offered, moving beyond preventive maintenance support services to incorporate energy management in their portfolio of services (e.g. innovative building services firms). Figure 7.1 below illustrates the dynamics between 'multitasking' hotels with a high absorptive capacity and KIBS engaged in interactions characterized by high participation of the hotel-client.

Figure 7.1: Relation between Absorptive Capacity, Intermediation and Adaptation in Multitasking Hotels



Source: author

Collaborative KIBS-client patterns contribute to shaping the adaptation response in the hotel by eliciting multiple episodes of interaction and learning between the hotel and the KIBS. The interaction starts in the pre-contract phase when the engineering consulting firm approaches the hotel with ideas and specifications for a project; and continues in the project implementation phase through intense and frequent meetings between the hotel top-management, hotel maintenance and the KIBS.

In the initial phases of interaction, there is the transfer of knowledge from the KIBS to the hotel on energy management opportunities and a negotiation on feasible alternatives. Likewise, the hotel top management and maintenance department provide the KIBS with data and information on the hotel's energy consumption profile that aid in designing the specifications for energy efficient or renewable energy systems. Knowledge on novel energy technologies, emerging from trial and verification experiments undertaken by the hotel in collaboration with the KIBS, becomes codified in the routine operations of maintenance such as through regular monitoring and logging of data in building management systems.

The KIBS-client interaction serves as a learning and negotiation space where hotels learn about the savings incurred from energy efficient technologies and opportunities for energy management and negotiate with the KIBS on the best possible 'alternatives'. The owner of a restructured palazzo described his relation with a traditional building services (α3) firm during the refurbishment project:

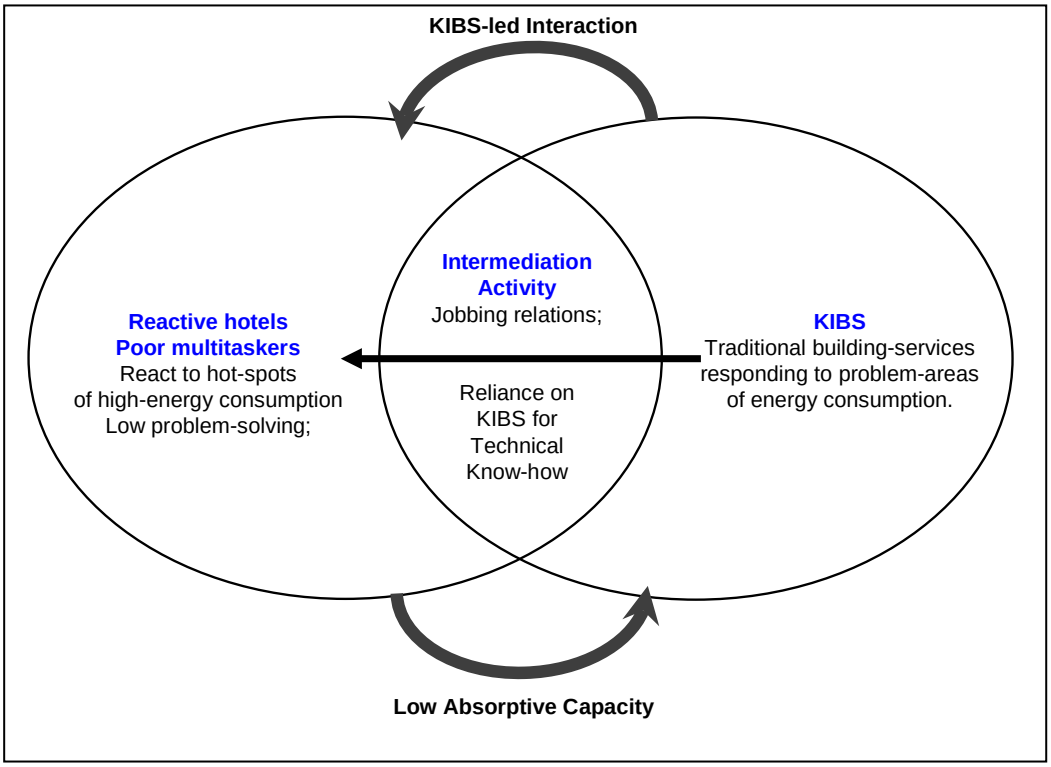
"*Decisions on particular technologies and systems were taken together* [with the engineering consultant]. *Sometimes I would come up with new ideas; other times the engineer brought in his expertise. I would say the interaction was a process of continuous learning.*" (Respondent Hotel Case D1T)

In summary, through engaging in collaborative interactions with diverse types of KIBS, multitasking hotels are able to gain from their relation with KIBS in terms of identifying energy-related solutions that fit their needs. This absorptive capacity is linked to the hotels possessing capabilities for problem-solving and evaluation that enable them to exploit the specialist knowledge coming from the KIBS. The high absorptive capacity and the nature of interaction with the KIBS provide the conditions for intermediation activity and a shift towards environmental action in hotels.

7.7.2.2 – Poor Multitasking Hotels with Limited Absorptive Capacity and Adaptability

Poor multitasking hotels – these are the reactive adapters - tend to outsource energy efficiency to the KIBS and their relation with the KIBS is defined by a high degree of dependence on the latter's expert knowledge about energy efficient measures and technologies. Coupled with this is the fact that the hotels' interaction with the KIBS is focused on routine tasks, tied to the hotel's preventive maintenance programme. In their interaction with the KIBS, the reactive hotels' absorptive capacity is limited to seeking expert advice for maintaining operational efficiency either because of lack of time, or technical expertise, or simply because environmental innovations are not prioritized. In these KIBS-client interactions there is constrained intermediation activity. Figure 7.2 summarizes the dynamics of the relation.

Figure 7.2: Relation between Absorptive Capacity, Intermediation and Adaptation Potential in Routine-Oriented Hotels



Source: author

As an expert on building services, the KIBS is the main input of knowledge in the KIBS-client interaction; this is typical of the KIBS-led interaction pattern. The relation serves as a locus for the transfer of explicit knowledge into the hotel, codified in manuals of operation and software implementation. The hotel top management is involved in decision-making about which environmental systems to adopt, based on expert advice received from the KIBS; whilst the maintenance manager is involved in the execution phase without necessarily acquiring the know-how to implement similar systems in the future. In fact, the empirical evidence suggests that the hotel-client has limited autonomy to implement new energy efficient projects because the knowledge remains mainly with the KIBS. This may in part explain the pattern of adoption of energy measures in the hotels which tends to occur on an *ad hoc* basis, in response to identified hot spots of consumption whilst energy efficiency is not embedded in the firm's operations. The following is an exemplary quotation:

"*When it comes to looking out for particular products or technologies, then the* [engineering consulting firm] *plays an important role because it knows the market very well, much better than I do, because he has contacts with suppliers or has implemented similar systems elsewhere……So the* [engineering consultant] *draws out the technical specifications of the equipment to be purchased based on his knowledge of our hotel - in terms of the design of the hotel, the plumbing system and the pumps we have available. The supplier will show you the newer models available but then, what do these have to offer? The* [engineering consultant] *assists us with these choices. When it comes to technical matters, then it is the role of the* [engineering consultant] *to look into these. The maintenance team comes into it when the decision on which system will be installed has been taken and the* [engineering consultancy] *comes up to us specifying what is needed, for example in terms of pipe work, where the pipe work is going to be passed etc..*" (Respondent Hotel Case A3M)

Overall, reactive hotels with a limited absorptive capacity are considered to gain less from their relation with the KIBS being focussed on routine operational efficiency and on solving problems that they are already familiar with. As a result of their dependence on outsourcing, the hotels do not develop internal problem-solving approaches that could be more widely applied to solving issues of high energy consumption; these hotels are considered to have a limited adaptability.

The discussion above linking the hotel capabilities to innovate with an ability to mobilize absorptive capacity with KIBS indicates that hotel adaptability is not only a reflection of the particular internal capabilities; but is also determined by the hotel's propensity to exploit its relations with external actors in order to innovate. This aspect broadens an understanding of firm adaptation as not being solely rooted within the firm but it is also interpreted as a function of how the firm adjusts in its relations with external actors to gain access to an external knowledge base about environmental innovations.

7.8 - Conclusion

This chapter took the example of KIBS as a type of intermediary acting between an external knowledge base on environmental innovations and the hotel; and focussed on the KIBS-client relation as a locus for intermediation activity. The main contribution is a practical demonstration of how the relational dynamics between the hotel and the KIBS may be influencing the adoption of energy efficiency, answering the second research question. The chapter also provides insights on service firm absorptive capacity.

The highlights from the findings are summarized below.

7.8.1 – Engineering Consulting Firms as a Diverse Group of KIBS

This study describes the KIBS as a heterogeneous group in terms of their roles in intermediating for energy efficiency adoption. This stands in contrast to the literature that tends to treat an intermediary as a homogeneous group, organization or agent and which creates the risk of conceptual over-simplification of how the intermediary may be acting in a system.

The adoption of energy efficient measures is likely to be facilitated by the energy services consultancies and those building services firms incorporating environmental and energy management as part of their portfolio of services. The KIBS may shape innovation adoption through the types of services and solutions packaged for the client that may be either tailored to the client's needs or targeted at solving problem areas identified through an energy audit.

However, the service-orientation of the KIBS is not sufficient to explain the adoption of energy efficient practices in the hotel-client. The relations established with the hotel plays a role in shaping the exchanges and flows of knowledge about energy efficiency at the KIBS-client interface.

7.8.2 - Patterns of KIBS-Client Interaction

By bringing together the hotel adaptation modes identified in Chapter 6 and the types of KIBS, the chapter builds three patterns of interaction. In contrast to van Lente *et al*., (2003), the findings suggest that an intermediary may not always speed up the innovation process. A more comprehensive interpretation of intermediation activity is one that takes into account the dynamics of the interaction of the KIBS with the hotel that influence the exchanges and flows at the KIBS-client interface. These dynamics are characterized by different professional relations and capabilities to adopt energy efficient measures present amongst the two classes of actors.

Collaborative relations provide the ideal space for intermediation activity. This is not only due to the high interactivity that promotes knowledge flows amongst the interacting parties as suggested by Tordoir's (1995) sparring relations. The study also shows that the hotel's capability for problem-solving plays a major role in enhancing the hotel's absorptive capacity

(proactive hotels) and therefore in shaping the interaction with the KIBS. This is in line with the argument of Grimshaw and Miozzo (2004) that smart clients with technical capabilities are in a better position to manage their relation with KIBS and gain from the outsourcing function.

Client-led interactions are characterized by the hotel creating a need for the adoption of environmental innovations. The hotel is the driver behind the adoption of energy efficient technologies and measures and it exploits its relation with KIBS to obtain information about novel solutions. The KIBS acquires a bridging function between the hotel's awareness on environmental action and the implementation of environmental innovations. Active and proactive hotels engage in client-led interactions with all three types of KIBS investigated in this study.

The KIBS-led pattern is an 'imbalanced' relation where the KIBS, typically a traditional building service firm, is the expert in the relation, providing advice on technical solutions to curb high energy consumption; whereas the hotel has limited technical capabilities and is dependent on the KIBS for outsourcing energy efficiency problem-solving. This relation tends to favour a business-as-usual approach and is focused on achieving operational efficiency other than on innovative behaviour.

7.8.3 - Relational Dynamics and Adaptation Responses

This research makes a novel contribution to the intermediation literature by combining aspects of absorptive capacity and intermediation activity. The findings demonstrate that the hotels are equipped with different degrees of absorptive capacity and this influences intermediation activity; and it confirms the argument made by Miles (2012) that the client's characteristics influence the extent to which it is able to exploit its relation with KIBS.

Extrapolating these findings to understand adaptation responses in hotels, the research demonstrates that intermediation activity may be supporting adaptation responses in proactive hotels with a high absorptive capacity; whilst a constrained intermediation activity involving reactive hotels may be limiting the adaptation responses in these hotels.

Multitasking hotels (active and proactive) acquire a degree of autonomy from the KIBS when adopting energy efficiency measures as they develop a problem-solving capability through implementing their own environmental projects. Proactive hotels also engage in collaborative interactions with KIBS for complex problem-solving and co-producing customized environmental solutions. In line with the findings of Weigelt and Sarkar (2012), service firms with capabilities for problem-solving are better equipped to make use of the knowledge and expertise of outsourcing partners and therefore have a higher absorptive capacity. These hotels stand to gain more from the relation with KIBS in terms of adoption of environmental measures because there is higher 'compatibility' with the KIBS in pursuing similar goals. They are considered better able to adapt.

In contrast, poor multitasking reactive hotels remain reliant on the KIBS for obtaining knowledge and expertise on energy efficiency. Due to their own limited capability for problem-solving, they lack the know-how to identify suitable energy efficient solutions that meet their needs. These particular dynamics of the KIBS-client relation, characterized by reduced absorptive capacity and a dependence on an external source for specialist knowledge, result in constrained intermediation activity. The hotel is seen to benefit less from its relation with the KIBS with regard to the adoption of environmental innovations and this influences its adaptability.

This chapter has demonstrated that intermediation activity is mobilized through the relation of the KIBS with the hotel-client through different patterns of interaction. In addition, the internal capabilities of the hotel and its ability to obtain information about energy efficiency from its relation with the KIBS appear to have a strong bearing on intermediation activity and on adaptation responses. The next chapter builds on these empirical findings. It considers how hotels are responding to developments in the external context and mobilizing their capabilities to implement environmental action.

Chapter-8: DEVELOPMENTS IN THE EXTERNAL CONTEXT AND THEIR ROLE IN INFLUENCING FIRM ADAPTATION RESPONSES

8.1 - Introduction

The context in which hotels are embedded is characterized by multiple signals affecting tourism as outlined in Chapter 2. Signals relating to environmental responsiveness in tourism represent a sub-set of these multiple signals. This chapter builds on and adds to the findings about capabilities and intermediation developed in Chapters 6 and 7 by exploring how developments in the external context may be influencing environmental action in hotels.

Its aim is to discuss how hotels are responding to external factors and policies to adopt environmental measures based on their combination of capabilities, answering the third research question of this study. In order to do so it draws from the three sets of interviews with hotels, consulting engineering firms and a wider group of actors from policy, education and tourism.

Based on the review of the external context in Chapter 2 and on the empirical findings, the principal factors influencing environmental action can be summarized as follows:

- ***Competitiveness and restructuring of the Maltese Hotel Sector:***

  Tourism in the Mediterranean is highly competitive and the hotel sector strives to maintain full occupancy, by reducing operational costs whilst at the same time maintaining the quality of the service offered. New developments in tourism namely the introduction of low cost airlines, the reduced reliance on tour-operated packages and other compounding factors (e.g. upgrading facilities and diversifying services) also play a role in the overall dynamics influencing hotel behaviour.

- ***Spikes in Energy Tariffs as government subsidies on utilities are removed:***

  Accommodation establishments are facing a substantial increase in operational costs as government subsidies on electricity and water tariffs were lifted in 2008 and as a result utility tariffs spiked. In order to incentivize the adoption of environmental and energy efficient measures, the government is offering subsidies on the purchase price of energy efficient and renewable energy systems and other measures promoting the adoption of environmental innovations. A challenge is for accommodation

establishments to obtain knowledge to implement environmental measures and exploit these incentives.

- ***Global Trends in Tourism and the Diffusion of Environmental Standards:***

  Apart from changes in the national context, Maltese hotels are influenced by signals coming from the international landscape about trends in tourism and the introduction of environmental standards in hospitality worldwide.

  Subsidiaries of multinational (MN) hotels are implementing environmental strategies and are developing a knowledge-base on environmental technologies and management systems. The trend towards 'greening' in these MN hotels is likely to put pressure on endogenous independent firms to follow similar strategies in order to retain their market position.

The set of signals discussed are complex and, though treated sequentially here, act simultaneously to influence environmental action.

8.2 - Restructuring the Maltese Hotel Sector

In response to global developments in tourism, national tourism policy is promoting the adoption of environmental measures under the 'sustainability' banner and links the quality of tourism with an increasing demand for environmental and ecological components[47]. Notwithstanding, this vision of tourism being intrinsically dependent on the environment and on attracting a 'quality tourist' market is not widespread amongst Maltese hotels that struggle to maintain price competitiveness especially in the low-occupancy months.

This context provides a mixed picture of, on the one hand, a push for tourism to embrace environmental goals and to invest in environmental technologies and practices. On the other hand, there is the urgency to upgrade the accommodation sector and the quality of the service to sustain competitiveness in the hotel sector. Coupled with this is the perception amongst the hotel managers that Malta's hotel sector cannot be sustained solely by up-market tourists that only certain types of hotels are able to attract; and mass-market tourism remains the most important source of revenue. The managing director of a midscale proactive hotel makes this point:

> "*Although the minister* [for Tourism, Culture and the Environment] *is insisting that Malta attract the five star luxury hotel market, we don't have enough of this type of tourist. We still need the mass market tourist to fill up our hotels and sustain the tourism economy in Malta.*

[47] Ministry for Tourism, Culture & Environment 'Tourism Policy for the Maltese Islands 2012-2016'.

When occupancy is low and five star [hotels] *reduce their prices to remain competitive and attract tourists; we four star hotels suffer too because it cascades onto us*." (Respondent Hotel Case B5T)

As a result, the adoption of environmental measures follows mainly a 'price' logic in most hotels investigated i.e. the implementation of energy efficient solutions translates into reduced utility tariffs and more competitive room pricing, which in turn results in a higher hotel-filling capacity. This logic provides a motive to invest in energy efficient technologies; and signals about incentives that part-finance energy efficient technologies are well on the radar of the hotels[48]. These schemes were discussed in Chapter 2. Ten out of the nineteen hotel cases adopt this logic and include mainly reactive and active hotels in the typology identified in Chapter 6.

In addition to this price logic, proactive hotels couple signals about environmental awareness with a competitiveness logic which is one where the hotels seek to diversify their service offering in order to attract a different type of 'green' or 'higher-spending' tourist; these hotels translate this logic into their corporate responsibility programmes or environmental programmes and community engagement initiatives.

The interviews with the KIBS indicate that government grants and incentive schemes are proving successful in stimulating the adoption of environmental innovations in hotels, but at the same time may deter from addressing issues about energy efficiency. Two hotel cases (B1 and D2) and more than half of the consulting engineering firms mentioned that in their view the schemes did not address more urgent issues of replacing high-consuming outdated equipment, such as air-conditioning systems which were not an eligible cost.

Another example is the adoption of the national eco-certification scheme for hotels[49]. This was launched by the Ministry for Tourism and the Environment to incentivize hotels to adopt environmental measures and enhance their energy efficiency profile. It was promoted as a tool to widen the marketing exposure of eco-certified hotels on the national tourism authority's website and other marketing media. When in fact the adoption of the eco-certification was not matched by the expected marketing advantage, the costs and resource commitment to implement the scheme appeared to outweigh its benefits[50]. This could perhaps account for the relatively low penetration rate of the scheme, with twenty-three hotels out of the 108 establishments obtaining the eco-certification up to the first quarter of 2013[51].

[48] The government's' Energy Grant Scheme' supporting energy efficient and renewable energy projects in tourism saw a very good response and uptake by the hotel sector. Tourism Sustainable Development Unit administering the Sustainable Tourism Projects grant scheme, personal communication.
[49] Malta Tourism Authority, personal communication.
[50] Malta Hotels & Restaurants Association, personal communication.
[51] Malta Tourism Authority National Eco-Certification Webpage accessed 28th March 2013 at: http://www.mta.com.mt/eco-certification'.

As identified in recent evaluations of energy efficiency programmes[52], financial measures to invest in energy efficiency and renewables create significant bureaucracy for the beneficiaries when compiling the applications and when having to comply with reporting requirements during the project implementation. Six out of the nineteen hotel cases mentioned this as a barrier to adoption; then there are hotels that lack the expertise to compile successful proposals and benefit from such incentive schemes[53].

Although financial measures may stimulate an immediate response for action to invest in energy efficient technologies, the research findings show that these measures do not contribute to building capabilities for energy management. One example is the lack of follow-up on the energy audits undertaken by the national business support agency. Although the hotels were offered the services of an energy assessor to undertake an audit and propose recommendations for implementing energy efficient measures; due to the lack of an ex-post evaluation of these audits, it was not possible to determine whether hotels were implementing the recommendations and the extent to which they acquired the necessary learning to assess the impacts of energy efficient measures on operational performance.

Whilst financial measures and the voluntary eco-certification scheme served to raise the sensing capability of hotels to environmental goals[54,55], they appear to have had limited impact on the capability for implementation and taking action. One of the issues that arose in the interviews is what happens beyond the incentive schemes? Are hotels able to adapt in the longer term? Although factors in the national context are pushing for firms to adopt environmental measures, the study shows that there appears to be a gap between sensing signals and longer-term action and adaptation.

8.3 - Gaining Access to Information on Energy Efficiency

As shown in the OECD/IEA (2012) evaluation of energy efficiency programmes, the availability of knowledge and information about energy efficient technologies and best practices is a significant barrier to adoption. The empirical results of this study indicate that this knowledge is not developing within a formal institutional setting. At the time of writing, educational institutions, namely the state university and the National Institute for Sustainable Energy, had only just started investing in formal training programmes addressing sustainable energy technologies for engineers and for the certification of installers of renewable energy technologies. This came in response to the shortage of skills for the maintenance and repair of such equipment[56]. Thus the main routes through which hotels acquire relevant knowledge about environmental innovations

[52] Chapter 2 discusses two such programmes: the ODYSSEE-MURE (2012) evaluation and the OECD/IEA (2012) evaluation of energy efficiency policies amongst European and IEA countries respectively.
[53] Tourism Sustainable Development Unit, personal communication.
[54] Tourism Sustainable Development Unit, personal communication.
[55] Malta Tourism Authority, personal communication.
[56] Institute for Sustainable Energy, University of Malta, personal communication.

is through their capabilities for problem-solving and evaluating potential environmental solutions ('learning-by-doing') and through procuring this from external sources. For the latter, the relation of hotels with engineering consulting firms was analyzed in Chapter 7.

The analysis of external context developments further reveals that policy measures may be influencing the hotels' capacity to gain access to specialist knowledge and to exploit relations with third parties in order to organize for energy efficiency. The knowledge flows between hotels and KIBS and that circulating amongst hotels are considered here.

8.3.1 - The Role of KIBS in Knowledge Transfer

This study has focussed on the relation of hotels with engineering consulting firms as a type of KIBS. As discussed in Chapter 7, the KIBS-client relation may present different dynamics in terms of which actors take initiative on energy efficiency, when and what motivates them. Also, the level of interaction varies: engineering consulting firms may keep an arm's length relation in not going beyond their role of assisting with the preventive maintenance programme whilst others engage with hotels on specific environmental projects.

Reactive hotels are inherently more dependent on outsourcing energy efficiency to KIBS because of limited internal capabilities to implement novel energy-related technologies; compared to active and proactive firms that develop capabilities for problem-solving on the job. However, the services of the KIBS may not always be readily available to the hotel if the former is not easily accessible or must be contracted specifically to implement energy efficient measures.

The study shows that the policies incentivizing the adoption of environmental and energy efficient measures are acting as a channel through which hotels gain access to KIBS' services. The fact that certain KIBS activities, such as energy auditing, are supported by the government through specialized incentive schemes, means that the hotel does not have to pay the cost directly and this favours the intermediary role of the KIBS in those firms that do not normally have access to expertise on energy efficiency. This could serve to enhance the absorptive capacity of hotels, mainly the reactive adapters, in two ways: one is by increasing their sensing capability about opportunities to enhance energy efficiency and the other is by providing specialist knowledge for implementation.

Active and proactive hotels are mobilizing absorptive capacity with KIBS in order to benefit from the financial incentives i.e. the relation is increasingly being exploited to obtain information on how to implement novel environmental technologies and take action. The hotels engage the KIBS to assist them with compiling proposals for an energy efficient installation or a renewable energy system or alternatively engage energy services consultancies to assist with incorporating environmental measures in building services. The KIBS fulfill the dual role of providing technical assistance as well as management assistance throughout the implementation of the project (Bessant and Rush, 1995).

In turn, developments in the national landscape are shaping engineering services by stimulating innovative activity in KIBS. All of the fourteen engineering consulting firms interviewed incorporate aspects of energy efficiency and management in their portfolio of services, either as part of the preventive maintenance support offered to their clients (as with building engineering services firms), or as in the case of the energy services consultancies by specializing in the provision of energy efficiency-related services. However, as shown in Chapter 7, the intermediary role of KIBS is mobilized through their interaction with the hotel-client.

8.3.2 - The Rise of an 'Informal' Knowledge-Base on Energy Efficiency

KIBS represent one out of a number of sources through which to tap information on energy efficient and renewable energy technologies. The empirical findings show that knowledge about environmental innovations is circulating through informal exchanges occurring amongst different hotels. The empirical analysis indicates that unlike knowledge on marketing and sales, that related to environment and energy efficient systems is freely shared between hotels through informal exchanges occurring amongst hotel technicians and maintenance managers and top managers (twelve out of the nineteen hotel cases show evidence of this).

The process of how this knowledge diffuses across hotels provides further insight on how hotels build absorptive capacity. Active and proactive hotels that have capabilities for problem-solving and evaluating technological solutions and are essentially good 'multitaskers', are able to exploit social networks to obtain information on environmental technologies. Social networks are exchanges occurring between different hotels in an informal setting. These networks are used firstly to exchange experience on the use of particular technological systems, including environmental technologies, and secondly to obtain assistance with problem-solving. The maintenance manager of an independent 4-star active hotel summarizes his interaction with other hotels:

> "*I am about to go to hotel* [Code A3] *with one of my technicians to assist with a problem that cropped up over there. Fifteen days ago, I was at hotel* [Code E2]*; they had a problem with the chiller and I provided assistance since my specialization is as a refrigeration technician. Similarly I had a problem with the steamer and the engineer from* [Code E3] *came over because they have a similar steamer*." (Respondent Hotel Case B4M)

On the contrary, poor multitasking hotels (reactive type) develop limited absorptive capacity from their interactions with other hotels: they rarely use informal networks of maintenance teams for information exchange and do not gain from the practice-based knowledge that circulates therein. They rely principally on traditional sources, namely suppliers to obtain information on emerging environmental technologies.

This study shows that those hotels which are actively engaged in knowledge exchange through their social networks - mainly proactive hotels - may be shaping and transforming practice-

based knowledge about how to enhance the efficiency of operations. Within the hotel sector, these proactive firms, that are mostly MN subsidiaries, are building an informal knowledge-base about novel energy efficient technologies and environmental best practice and playing an active role in influencing maintenance management practices in other Maltese hotels. The following quotation, from a MN subsidiary active in implementing environmental measures, illustrates how this function may be arising:

> "*The five star engineers come up with the ideas and we give the ideas* [to four star hotels] *almost ready on a plate so they can implement them if they wish to. So we share our experiences with certain systems and technologies with* [these hotels]. *We would have tested and implemented these systems in our hotels, even something as simple as LED technology. We can say we tested these particular types of LED technologies and say: 'listen we think these two types are the best'……So, the other hotels at their end can just go in and do something where their mind is at rest that it is the best technology available.*" (Respondent Hotel Case E5M)

The above is suggestive of the fact that Maltese hotels are not only relying on specialist knowledge coming from KIBS, to implement environmental technologies and measures; but also on 'practice-based' knowledge that circulates amongst informal networks of hotels that are actively engaged in implementing these innovations. This has implications for diffusion studies because it shows that traditional service firms are innovating by exchanging knowledge and experiences about environmental technologies internally, and do not rely solely on sourcing this externally from third parties.

8.4 - The Diffusion of Environmental Standards through Multinational Subsidiaries

The quality of service in hospitality has typically focussed on the general upkeep and ambience of the hotel, the quality of the services offered and relations with the guest[57]. An emerging trend in multinational hotel groups is to include the environment as a standard in hospitality, alongside the quality of the service. Quoting the Hilton's chief executive officer:

> "*Hilton aims to become the first major multi-brand company in the hospitality industry to make sustainability a brand standard*"[58].

Multinational (MN) subsidiaries are particularly tuned to developments in global tourism about the introduction of environmental programmes and strategies, unlike locally-owned hotels that

---

[57] Hospitality Assured label accessed 3rd April 2013 at: http://www.instituteofhospitality.org/hospitality-assured/about_ha/ha.

[58] USA Today Travel Hotel Check-In Blog: 'CEO Chris Nassetta: Hilton launching Brand-wide Sustainability Plan' posted on 26th April 2010; accessed 3rd April 2013 at http://travel.usatoday.com/hotels/post/2010/04/-ceo-chris-nassetta-hilton-launching-brand-wide-sustainability-plan/89795/1.

respond principally to push-factors in the national context. For MN hotel groups, the environmental component is becoming part of the corporate group's strategy, quoting the president of Starwood, a corporate group encompassing a number of brands[59]:

> "*These efforts* [for the environment] *make sense operationally and our guests are choosing brands that share this sense of purpose for reducing environmental impact. Meeting and exceeding these expectations is a critical aspect to the way we see the future and importantly, our future success.*"

The corporate group of multinational hotel brands are placing increased demands on their subsidiaries to adopt environmental strategies; they provide resources such as training sessions, information on environmental measures available on the company intranet and sharing of 'best practice' amongst sister subsidiaries[60]. In turn, the subsidiaries report to the headquarters on water and energy consumption, waste minimization and community engagement. The MN subsidiaries translate the value of complying with corporate environmental policy in terms of its impact on performance, since environmental measures and targets to reduce energy and water consumption are being included as indicators of overall hotel performance[61].

Through a centralized reporting system, the subsidiaries transmit data on energy and water consumption and their environmental achievements to the corporate group that is used to benchmark the performance of subsidiaries at regional level against the set targets. A ranking mechanism of the 'best performing' subsidiary hotels translates into a gain for the subsidiary such as enhanced marketing exposure in the corporate group's newsletter and media. One example illustrates how the achievement of the 'Travelife Sustainability Award' can provide a marketing opportunity, as described by the health and safety officer of a MN subsidiary:

> "*Travelife is part of a group of auditors that audit companies in the hospitality industry; once you obtain the* [sustainability] *certification, your hotel features on* [corporate office's] *website, leaflets and media in general and this has a very big advantage as a marketing tool. So it gives you a marketing opportunity.*" (Respondent Hotel Case E4O)

Whereas MN subsidiaries are sensing a broader array of signals about tourism and environmental standards, the indigenous hotel sector is inward-looking i.e. the importance given to environmental measures is comparatively low. Nonetheless, the environmental response

---

[59] Frits van Paasschen, President and CEO of Starwood, Starwood News 'Reinforcing Commitment to Conservation, Starwood Calls for Significant Reductions in Energy and Water Use at Properties Worldwide' posted on 17th June 2010; accessed on 3rd April 2013 at:http://development.starwoodhotels.com/news/41/120-reinforcing_commitment_to_conservation_starwood_calls_for_significant_reductions_in_energy_and_water_use_at_properties_worldwide.

[60] Interview with Hotel Case E4.

[61] Interviews with Hotel Cases E2 to E5.

behaviour of the MN hotels may be acting as a selective pressure for the up-market indigenous hotel sector to step up implementation of environmental measures. The director of a national independent proactive hotel chain discussing the diffusion of the national eco-certification scheme, claims:

> "*If eco-certification diffuses in the hotel sector, this may prevent hotels from slashing prices. Hotels tend to slash prices when costs go up. This would be a gain for my hotel because I too will not need to slash prices*." (Respondent Hotel Case B6T)

Although the above only represents one case, it offers an alley to understanding how global trends in tourism about environmental performance and standards may permeate into the local hotel sector through practices adopted by MN subsidiaries. In their role as 'trendsetters', MN subsidiaries may be setting a standard for good practice on energy efficiency as exemplified by the following quotation:

> "*Often we are asked to deliver presentations on the initiatives we implement. As I mentioned, we are taken as a 'best practice example', not only in the hotel industry but for industry in general. I think other hotels are very interested in what we are doing and what we have to say since we are leaders in the field of environmental performance; so really it is more of a one-way exchange* [of information]*."* (Respondent Hotel Case E5M)

8.5 - Synthesis

This chapter adds to Berkhout's (2012) assessment of adaptation responses being the result of an interaction between factors in the environment and endogenous factors that are characteristic of the firm. The findings show that external developments about energy pricing policies and factors related to a growing environmental awareness in tourism overall create a potentially wider range of options for hotels to adapt, addressing the third research question of this study. The question of whether the Maltese hospitality sector is able to adapt and respond to these developments remains open since the analysis shows the hotels to be inward looking, and signals about environmental awareness are not significant influences on the environmental response behaviour of these hotels.

The combination of the hotels' capabilities plays a role in determining whether these developments equally constitute an opportunity or a constraint for the firm. Reactive hotels have limited absorptive capacity to mobilize external linkages and obtain external knowledge about energy efficiency. Although the hotels are becoming increasingly aware about opportunities to invest in environmental innovations, they do not appear to be leveraging competences and resources in order to implement environmental action. For these firms, the response options are limited by their technical capabilities to evaluate the technology options and adopt environmental measures.

In contrast the MN subsidiaries, and a small group of independent hotels in the group of proactive adapters, are responding to a broader range of signals about environmental awareness and environmental standards in hospitality through adapting aspects of the service delivery process. They use their internal capabilities to exploit policy measures that enable environmental action. These proactive hotels are also using informal networks of maintenance managers as a channel for knowledge exchange.

The analysis shows that policy measures may be enhancing the access by hotels to specialist knowledge and resources, including engineering services, thus facilitating the intermediary role of KIBS. However, the extent to which hotels are benefiting from this type of technical expertise is found to depend on their absorptive capacity. Active and proactive hotels are leveraging their relation with KIBS in order to benefit from policy incentives, and exploiting their social networks to assist with problem-solving for energy efficiency. In these hotels such policies and measures are creating an enabling environment to implement environmental action.

The findings point at another emergent source of knowledge on environmental technologies which is the knowledge circulating amongst hotels. This could represent a more accessible source of practice-based knowledge on environmental and energy-efficient innovations than the technical knowledge that is sourced from external experts.

The final chapter provides the overall conclusions of the thesis and implications for policy and offers insights for future research.

Chapter-9: CONCLUSION

9.1 - Introduction

This thesis explores the capabilities that enable environmental action in traditional service firms with particular reference to how these firms shift towards improved energy efficiency. It addresses a gap in the literature about the capabilities of traditional services for innovation that is an ill-defined area of research; and how these capabilities may account for particular innovative behaviour (den Hertog *et al*., 2010; Sundbo, 2011). The processes leading to the adoption of energy efficient measures in hotels in Malta are investigated in order to address the research problem. This focus addresses a concern for policy and firm strategy about high energy prices and other factors related to environmental responsiveness in tourism that are spurring Maltese hotels to take environmental action.

The study provides an in-depth analysis of adaptation at the firm-level. Adaptation is understood as a process through which the firm adopts energy efficient technologies and measures and integrates these into existing activities and tasks. It also takes into account how the firm re-organizes and distributes activities and practices and implements new structures in order to achieve improved energy efficiency. Thus the firm is seen as a multitasking entity, following Sundbo (2010), where innovative activity occurs alongside the service delivery process.

The original contribution of this thesis is that it demonstrates the presence of heterogeneous adaptation responses amongst firms in the same sector in terms of the nature and types of energy efficient measures and technologies adopted to enhance efficiency of operations; this is accounted for by different combinations of capabilities that the firms deploy for environmental action. The research also contributes a deeper understanding of absorptive capacity in services and demonstrates a link between the service firm's internal capabilities and its ability to mobilize absorptive capacity to obtain external knowledge about energy efficiency measures. The relation with a type of KIBS, the engineering consulting firm, is used as one example of a source of specialist knowledge on environmental innovations and energy efficiency measures.

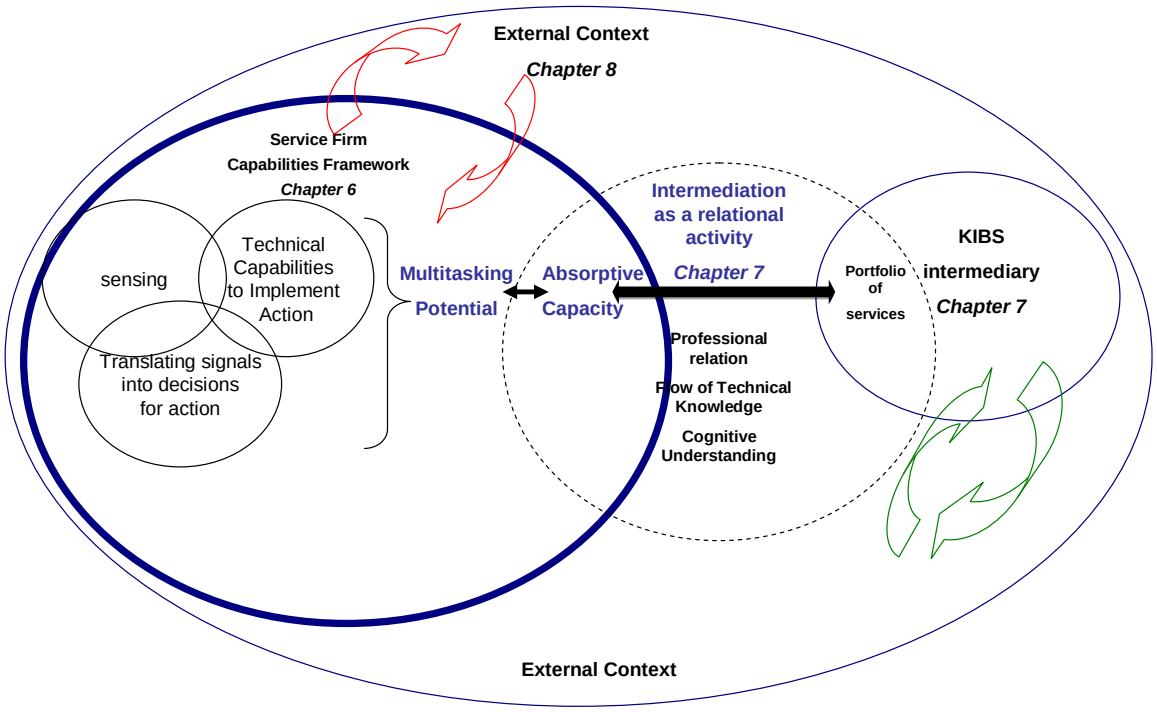
The qualitative approach used in this study contributes a wealth of descriptive data about firm capabilities and adaptation responses. This in itself is a contribution and adds to existing quantitative surveys on hospitality firms' environmental performance (e.g. Molina-Azorin *et al*., 2009). A total of fifty six semi-structured interviews were conducted with twenty-six top and maintenance managers in nineteen hotel cases, senior partners within fourteen engineering consulting firms and sixteen entities representing government, educational, and other public bodies in the institutional environment. Additional data were collected through website analyses and the researcher's participation in relevant seminars organized locally.

This chapter proceeds in Section 9.2 by presenting a model to understand firm adaptation and environmental action based on the aspects discussed in this study. This is used to answer the research questions (Section 9.3) based on the empirical findings in Chapters 6-8. The chapter then highlights the main contributions to knowledge about innovation in services and dynamic capabilities in Section 9.4 and the implications for policy and practice in Section 9.5. The limitations of the research are outlined in Section 9.6, together with areas for future research.

9.2 - A Model to Investigate Adoption of Energy-Efficiency in Hotels

Based on insights from strategic management and the innovation management literature, the study develops a model which offers an advance on current theoretical perspectives about dynamic service firm capabilities in relation to the adoption of environmental innovations. This model is presented in Fig. 9.1.

Figure 9.1 - A Model to Investigate Capabilities for Environmental Action in Services



Source: author

The model takes as its analytical focus the firm and its internal capabilities to adopt environmental innovations. It subsequently broadens the analysis to understand how the firm exploits its relation with a type of intermediary, the knowledge intensive business service firm or KIBS, in order to obtain knowledge about energy efficiency and adopt energy efficient measures. The ‘space’ between the service firm and the KIBS is the KIBS-client interface where

intermediation activity takes place. In this study, intermediation activity refers to the potential for the exchange of knowledge and learning about energy efficient technologies and measures at the KIBS-client interface. The external context (outermost circle) is the background of this study where external signals (energy price signals and policy measures to adopt environmental innovations) are putting pressure on firms to take environmental action, with energy efficiency being one aspect.

The model provides a basis to understand the variability of hotel environmental action. Specifically, it demonstrates that the differentiated responses observed amongst firms in the hotel sector are the outcome of different internal capabilities to adopt environmental innovations and of the dynamic interactions with KIBS. The model is derived from iterations between the empirical results and the theoretical framework. The theory served to elaborate a framework on capabilities to adopt environmental innovations; the empirical work supported theory development adding to it descriptions and themes that served to enrich and refine the original constructs about capabilities.

The empirics also played an important role in guiding the study. The fieldwork helped scope the study by providing background knowledge on the process of adoption of environmental and energy efficiency measures in hotels and how this is principally related to technical aspects (and therefore innovative activities in the back-office operations). Secondly, the fieldwork identified the KIBS (engineering consulting firms) as a relevant actor to investigate since these maintain links with hotels, providing services related to the preventive maintenance programme where aspects about energy efficiency are likely to arise.

A novel aspect of the model is that it discusses certain elements of the literature in a new way. It brings insights from strategic and organizational management into service innovation; and it combines concepts about intermediation and absorptive capacity by dissecting out the relation between the KIBS and the hotel in a way that has not yet been sufficiently addressed in the literature. The aim was to explore those elements of the relation that may be influencing intermediation activity.

9.3 - Reprising the Research Questions

The model enables an enriched evidence-base analysis of the research problem and helps define how traditional services deploy capabilities for environmental action and adopt energy efficient technologies and measures. It is used here to answer the research questions in light of the empirical findings.

RQ1: How can a capabilities-perspective explain the adaptation of a traditional service sector to achieve energy efficiency?

The empirical findings confirm the proposition that particular combinations of capabilities can account for different patterns of environmental action in hotels. Chapter 6 identifies three adaptation responses based on the firms' characteristic combination of capabilities and the environmental innovations adopted; these are summarized in Table 9.1 below.

Table 9.1 – Capabilities for Adopting Environmental Innovations in Maltese Hotels

Hotel Adaptation Mode	Capabilities	Innovation Patterns	Adaptability of the Firm
Reactive adapters	Sensing internal signals about high energy consumption; Capabilities to solve 'hot-spots' of high energy consumption.	Adopt narrow range of energy efficient measures.	**Limited Adaptability** Hotels implement *ad hoc* technology solutions and maintain operational efficiency.
Active adapters	Sensing internal signals about high energy consumption; Capabilities for problem-solving and evaluating technology options.	Adopt wide range of energy efficient measures and renewable energy technologies.	**Good Adaptability** Hotels modify maintenance practices to enhance energy efficiency.
Proactive adapters	Sensing broader range of signals about environmental awareness in tourism and signals about policy incentives to adopt environmental innovations; Capabilities for problem-solving and evaluating technology options; Capabilities to implement innovative organizational structures; Commit resources into environmental strategies and policies in the hotel.	Adopt wide range of environmental innovations as well as organizational innovations; implement new environmental projects beyond day-to-day maintenance tasks.	**High Adaptability** Hotels implement new practices and organizational structures for environmental action.

Source: empirical analysis

The three adaptation responses distinguish between reactive hotels with low multitasking potential, and active and proactive hotels with a keen and good multitasking potential respectively. Thus there is a continuum of multitasking potential other than distinct categories as

presented here for clarity. This is confirmed by the fact that as discussed in Chapter 6, there are a few cases that do not fit neatly into the three types.

In order to account for these adaptation responses, the analysis looked at the capabilities that hotels deploy in order to adopt energy efficiency measures. These included capabilities to sense a variety of signals ranging from environmental responsiveness in tourism to energy pricing signals; capabilities to translate or interpret these signals in the firm and capabilities for problem-solving and evaluating technology options. At the lower end of the multitasking scale, reactive hotels exhibit limited sensing capabilities and are responding principally to internal signals about energy consumption. They deploy capabilities to adopt measures that result in enhanced operational efficiency thereby reducing operational costs and improving guest occupancy rates.

Keen and good multitasking hotels, that include the group of active and proactive firms respectively, are sensing a wider array of signals about environmental responsiveness in tourism and translate these into the firm in the way of 'green' advertizing and marketing or are embedding these signals in their corporate environmental programmes (in the case of MN subsidiaries). Their enhanced multitasking potential is also accounted for by their capabilities for problem-solving and evaluating technology options. Distinguishing the proactive hotels from the active ones is the fact that the former go further in implementing new environmental projects that go beyond day-to-day tasks. There is also a higher investment of resources in researching and experimenting novel environmental technologies. Proactive hotels deploy capabilities to implement innovations in organizational structures such as setting up green/eco-teams and environmental training programmes with staff.

Within the three adaptation modes, there is evidence of hotels exhibiting a variety of innovation patterns, demonstrating a link between the combinations of capabilities and the innovation behaviour. As shown in Table 9.1, reactive hotels adopt a narrow range of energy efficient technologies compared to the group of active hotels that implement a wider range of energy efficient and renewable energy measures. In addition to energy efficient technologies, proactive hotels implement new organizational structures dedicated to implementing the firm's environmental strategy.

Another finding is that the particular capabilities residing in the firms reflect their degree of adaptability and potential to adopt environmental action and achieve enhanced energy efficiency. The adaptability of the firm is linked to the multitasking potential. As discussed in Chapter 6, reactive hotels show limited adaptability in that they are principally focused on solving short-term problems of high energy consumption through a technology-replacement strategy. They are essentially 'inward-looking' firms that exploit existing resources and capabilities to maintain or enhance efficiency. Their orientation towards carrying out routine activity drives them to adapt in the short-term, by making adjustments that require minimal

modifications to current practices of service delivery. They are poor multitaskers and thus are considered to be the least adaptable.

The groups of active and proactive hotels are considered more adaptable in terms of them adopting more diverse energy efficient technologies and practices that enable environmental action. Adaptation proceeds through the modification of existing practices of maintenance and the adoption of new ones. This multitasking potential enables the firms to diversify their innovation behavour by adopting a wide range of energy efficient technologies and measures. Proactive firms adopt both an exploitative strategy where they maximize existing resources and competences and an exploratory strategy where they build new competences to implement environmental innovations. These firms exhibit the highest adaptability in undergoing 'deeper' organizational changes that result in environmental action compared to the other two groups.

This study did not set out to distinguish between the innovation process in multinational hotels and that in domestic hotels; even though the sample of hotels consisted of a variety of firms in terms of their size, employment and facilities offered; and included both branded and independent hotels. Nonetheless the adaptation modes constructed do reveal an interesting finding about innovation in Maltese hotels. Proactive hotels that innovate through making organizational changes include both large multinational subsidiaries and also small independent hotels. Despite having limited resources, independent hotels in the proactive group exhibit similar innovative activity to the larger hotels forming part of a hotel chain. This is linked to two factors: one is the fact that small independent hotels are nurturing a multitasking environment in the way they organize the maintenance tasks and create an environment conducive to problem-solving and evaluation. Another is their enhanced absorptive capacity discussed later in the chapter.

As a result of the methodological approach adopted in this research, the analytical focus has been on those aspects of innovation occurring mainly in the 'backstage' activities. Thus the study considers the case of hotels adopting innovations that are not at the core of their activity if this is understood to be that of delivering 'up-to-date' service solutions and service experiences (den Hertog *et al*., 2010). Notwithstanding, the results show that there is significant innovative activity going on and that innovations in the backstage are supporting the processes of service delivery as discussed by Bitner *et al*., (2008).

The aim of changing the customer experience is generally absent, and customer issues arise mainly insofar as efforts are made to minimise impacts on service quality or as a requirement for consumer behaviour change. As a result, consumer involvement in innovation is limited either in the sense of pressure for change or change induced by different consumer behaviours. Although many environmental innovations adopted in the backstage activities, including measures to achieve higher energy efficiency, often go un-noticed by the customer, they become enablers of the front-office characteristics of the service in the way of providing adequate thermal comfort, hot water supply and lighting to the customer. This perspective

follows Glushko and Lindsay's (2009) view that back- and front stage innovations are part of a continuum that form the service innovation value chain.

RQ2: How does the relation of the service firm with a type of intermediary, the KIBS, influence environmental action and the adoption of energy efficient measures?

Another aspect of the model is the intermediation activity at the KIBS-hotel interface and the extent to which this may be influencing environmental action in hotels. This is analyzed in Chapter 7. The findings show that there are two key features of this relation that influence intermediation activity: 1) the type of KIBS and the nature of the services it delivers; and 2) the hotel's internal capabilities and the extent to which the firm mobilizes absorptive capacity to adopt environmental innovations.

The analysis builds different patterns of KIBS-client interactions, by bringing together the hotel adaptation modes and their capabilities, and the type of KIBS. Table 9.2 summarizes how the hotel adaptation modes play out against the relations with the KIBS in affecting intermediation activity.

Table 9.2 Patterns of KIBS-Client Interaction: Linking the Hotel Adaptation Modes and KIBS Types

Patterns of KIBS-Client Interaction	Hotel Adaptation Mode	Hotel Absorptive Capacity	Type of KIBS	Intermediation activity
KIBS-led	**Reactive Hotels** with capabilities to implement *ad hoc* technology solutions and maintain operational efficiency.	Limited	Traditional building services engineering firms	Constrained
Client-led	**Active Hotels** with capabilities to modify maintenance practices to enhance energy efficiency. **Proactive Hotels** with capabilities to implement new practices and organizational structures for environmental action.		Energy services consulting firms; Innovative building services engineering firms	Good
Collaborative	**Proactive Hotels**	High	all three KIBS types	Strong

Source: empirical analysis

The findings show that the KIBS represent a heterogeneous group of firms providing engineering services and those energy services consulting firms specialized in delivering energy management solutions. Their role as an intermediary in the adoption of environmental innovations emerges through the type of interaction with the hotel. Likewise there is a diversity of hotel-clients. There are reactive hotels that are passive recipients of novel environmental technologies, sold as off-the-shelf solutions by the KIBS. Then there are hotels that are actively searching for and co-producing environmental solutions with the KIBS (proactive type).

Table 9.2 above suggests a different pattern of KIBS use between reactive hotels and the others, which is suggestive of a cluster differentiation. Reactive hotels are set apart from the active and proactive hotels by their low multitasking potential and this determines which type of KIBS they interact with. Active and proactive hotels show similar patterns of interaction with KIBS being more similar in terms of the types of capabilities for adopting environmental action; however a feature distinguishing these two adaptation modes is their absorptive capacity.

The research shows that there is a link or relation between intermediation and the hotels' absorptive capacity. Reactive hotels depend on outsourcing energy efficiency problem-solving to KIBS and their absorptive capacity is limited to obtaining expert knowledge about innovative solutions that relate primarily to keeping operations running efficiently. They engage in KIBS-led interactions with traditional building services firms that appear to be constraining intermediation activity i.e. these interactions do not create opportunities to introduce environmental measures but tend to be focused on routine operations. Substantiating this finding is the fact that reactive hotels do not engage in collaborative relations with KIBS offering energy-related services and are unlikely to co-design new environmental solutions; rather they buy-off standard 'off-the-shelf' energy efficient solutions to meet short-term requirements of lowering energy consumption.

Client-led and collaborative interactions favour intermediation activity when they involve hotel-clients with internal capabilities for problem-solving and evaluation that mobilize absorptive capacity to obtain specialist knowledge about environmental technologies and measures. These are the multitasking active and proactive hotels that interact with all three types of KIBS investigated in this study. Although it is more difficult to identify distinct clusters of active and proactive hotels and specific types of KIBS, the findings indicate that proactive hotels have a higher absorptive capacity in being more likely to engage in collaborative interactions with the KIBS. In turn, the KIBS mobilize their resources to create solutions that often lie outside their core portfolio of engineering services in order to meet the hotels' needs. The interactions of proactive hotels with innovative building services engineering firms are characterized by a strong element of co-production and customization of environmental solutions.

Collaborative interactions are more likely to generate two-way flow of knowledge from the KIBS to the client and vice-versa when compared to KIBS-led interactions involving clients with limited absorptive capacity. Proactive hotels acquire a degree of autonomy to adopt environmental innovations through their own problem-solving capability; they use this capability in order to

make specific requests for the KIBS to provide novel environmental solutions. Therefore they have a high absorptive capacity that is influencing intermediation activity.

RQ3: How do policy and other factors external to the service firm influence the adoption of energy efficient technologies and measures?

Chapter 8 investigates how external signals might be shaping the environmental response behaviour in Maltese hotels. The results show that Maltese hotels are essentially 'inward-looking' when it comes to taking decisions about adopting environmental innovations i.e. they follow a profit-driven or cost-saving model whereas signals about environmental responsiveness are in general not significant influences on their environmental response behaviour.

Policy incentives and measures aimed at promoting the diffusion of environmental technologies can potentially serve to establish a wider range of response options for firms to adopt environmental innovations. However, the degree to which the hotels can accrue benefit from such policy measures is linked to their capabilities for environmental action. Specifically, the empirical findings show that whereas initiatives such as the provision of subsidies or access to specialist technical expertise are effective in placing signals about energy efficiency on the hotel's radar, they are having less of an impact on the hotels' capabilities to adopt environmental innovations. This finding has an implication for policy in that it provides insight on how policy frameworks can be better tailored to the needs of Maltese hotels to shift along energy efficient trajectories. This aspect is discussed in Section 9.5 on the implications for policy.

The components of the model are discussed separately below in terms of how each component is an advance to current theory; each section is enriched with examples from the empirical findings that support these theoretical contributions.

9.4 - Contributions to Knowledge

This study makes a contribution to knowledge about capabilities in services, as well as on the innovation process in services. Three elements of the conceptual model in Figure 9.1 advance to theory on service firm adaptation and innovation. These are summarized in the following points:

1. Hotels exhibit a variety of adaptation responses; this means that firms within the same sector exhibit different innovation patterns and this provides a more dynamic view of innovation than is perceived to occur in mature services;
2. Different combinations of dynamic capabilities account for the heterogeneous or variable responses observed in hotels;

3. By bringing together the hotels' combination of internal capabilities and absorptive capacity and the patterns of interaction with the KIBS, the study contributes a deeper understanding of how particular dynamics at the KIBS-client interface influence intermediation and innovation adoption.

These contributions are discussed below.

9.4.1 – The Innovation Process in Services

As outlined in the review of the literature in Chapter 3, theories about innovation in services indicate that the process tends to be non-systematic (Sundbo, 2011). This study uses the concept of multitasking to explain the dynamics of innovation in traditional services (after Sundbo, 2010 and 2011). In this interpretation, adaptation in hotels is determined by the firms' multitasking potential. Adding to Sundbo's (2011) definition of multitasking, the research characterizes hotels as varying in their multitasking potential, which helps to account for the variety of responses to adopt the environmental innovations observed.

A significant contribution of this study is to understand the innovation process as depending on the multitasking potential of firms; this can account for the diversity of responses of firms in the same sector to the challenge of environmental action. Using this perspective, innovation in traditional services is understood as being an informal process, involving not a specific department in the firm, rather engaging resources and capabilities across the firm. The study shows that innovative activity is built-into existing tasks and operations rather than being organized as a distinct activity in specialized departments. The multitasking potential is reflected in the firm's choices on how to distribute resources and capabilities across multiple processes and new activities. Similar to the concept of ambidexterity (O'Reilly and Tushman, 2007), multitasking is about finding a balance between routine tasks and innovative activities that may lead to innovations (organizational and/or technological innovations) supporting service delivery. The view of the traditional service firm as a 'multitasking' entity with different potential for innovation has implications on how to measure innovation in traditional services: the findings from this study show that this should focus not so much on the 'outcomes' of the innovation process (such as a new service product) as on identifying new activities and practices that may result in these innovations.

Innovation management often treats service firms as a homogeneous group that innovates in the same way. In order to unpack the dynamics of service innovation, Chapter 6 shows that service firms exhibit a heterogeneous behaviour in terms of different patterns of innovation. Thus, the findings counter the monochromatic perspective of traditional services exhibiting minimal to no innovative activity (Sundbo, 2011).

9.4.2 - Dynamic Capabilities and Adaptation Responses in Hotels

The concept of dynamic capabilities represents a widely-used approach to understanding firm adaptation and innovation in response to external change (Eisenhardt and Martin, 2000; Teece, 2007). In their six-dimensional model on dynamic service innovation capabilities, den Hertog *et al*., (2010) argue that service firms make use of different types of capabilities in order to innovate; however the literature linking types of capabilities with particular innovative behaviours is under-developed, with little examination of the issues addressed in this thesis. Chapter 6 makes a contribution to addressing this gap by identifying different groups of service innovators with different combinations of dynamic capabilities.

This study addresses a crucial issue about dynamic capabilities which is the commonalities paradox. Different firms may possess similar types of capabilities as identified in the capabilities framework in Annex 10; however these may differ in their underlying characteristics. Thus the study holds that the idiosyncratic nature of dynamic capabilities lies not in their presence *per se* but in the micro-foundations that define these capabilities, in line with Kindström *et al*., (2012). The capabilities become a set of 'labels' that can account for particular firm behaviours; however the processes explaining such behaviours can be found in the micro-foundations or in the way the firm mobilizes resources and adjusts and modifies particular activities and tasks in order to adopt energy efficiency measures (Helfat and Peteraf, 2003).

Through the elaboration of the capabilities framework in Annex 10, the study unpacks these micro-foundations that account for differences in firm innovative activity. The framework thus contributes to shaping an understanding of dynamic capabilities as applied to traditional services. Although there may appear to be little or no change in the way traditional firms deliver a service or in the service itself, taking a detailed look at their capabilities reveals that there is change occurring in the characteristics of these capabilities that enables to distinguish different firm behaviours. These capabilities do not appear to be bringing about radical change in the way the service firms are making a living as suggested by Teece (2007). However the study holds that different firms may be at different 'starting points' in shifting towards more environmentally-sound practices: some may require capabilities to 'catch-up' with competitors and survive in an environment that is posing new challenges which in this study are related to the high cost of energy; whilst other firms are deploying similar capabilities in order to implement environmental action and gain some competitive advantage in the market such as by attracting a different type of 'ecofriendly' customer.

The above suggests that dynamic capabilities may be equally valuable for making short-term adjustments and ensuring survival of the service firm as they are a source of performance difference as suggested by Teece (2007). This also means that dynamic capabilities need to be assessed over a temporal scale in order to determine whether short-term adjustments may lead to more radical change in the longer term.

The findings indicate that those hotels with a more diverse combination of capabilities in the way of problem-solving and evaluating technology options are considered to be more adaptable; these are the group of active and proactive firms. In these firms, adaptability is related to the capabilities of solving challenges about high energy consumption and embedding these in the service delivery process. These capabilities equip the firm with practical knowledge to adopt solutions that may result in long-term efficiency gains and that can be exploited again to solve future problems. Reactive hotels are constrained in their adaptation response to exploiting existing competences due to their limited capability of problem-solving for energy efficiency and are responding principally to internal signals about energy prices. Extrapolating the results, these firms are less likely to adapt in the long-term; even though in the short-term they may still be competitive in terms of surviving and 'keep-up' with competitors.

The research shows that not any combination of capabilities 'works' and is equally effective in enabling the adoption of environmental innovations and energy efficiency measures. One example of a reactive hotel showed that a heightened sensing capability about environmental awareness in tourism residing in the top management was not equally matched by a technical capability to solve issues around high energy consumption and taking initiative to implement new environmental projects.

Treating capabilities as being linear, where the presence of one capability is causal to the presence of another, does not explain adoption behaviour; rather the findings substantiate the need for a non-linear model of adaptation based on the presence of a combination of capabilities in line with den Hertog *et al*., (2010). The empirical findings show that although active hotels lack a proactive environmental approach, in the way of a written environmental policy, they have similar technical capabilities to the proactive hotels implementing an environmental strategy. These findings counter previous studies that generally assume that only firms with a pro-environment strategy are likely to possess capabilities to adopt environmental innovations (Post and Altman, 1994; Sharma and Vredenburg, 1998). Distinguishing the proactive firms from the other groups is their capability to translate external signals into opportunities for the firm to gain some advantage from implementing environmental action.

9.4.3 – Relational Dynamics at the KIBS-Client Interface and Intermediation Activity

The notion of KIBS acting as intermediaries in innovation adoption is not new (e.g. Miles *et al*., 1995, den Hertog, 2000). The literature has also stressed the importance of the KIBS-client relation in the innovation process (Grimshaw and Miozzo, 2004; Howells, 2006; Miles, 2012). Although there have been a few studies addressing these aspects as indicated in the literature review in Chapter 4, the distinctiveness of this study is that it provides a demonstration of different patterns of KIBS-client interactions and how these influence intermediation activity.

In order to build these patterns, Chapter 7 unpacks the characteristics of a type of KIBS – the engineering consulting firm - and the hotel to determine the nature of the interactions. The literature discussed in Chapter 4 indicates that the client can play an active role at the KIBS-client interface in mediating different aspects of the relation (Hislop, 2002; Grimshaw and Miozzo, 2004; Miles, 2012). This study adds to this literature by showing that the client characteristics, described in terms of the capabilities to adopt environmental innovations, influence the interaction with the KIBS and its outcome. They confirm Grimshaw and Miozzo (2004) that the client's characteristics and namely its technical capabilities determine a level of compatibility with the KIBS that are shaping the relations between these actors.

This study makes a contribution to understanding absorptive capacity in a non-R&D based setting. The literature generally describes absorptive capacity as a source of technological knowledge; in traditional services this construct acquires a broader meaning. Absorptive capacity describes the extent to which the service firm is able to make use of developments in engineering and environmental technologies developed elsewhere for its own process innovations and organisational innovations.

Service firms build absorptive capacity through the nature of the relation established with KIBS: this is measured in terms of the scope of the interaction (what problems are addressed and what issues are brought to the fore in the relation with the engineering consulting firm) and the degree of interactivity (collaborative relations are more likely to result in customized solutions that promote opportunities for mutual learning). The KIBS-client relation is the locus of several different activities including training on novel technological systems, adopting novel energy efficient technologies and designing building services that result in more efficient use of energy. Thus the interaction of the service firm with the KIBS, through these multiple activities, serves not only as a source of technical knowledge for the service firm. It also contributes to building absorptive capacity in the way the service firm integrates this information and knowledge into its routines and practices and that result in organisational innovations (such as new or modified practices in operations management and new ways of engaging the staff in the firm's environmental strategy). The findings indicate that the nature of the interaction with the KIBS, whether this is collaborative or a sales-type relation, influence the integration of external knowledge into the firm's routines and practices and determines the ability of the firm to achieve particular innovation outputs (technological and/or organisational innovations).

The research indicates that service firms are equipped with different 'levels' of absorptive capacity and therefore do not gain equally from their relation with KIBS. The empirical findings show that intermediation is constrained in reactive hotels with limited multitasking potential engaging in KIBS-led interactions; whereas there is stronger intermediation activity where proactive hotels - with an enhanced absorptive capacity - are engaged in collaborative type relations with all three groups of KIBS investigated. The empirical results are in line with Weigelt and Sarkar (2012) that firms with internal capabilities for problem-solving and evaluation (active and proactive hotels), are in a better position to assimilate knowledge about environmental

innovations from KIBS. Similarly the results confirm the argument of Grimshaw and Miozzo (2004) that clients with enhanced technical and managerial capabilities ('smart' clients) are more likely to gain out of their interaction with KIBS.

The thesis adds to research about KIBS-client relations and adaptability which has argued that service firms with capabilities for problem-solving have a higher absorptive capacity and are more likely to derive benefit from their relation with KIBS to enhance their adaptability (Weigelt and Sarkar, 2012). Hotels that are capable of complex problem-solving internally can use this experience in their interaction with the KIBS to implement energy efficiency measures. The relation of such active and proactive hotels with KIBS is considered to enhance their adaptability compared to cases of reactive hotels that are focussed on routine operational efficiency in their interaction with KIBS and on solving problems that they are already familiar with.

The above also contributes to a discussion on the role of intermediaries as not being restricted to that of a conduit or channel carrying information about energy efficiency measures; rather the intermediation space becomes a locus where different interpretations and meanings about environmental action are brought forward and where there are different capabilities for adoption. Thus intermediation activity and its outcomes are best understood by explicating the relational characteristics between the two actors that are shaping these exchanges and flows (Randles and Mander, 2011).

These patterns demonstrate that in contrast to earlier statements, intermediation does not always act as a catalyst speeding innovation (den Hertog and Bilderbeek, 1998; van Lente *et al*., 2003). Intermediation can slow down innovation when reactive hotels interact with traditional building services engineering firms that are concerned with implementing routine preventive maintenance operations. Intermediation may also be shaping and directing innovation adoption through the relations established between active and proactive hotels and innovative building services engineering firms and energy services consulting firms respectively. Here the hotels' ability to mobilize absorptive capacity with the KIBS is likely to drive the adoption of environmental measures, enhancing intermediation activity.

9.5 - Limitations and Areas for Future Research

9.5.1 - Generalizing the Research Results to Other Contexts

The research is based on a study of adaptation responses in hotels that provide an example of a traditional service sector. Although the research results are based on data collected from a single sector located in Malta, they could potentially have wider applications to low-tech sectors in similar contextual settings. These could include other types of tourism-related firms such as restaurants or other low-tech sectors such as retail; or to contexts where low-tech firms are likely to rely on similar capabilities and interact with similar types of intermediaries to adopt environmental innovations.

One consideration is the fact that a hotel represents an environment with a diversity of operational activities and facilities, including machinery operated in the plant-rooms, eateries and accommodation facilities; thus it is not a typical establishment, factory or office. This means that this study's results about energy efficiency adoption, account for different possible physical environments and spaces in which energy consumption may present similar problems including shops, or offices and plant-rooms that are likely to be present in other sectors.

Also generalizations about the relation of service firms with intermediaries and how this affects the innovation process can be made. The results from the study show that the type of adaptation response in the service firm is linked to how this manages its relations with external knowledge sources. Similar dynamics of interaction may be applicable to other low tech sectors that depend on external actors for obtaining specialist knowledge about environmental measures.

9.5.2 - Research Limitations

As discussed by several authors (e.g. Arnell and Delaney, 2006; Berkhout, 2012), firm responses to "environmental" stimuli are interwoven with other pressing issues such as economic and market signals. This makes it difficult to identify response strategies to individual stimuli; and means that 'environment' and energy in particular are understood in terms of their importance in relation to other external signals pressuring the industry.

At the same time however, it offers scope for understanding how firms cope with conventional drivers as well as emerging signals of change and presents a picture of the pressures and challenges that firms face up to and to which they build a response. In addition, during the fieldwork it became apparent that "energy efficiency" was grouped by the respondents with other environmental measures implemented in the hotels such as their waste management strategy, linen reuse policy etc. In other words 'energy efficiency' at times became a rather abstract concept to examine firm practices, and to be differentiated from other environmental measures implemented by the firms.

The study shows that service firms with a diverse combination of capabilities are more adaptable and more likely to implement environmental action. Whilst this in itself is an important contribution, it raises the issue of whether firms that are good at multitasking are deploying similar capabilities for other innovative activities other than for implementing environmental action. Nonetheless, the value of the approach used in this study is in the fact that it uses dynamic capabilities as being explanatory of a particular firm behaviour and modes of adaptability. These capabilities are dynamic in the sense that they help improve the firm's operational capabilities and make these more relevant to the needs of the firm at a particular moment in time (following Helfat and Peteraf, 2003). Thus they could equally be relevant for firms that are merely catching up with competitors and surviving and others that are gaining a competitive advantage from implementing environmental action. The suggestion is that these

capability combinations may be indicative of the firm's propensity to carry out innovative activity more generally though this aspect would require further investigation. Future research could assess how firms deploy similar capabilities for processes that support other types of innovations including service innovations.

9.5.3 - Areas for Further Research

The capabilities framework developed in this study can be applied more widely to investigate how firms in other traditional services implement environmental action. The framework could be used to develop indicators for a large scale quantitative survey to measure the multitasking potential of firms by identifying their internal capabilities to multitask and their absorptive capacity to source knowledge from KIBS or other types of external actors. Similarly the framework could be applied to study environmental action in the hotel sector across countries with a similar contextual setting to that present in Malta. This would allow for empirical comparisons across different national contexts or across similar traditional sectors in the same context that would contribute to the robustness of the framework.

The research has touched on some aspects through which firms build a multitasking potential; this has been discussed in relation to the organization of maintenance tasks and engagement in projects that go beyond the 'job' description. Further research could investigate the mechanisms through which multitasking is enabled in a firm i.e. how firms actually build a multitasking potential, such as through processes of recruitment of staff or staff training to mention a few examples. This would add further to explicating how firms nurture a multitasking potential through acquisition or deployment of resources. This approach could be valuable in explicating the propensity of services to undertake innovative activity more generally beyond implementing environmental action.

The question of whether the capabilities to multitask could apply equally in a high-tech sector would be interesting to investigate in the future since high-tech firms are assumed to have similar requirements for resources and knowledge needs when it comes to adopting environmental innovations and measures. Although the general approach could be applied more widely to these sectors, the particular framework may need modification, for example, to take into account of how high-tech firms organize innovative activity and build absorptive capacity to source external knowledge.

The empirical findings have indicated a link between the multitasking potential of hotels and their adaptability in relation to a particular behaviour which is that of implementing energy efficiency measures as a sub-set of environmental action. However there could equally be firms with a multitasking potential that are adapting to similar external challenges described in Chapter 2 by deploying capabilities elsewhere in order to find a fit with their external environment, for example by occupying niche tourism areas. Therefore in order to determine whether the capabilities for multitasking apply more widely to describe a firm's innovative potential, future research could investigate how multitasking firms may be adapting to similar

challenges by exhibiting different types of innovative behaviour in order to sustain a competitive advantage or perhaps merely to survive and catch up. This approach would throw light on the process of how firms prioritize capabilities across different activities and functions, and how these relate to strategic activities and performance. It would also strengthen the conceptual model built in this study and its application to analyze firm adaptability more generally, beyond the adoption of environmental action.

In order to address this aspect, future research could design a study amongst firms that are adopting environmental innovations and another group that does not exhibit an environmental responsive behaviour but is engaged in other types of innovations (such as service innovations). A longitudinal study amongst the top managers of both types of firms could generate valuable data on the relation between capabilities development, innovative activity and strategy and how these may change over time. It could also shed light on why firms with a multitasking potential and with particular combinations of capabilities may not be mobilizing these to adopt environmental innovations but may be channelling capabilities across other activities.

From the perspective of the KIBS, future work could look into the processes through which these firms develop capabilities to deliver new services related to energy management alongside their core portfolio of services such as through their interaction with other actors including suppliers and knowledge institutions and how they communicate knowledge about environmental technologies and practices in their interaction with the client.

9.6 - Implications for Policy and Practice

9.6.1 – Energy Efficiency Adoption in Traditional Service Firms

This study has contributed to unpacking the pattern of innovation in traditional services and the role of dynamic capabilities in the process. It has shown that innovation activity in traditional services is not linear. Firms exhibit different innovation patterns depending on their potential to multitask; this heterogeneous response is not often discussed or accounted for in the theory about innovation management and in practice.

The dynamic capabilities approach provides an avenue to explain differences in innovation behaviour that can be useful for practice not least because it throws light on those firm characteristics that are likely to distinguish responsive from adaptive behaviour in traditional firms. The findings offer insights into those aspects that managers need to focus their efforts on in order to enhance environmental action and shift towards achieving energy efficiency in their operations.

The study provides insights on how Maltese hotels can implement environmental action and shift towards adopting environmental technologies and practices. There are some practical lessons for hotel managers about how to nurture a multitasking environment in the firm and

create an environment where the staff is encouraged to take new initiatives that go beyond their day-to-day tasks. One practical recommendation is for the hotels to invest in a training programme for the technical staff that addresses novel aspects of engineering in such a way that the maintenance staff are kept abreast with developments in technologies that could significantly improve the performance of the hotel's operations (e.g. heating and ventilation systems). This knowledge could contribute to building a problem-solving capability and facilitate the implementation of environmental technologies. Another aspect relates to accessing new sources of funding, including applying for government subsidy schemes, and training related to managing such projects that often involve a significant bureaucratic load.

There could be scope for enhanced sharing of information and knowledge about environmental practices amongst hotels. Often the hotels in the study claimed to have insufficient time to attend meetings and exchange ideas and best practices with engineers and maintenance staff from other hotels. The study does identify an informal knowledge base about energy efficiency and environmental innovations circulating principally amongst active and proactive hotels; this is mainly tacit knowledge that is generated through learning-by-doing. A practical recommendation would be for the reactive hotels that are not normally engaged in this knowledge exchange process to organize site-visits to those hotels that are adopting environmental technologies and practices. Such site-visits could serve to transfer the tacit knowledge about problem-solving around energy efficiency that is not easily captured in manuals and would be addressed at solving particular problems that the hotels encounter when adopting such technologies.

There are also lessons to be drawn from the relation of hotels with KIBS in terms of how this can act as a locus for knowledge exchange about energy efficiency measures. The findings provide insight on how hotels can build absorptive capacity in their relation with the engineering consulting firms during routine preventive maintenance tasks and also in short-term projects such as hotel renovations. Hotels that build internal capabilities to solve problems around energy efficiency are equipped with a higher absorptive capacity and more likely to engage in collaborative interactions with engineering consulting firms that create the necessary spaces to discuss energy efficiency and involve knowledge exchange. This absorptive capacity could potentially have an impact on the service value chain and on the relation of hotels with other types of actors in the sector.

In turn, in order for the engineering consulting firms to take up a more "active" role as intermediaries in the adoption of energy efficiency, they need to create further opportunities to introduce environmental technologies and practices both during routine activities of preventive maintenance operations as well as in the pre-tender phase when designing a new construction development.

Although this is a study about the firm and offers a micro-level analysis of adaptation responses, it provides some insight to a discussion on transformation at the sector level. Transformation can be understood as a process leading to enduring and therefore long-term change of the

Maltese hotel sector along a path characterized ultimately by a more sustainable use of natural resources. In focusing on a traditional sector that is essentially located 'downstream' in the innovation chain, this study has addressed the issue of how incumbent firms innovate and adapt to the challenge of implementing environmental action.

According to the findings, environmental action is being spearheaded by a cluster of proactive firms that are taking initiatives to implement new environmental projects and are exploiting opportunities in the external environment in order to implement environmental action. These have an enhanced absorptive capacity to tap specialist knowledge about energy efficiency and environmental technologies through interaction with KIBS and also through the emergence of informal exchanges amongst active and proactive hotels that are adopting energy efficiency measures. The proactive hotels evidence adjustments in the way of managing and distributing maintenance practices and implementing new organisational structures. This could be representative of deeper change and adaptation compared to those hotels that go back to doing things the 'old' way as with reactive hotels. The fact that proactive firms include independent Maltese hotels amongst the multinational subsidiaries implies there is also potential for the 'indigenous' or native hotel business to adapt to the challenge of implementing environmental action.

A transformation in the macro-context of the hotel sector would involve hotels shifting from being reactive adapters to becoming proactive adapters. It would also require hotels to build an absorptive capacity in such a way that they increasingly exploit their relations with KIBS to source external knowledge about environment innovations and implement environmental action.

In light of the above, policies addressing access to specialist knowledge are more likely to have an impact on active and proactive firms by enhancing absorptive capacity; whilst reactive firms are more likely to benefit from policies aimed at building internal capabilities for energy management. These findings can inform policy that needs to identify a package of measures to increase the capabilities for energy management. These policy implications are discussed in the next section.

9.6.2 - Implications for Policy

The findings are consistent with recent policy evaluations of energy efficiency programmes (e.g. OECD/IEA, 2012; ODYSSEE-MURE, 2012) that a package of measures promoting the adoption of energy efficiency is more effective in influencing a firm's adaptive behaviour over policies based solely on financial incentives.

Direct subsidies and grants tend to promote the diffusion of prescribed technologies such as photovoltaic systems in Maltese hotels. Without debating on the effectiveness of such policies, this research endorses trends in energy efficiency evaluation programmes that financial measures may not reach the target consumer; rather they are supporting 'free-riding' customers that would invest anyway (WEC, 2008).

Hotels are shown not to possess the technical expertise to evaluate alternative technology options that best fit the requirements of the hotel property; thus there is no 'one size fits all' technology solution. One suggestion is that energy efficiency programmes benefit from funding channelled to developing protocols that evaluate a range of environmental innovations, in terms of the energy savings they accrue, and establish a list of validated technologies that firms, including hotels could implement. This means providing low-tech services with a guide of the best available technologies, validated and tested.

Another suggestion is for policy to shift from a focus on subsidizing environmental technologies to building capabilities for energy management in firms. As the OECD/IEA (2012) evaluation has demonstrated, capabilities-building measures are growing in importance in policy packages promoting the diffusion of energy efficiency. These policies would be designed to build capabilities to identify solutions that accrue long-term savings on energy consumption and significantly reduce operational costs. This is especially relevant for the reactive hotels with limited capabilities for problem-solving and with a low absorptive capacity to access specialist knowledge about energy efficiency measures. This approach is believed to favour responses that are high impact that is that result in a significant reduction in energy consumption over low impact measures.

Another important consideration is the informal knowledge about energy efficient practices arising amongst hotels and between hotels and KIBS. Policies may have to consider measures to capture this knowledge by creating more effective linkages between service firms themselves and between firms and external actors to promote knowledge transfer. This could occur through schemes promoting the mobility of technical staff amongst firms. In particular, the loan of technical staff from proactive adapters to reactive hotels could create a momentum for the reactive hotels to build the internal capabilities they would need to then mobilize their relations with external actors in order to adopt environmental action.

In order to benefit from specialist knowledge, hotels need to receive long-term support where the technical expert from an engineering consulting firm, becomes embedded for a time period in a hotel and works with the hotel maintenance manager to assist the hotel in evaluating technology options for the hotel property. Measures aimed at one-off interactions and solutions such as an energy audits scheme may bring short-term benefits of identifying opportunities for energy management; however the hotels are then left to adopt novel technologies without further assistance

References

AGARWAL R. & SELEN W. (2009) Dynamic Capability Building in Service Value Networks for Achieving Service Innovation *Decision Sciences*, Volume 40, Number 3 (August), pp. 431-475.

ALVESSON M., DAN KARREMAN D., STURDY A., & HANDLEY K. (2009) Unpacking the Client(s): Constructions, Positions and Client—Consultant Dynamics *Scandinavian Journal of Management*, Volume 25, pp. 253-263.

AMABILE T.M. (1996) Creativity and Innovation in Organizations *Harvard Business School* Volume 5 (January), pp. 1-15.

ARDICHVILI A., CARDOZO R., & RAY S. (2003) A Theory of Entrepreneurial Opportunity Identification and Development *Journal of Business Venturing*, Volume 18, pp. 105–123.

ARKSEY H. & KNIGHT P. (1999) *Interviewing for Social Scientists*, SAGE Publications London, Thousand Oaks.

ARNELL N.W. & DELANEY K.E. (2006) Adapting to Climate Change: Public Water Supply in England and Wales *Climatic Change*, Volume 78, pp. 227–255.

BAKER S., HUYTON J. & BRADLEY P. (2000) *Principles of Hotel Front Office Operations*, South-Western Cengage Learning Second Edition, Chapter 2, pp. 13-28.

BARNEY J. (1991) Firm Resources and Sustained Competitive Advantage *Journal of Management*, Volume 17, No.1, pp. 99-120.

BARRETO I. (2010) Dynamic Capabilities: A Review of Past Research and an Agenda for the Future *Journal of Management*, Volume 3, No. 1 (January), pp. 256-280.

BERG B.B. & LUNE H. (2012) Qualitative *Research Methods for the Social Sciences*, Eight Edition Pearson Education Inc., USA.

BERKHOUT F., HERTIN J. & GANN D.M. (2006) Learning to Adapt: Organizational Adaptation to Climate Change Impacts *Climatic Change*, Volume 78, pp.135-156.

BERKHOUT F. (2012) Adaptation to Climate Change *WIREs Climate Change*, Volume 3 (January/February), pp. 91-106.

BERKHOUT F. (2008) Innovation Theory and Socio-Technical Transitions in VAN DEN BERGH J.C.J.M. & BRUINSMA F.R. (eds.) *Managing the Transition to Renewable Energy*, Edward Elgar Publishers UK, Chapter 5, pp. 129-148.

BERRY L.L., CARBONE L.P. & HAECKEL S.H. (2002) Managing the Total Customer Experience *MIT Sloan Management Review*, (Spring), Volume 43, No. 3, pp. 1-7.

BESSANT J. & RUSH H. (1995) Building Bridges for Innovation: The Role of Consultants in Technology Transfer *Research Policy* Volume 24, pp. 97-114.

BEVERIDGE R. & GUY S. (2009) Governing through Translations: Intermediaries and the Mediation of the EU's Urban Waste Water Directive *Journal of Environmental Policy & Planning* Volume 2, No. 2 (June Issue), pp. 69-85.

BHAVE M.P. (1994) A Process Model of Entrepreneurial Venture Creation *Journal of Business Venturing* Volume 9, pp. 223-242.

BIRKINSHAW J., HAMEL G. & MOL M.J. (2008) Management Innovation *Academy of Management Review* Volume 33, No. 4, pp. 825–845.

BITNER M.J., OSTROM A. & MORGAN F. (2008) Service Blueprinting: a Practical Technique for Service Innovation *California Management Review* Volume 50, No. 3, pp. 66–94.

BLAIKIE N. (2000) *Designing Social Research: The Logic of Anticipation Polity* Press UK Chapter 4, pp. 85-126.

BLANKE J. & CHIESA T. (2011) The Travel & Tourism Competitiveness Index 2011: Assessing Industry Drivers in the Wake of the Crisis in BLANKE J. & CHIESA T. (eds) *The Travel & Tourism Competitiveness Report 2011: Beyond the Downturn* World Economic Forum, Switzerland, Chapter 1.1., pp.3-34.

BOELIE E. & WIECZOREK A. (2005) Transitions towards Sustainability through System Innovation *Technological Forecasting & Social Change* Volume 72, pp. 651–661.

BOELLA M.J. (1992) *Human Resource Management in the Hospitality Industry* Fifth Edition, Stanley Thornes Publishers Ltd., UK, Chapter 1, pp. 15-29; Chapter 21, pp. 256-270.

BOHDANOWICZ P., ZIENTARA P. & NOVOTNA E. (2011) International Hotel Chains and Environmental Protection: an Analysis of Hilton's We Care! Programme (Europe, 2006–2008) *Journal of Sustainable Tourism* Volume 19, Issue 7, pp. 797-816.

BOHDANOWICZ P. & MARTINAC I. (2002) Thermal Comfort and Energy Saving in the Hotel Industry, *Proceedings of the 15th Conference on Biometeorology and Aerobiology Joint with the 16th International Congress on Biometeorology*, October 27 – November 1, Kansas City, Missouri, USA.

BOHDANOWICZ P., CHURIE-KALLHAUGE A. & MARTINAC I. (2001) Energy Efficiency and Conservation in Hotels – Towards Sustainable Tourism *4th International Symposium on Asia Pacific Architecture* Hawaii (April), pp. 1-23.

BROWN J.S. & DUGUID P. (1991) Organizational Learning and Communities-of-Practice: Toward a Unified View of Working, Learning, and Innovation *Organization Science*, Volume 2, No. 1, Special Issue: Organizational Learning: Papers in Honor of (and by) James G. March, pp. 40-57.

CAO Q., DEDAJLOVIC E. & ZHANG H. (2009) Unpacking Organizational Ambidexterity: Dimensions, Contingencies, and Synergistic Effects *Organization Science* Volume 20, No. 4 (July–August), pp. 781–796.

CARLILE P.R. (2002) A Pragmatic View of Knowledge and Boundaries: Boundary Objects in New Product Development *Organization Science*, Volume 13, No. 4 (Jul-Aug), pp. 442-455.

CHAKRAVARTHY B.S. (1982) Adaptation: A Promising Metaphor for Strategic Management *The Academy of Management Review* Volume.7, No. 1 (January), pp. 35-44.

CHON K.S. & MAIER T. (2010) *Welcome to Hospitality: An Introduction* Third Edition Demar CenGAGE Publishers USA, Chapter 1, pp. 5-37.

CHOO C. W. (1999) The Art of Scanning the Environment *Bulletin of the American Society for Information Science* (February/March), pp. 21-24.

CHOSE (2001) *Energy Savings by Combined Heat Cooling and Power Plants in the Hotel Sector* Final Report (May), Commission of the European Communities, Directorate General for Energy, SAVE II Programme, pp. 1-128.

COATHUP D. C. (1999) Dominant Actors in International Tourism *International Journal of Contemporary Hospitality Management* Volume 11, No. 2/3, pp.69-72.

COHEN W.M. & LEVINTHAL D.A. (1990) Absorptive Capacity: A New Perspective on Learning and Innovation *Administrative Science Quarterly*, Volume 35, No. 1, Special Issue: Technology, Organizations, and Innovation (March), pp. 128-152.

COLLIS D.J. (1994) Research Note: How Valuable are Organizational Capabilities? *Strategic Management Journal* Volume 15, Special Issue: Competitive Organizational Behaviour (Winter), pp. 143-152.

CRESWELL J.W. (2007) *Qualitative Inquiry and Research Design: Choosing Among Five Approaches* Second Edition, SAGE Publications, USA.

DAFT R.L. & WEICK K.E. (1984) Toward a Model of Organizations as Interpretation Systems *The Academy of Management Review* Volume 9, No. 2 (April), pp. 284-295.

DALTON G.J., LOCKINGTON D.A. & BALDOCK T.E. (2008) A Survey of Tourist Attitudes to Renewable Energy Supply in Australian Hotel Accommodation *Renewable Energy* Volume 33, pp. 2174–2185.

DAMANPOUR F. (1991) Organizational Innovation: A Meta-Analysis of Effects of Determinants and Moderators *The Academy of Management Journal* Volume 34, No. 3 (September), pp. 555-590.

DAY G. (1994) The Capabilities of Market-driven Organisations *The Journal of Marketing* Volume 58, No. 4 pp. 37-52.

DE VAUS D. (2001) *Research Design in Social Research* SAGE Publications, UK.

DEL BRIO J.A., FERNANDEZ E. & JUNQUERA B. (2007) Management and Employee Involvement in Achieving an Environmental Action-based Competitive Advantage: an Empirical Study *International Journal of Human Resource Management* Volume 18, No. 4 (April), pp. 491–522.

DEN HERTOG P., GALLOUJ F., & SEGERS J. (2011) Measuring Innovation in a 'Low-Tech' Service Industry: The Case of the Dutch Hospitality Industry *The Service Industries Journal* Volume 31, No. 9, pp. 1429-1449.

DEN HERTOG P., VAN DER AA W. & DE JONG M.W. (2010) Capabilities for Managing Service Innovation: towards a Conceptual Framework *Journal of Service Management* Volume 21, No. 4, pp. 490-514.

DEN HERTOG P. & BILDERBEEK R. (1998) Conceptualizing (Service) Innovation and the Knowledge Flow between KIBS and their Clients *A Report from the Project 'Services In Innovation, Innovation In Services – Services in European Innovation Systems (SI4S)*', funded by the European Commission, through the Targeted Socio-Economic Research Programme (TSER), within Area I: Evaluation of Science and Technology Policy Options in Europe, Topic Paper No. 11.

DEN HERTOG P. (2010a) Managing the Soft Side of Innovation: How do Practitioners, Researchers and Policymakers Deal with Service Innovation in SMITS R.E., KULHMANN S. & SHAPIRA P. (eds.) The *Theory and Practice of Innovation Policy: An International Research Handbook* PRIME Series on Research and Innovation Policy in Europe Edward Elgar UK, Chapter 13, pp. 303-331.

DEN HERTOG P. (2010b) *Managing Service Innovation: Firm-level Dynamic Capabilities and Policy Options*, PhD Thesis, Dialogic Innovatie & Interactie, Utrecht, pp.1-320.

DEN HERTOG P. (2000) Knowledge Intensive Business Services as Co-producers of Innovation *International Journal of Innovation Management* Volume 4, No. 4 (December) pp. 491–528.

DENSCOMBE M. (1998) The *Good Research Guide for Small-scale Social Research Projects* Open University Press USA, Chapter 1, pp. 6-29.

DEY I. (1993) *Qualitative Data Analysis: A User-Friendly Guide for Social Scientists* Routledge UK.

DODDS R. & KELMAN E. (2008) How Climate Change is Considered in Sustainable Tourism Policies: A Case of the Mediterranean Islands of Malta and Mallorca *Tourism Review International* Volume 12, pp. 57-70.

DODDS, R. (2007) Malta's Tourism Policy: Standing Still or Advancing towards Sustainability? *Island Studies Journal* Volume 2 No. 1, pp. 47-66.

DOSI G., NELSON R.R. & WINTER S.G. (2000) Introduction: The Nature and Dynamics of Organizational Capabilities in DOSI G., NELSON R.R. & WINTER S.G. (eds.) *The Nature and Dynamics of Organizational Capabilities* Oxford University Press, USA, Chapter 1, pp. 1-22.

DUTTON J.E. & JACKSON S.E. (1987) Categorizing Strategic Issues: Links to Organizational Action *The Academy of Management Review* Volume 12, No. 1 (January), pp. 76-90.

DYER J.H. & SINGH H. (1998) The Relational View: Cooperative Strategy and Sources of Inter-organizational Competitive Advantage *The Academy of Management Review* Volume 23, No. 4 (October), pp. 660-679.

EASTERBY-SMITH M., THORPE R. & LOWE A. (1991) *Management Research: An Introduction* SAGE Publications UK, Chapter 3, pp. 21-43.

EASTON G. (2010) Critical Realism in Case Study Research *Industrial Marketing Management* Volume 39, pp. 118-128.

EISENHARDT K.M., FURR N.R. & BINGHAM C.B. (2010) Microfoundations of Performance: Balancing Efficiency and Flexibility in Dynamic Environments *Organization Science* Volume 21, No. 6, (November–December), pp. 1263–1273.

EISENHARDT K.M. & MARTIN J.A. (2000) Dynamic Capabilities: What are They? *Strategic Management Journal* Volume 21, pp. 1105-1121.

EISENHARDT K.M. (1989) Building Theories from Case Study Research *The Academy of Management Review* Volume 14, No. 4 (October), pp. 532-550.

ELLUL A. (2008). *Promoting Sustainable Tourism: National Study for Malta, Mediterranean Strategy for Sustainable Development Report* for the Plan Bleu Regional Activity Centre Sophia Antipolis (June), pp 1-32.

EUROPEAN COMMISSION – DIRECTORATE GENERAL ENVIRONMENT (2006) *Study on Eco-industry, its Size, Employment, Perspectives and Barriers to Growth in an Enlarged EU* Final report (September), pp. 1-347.

EUROPEAN UNION DIRECTIVE 2010/31/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 19 May 2010 on the Energy Performance of Buildings (recast), *OJ* L153/13.

EUROPEAN UNION DIRECTIVE 2010/30/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 19 May 2010 on the 'Indication by Labelling and Standard Product Information of the Consumption of Energy and other Resources by Energy-Related Products', (recast) *OJ* L153/1.

EUROSTAT (2009) *Malta Energy Mix Fact Sheet* prepared for the ASEM Ministerial Conference on Energy Security Brussels, 18th June 2009.

EUROSTAT (2005) *The Measurement of Scientific and Technological Activities – Proposed Guidelines for Collecting and Interpreting Technological Innovation Data Oslo Manual*, European Commission 2005.

FANKHOUSER S., SMITH J.B. & TOL R.S.J. (1999) Weathering Climate Change: Some Simple Rules to Guide Adaptation Decisions *Ecological Economics* Volume 30, pp. 67–78.

FLEITER T., HIRZEL S., & WORRELL E. (2012) The Characteristics of Energy-Efficiency Measures– A Neglected Dimension *Energy Policy* Volume 51, pp. 502–513.

FLORIDA R. & ATLAS M. (2001) What Makes Companies Green? Organizational and Geographic Factors in the Adoption of Environmental Practices *Economic Geography* Volume 77 No. 3 (July) pp. 209-224.

FOXON J. (2011) A Co-Evolutionary Framework for Analyzing a Transition to a Sustainable Low Carbon Economy *Ecological Economics* Volume 70, pp. 2258-2267.

GALLOUJ F. & TOIVONEN M. (2011) Elaborating the Characteristics-Based Approach to Service Innovation: Making the Service Process Visible *Journal of Innovation Economics* Volume 2, No. 8, p. 33-58.

GALLOUJ F. & SAVONA M. (2009) Innovation in Services: a Review of the Debate and a Research Agenda *Journal of Evolutionary Economics* Volume 19, pp.149–172.

GALLOUJ F. & WEINSTEIN (1997) Innovation in Services *Research Policy* Volume 26, Issues 4-5 (December), pp. 537-556.

GALLOUJ F. (2002) *Innovation in the Service Economy: the New Wealth of Nations* Edward Elgar, Cheltenham, UK, Chapter 2, pp 28-69.

GALLOUJ F. (2000) Beyond Technological Innovation: Trajectories and Varieties of Services Innovation in BODEN M & MILES I. (eds.) *Services and the Knowledge-Based Economy* Continuum Publishers UK, Chapter 7, pp. 127-145.

GEELS F. W. & SCHOT J. (2007) Typology of Sociotechnical Transition Pathways *Research Policy* Volume 36, pp 399-417.

GEELS F.W. (2011) The Multi-level Perspective on Sustainability Transitions: Responses to Seven Criticisms *Environmental Innovation and Societal Transitions* Volume 1, pp. 24-40.

GEELS, F. W. (2002) Technological Transitions as Evolutionary Configuration Processes: a Multi-level Perspective and a Case Study *Research Policy* Volume 31, pp. 1257-1274.

GHINA F. (2003) Sustainable Development in Small Island Developing States: The Case of the Maldives *Environment, Development and Sustainability* Volume 5, Nos. 1-2, pp. 139–165.

GLUSHKO R.J. & LINDSAY T. (2009) Designing Service Systems by Bridging the “Front stage” and “Back stage” *Information Systems and e-Business Management* September 2009, Volume 7, Issue 4, pp. 407-427.

GOLDSTEIN S.M., JOHSTON R., DUFFY J., & RAO J. (2002) The Service Concept: The Missing Link in Service Design Research? *Journal of Operations Management* Volume 20, pp.121-134.

GREEN K. & RANDLES S. (2006) At the Interface of Innovation Studies and Industrial Ecology in GREEN K. & RANDLES S. (eds.) *Industrial Ecology and Spaces of Innovation* Edward Elgar UK, Chapter 1, pp. 3-27.

GREEN K., MORTON B., & NEW S. (2000) Greening Organizations: Purchasing, Consumption, and Innovation *Organization & Environment* Volume 13, No. 2 (June), pp. 206-225.

GRIMSHAW D. & MIOZZO M. (2004) High-Tech Business Services and Innovation in Germany and the UK: The Case of IT Outsourcing *Anglo-German Foundation for the Study of Industrial Society* (June), pp. 1-50.

HALL M.C. (2009) Tourism Firm Innovation and Sustainability in GÖSSLING S., HALL C.M. & WEAER D.B. (eds.) *Sustainable Tourism Futures: Perspectives on Systems, Restructuring and Innovations* Routledge Taylor & Francis UK, Chapter 15, pp. 282-298.

HARGADON A.B. (2002) ‘Brokering Knowledge: Linking Learning and Innovation’ Research in *Organisational Behaviour* Vol. 24, pp. 41-85.

HARKER M.J. (1999) Relationship Marketing Defined? An Examination of Current Relationship Marketing Definitions *Marketing Intelligence & Planning* Volume 17/1, pp 13–20.

HART S.L. (1995) A Natural-Resource-Based View of the Firm *The Academy of Management Review* Volume 20, No. 4 (October), pp. 986-1014.

HELFAT C.E. & PETERAF M.A. (2009) Understanding Dynamic Capabilities: Progress along a Developmental Path *Strategic Organization* Volume 7, No. 1, pp. 91–102.

HELFAT C.E. & PETERAF M.A. (2003) The Dynamic Resource-Based View: Capability Lifecycles *Strategic Management Journal* Volume 24, pp. 997-1010.

HELLMANN T. & THIELE V. (2011) Incentives and Innovation: A Multi-tasking Approach *American Economic Journal: Microeconomics* Volume 3, No. 1 (February), pp. 78-128.

HERRING H. (2006) Energy Efficiency—a Critical View *Energy* Volume 31, pp. 10–20.

HERTIN J., BERKHOUT F., GANN D. & BARLOW J. (2003) Climate Change and the UK House Building Sector: Perceptions, Impacts *Building Research & Information* Volume 31(3–4), pp. 278–290.

HIRSCH-KREINSEN H., JACOBSON D. & ROBERTSON P.L. (2006) 'Low-tech' Industries: Innovativeness and Development Perspectives—A Summary of a European Research Project *Prometheus* Volume 24, No. 1 (March), pp. 1-20.

HIRSCH-KREINSEN H. (2008) "Low-Tech" Innovations *Industry and Innovation* Volume 15, No.1, pp. 19-43.

HISLOP D. (2002) The Client Role in Consultancy Relations during the Appropriation of Technological Innovations *Research Policy* 31, pp. 657-671.

HJALAGER A.M. (2010) A review of Innovation Research in Tourism *Tourism Management* Volume 31, pp.1–12.

HOFFMANN V.H., SPRENGEL D.C., ZIEGLER A., KOLB M. & ABEGG B. (2009) Determinants of Corporate Adaptation to Climate Change in Winter Tourism: An Econometric Analysis *Global Environmental Change* Volume 19, pp. 256–264.

HOFFMAN A.J. (2001) Linking Organizational and Field-Level Analyses: The Diffusion of Corporate Environmental Practice *Organization & Environment* Volume 14 No. 2, (June), pp. 133-156.

HOLMSTROM B. & MILGROM P. (1991) Multitask Principal-Agent Analyses: Incentive Contracts, Asset Ownership, and Job Design *Journal of Law, Economics, & Organization* Volume 7, Special Issue: Papers from the Conference on the New Science of Organization (January) pp. 24-52.

HOOPES D.G., MADSEN T.L. & WALKER G. (2003) Guest Editors' Introduction the special Issue: Why is there a Resource-Based View? Toward a Theory of Competitive Heterogeneity *Strategic Management Journal* Volume 24, pp. 889–902.

HOTEL ENERGY SOLUTIONS (2011a) *Key Energy Efficiency Solutions for SME Hotels, Hotel Energy Solutions* Hotel Energy Solutions Project Publications, pp 1-41.

HOTEL ENERGY SOLUTIONS (2011b), *Analysis on Energy Use by European Hotels: Online Survey and Desk Research* Hotel Energy Solutions Project Publications, pp 1-48.

HOWELLS J. (2006) Intermediation and the Role of Intermediaries in Innovation *Research Policy* 35, pp. 715-728.

HREBINIAK L.G. & JOYCE W.F. (1985) Organisational Adaptation: Strategic Choice and Environmental Determinism *Administrative Science Quarterly* Volume 30 No. 3 (September), pp. 336-349.

ISMAIL A. (2001) *Front Office Operations and Management* Delmar Thomson Learning Chapter 5, pp. 95-133.

ITRE (2010) *Overview of Energy Efficiency Measures of European Industry* European Parliament Directorate General for Internal Policies, Policy Department A: Economic and Scientific Policy Industry Research & Energy, pp. 1-51.

IPCC (2007) *Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Summary for Policymakers*, pp. 1-104 Accessed on 12th November 2012 at: http://www.ipcc.ch/publications_and_data/ar4/syr/en/contents.html

JACOB M., FLEITER T., CATENAZZI G., HIRZEL S., REITZE F. & TORO F. (2012) The Impact of Policy Measures on the Electricity Demand of the Tertiary Sector of the European Countries: An Analysis with the Bottom-up Model FORECAST *Improving Energy Efficiency in Commercial Building Conference (IEECB'12)* Frankfurt 18th-19th April 2012, pp. 1-17.

JIMENEZ B., ANGELOV B. & RAO B. (2010) Service Absorptive Capacity: Its Evolution and Implications for Innovation Technology Management for Global Economic Growth *Proceedings of PICMET Portland International Centre for Management of Engineering & Technology Conference*, Phuket Thailand, pp 1-13.

JOHNSTON R. & KONG X. (2011) The Customer Experience: A Road Map for Improvement *Managing Service Quality* Volume 21, Issue 1, pp. 5-24.

JOINT RESEARCH CENTRE (2012) *Reference Document on Best Environmental Management Practice in the Tourism Sector Final Draft* (June), Institute for Prospective Technological Studies, Sustainable Production and Consumption Unit, European Commission, pp. 1-689.

KARAGIORGAS M., TSOUTSOS T., DROSOU V., POUFFARY S., PAGANO T., GERMÁN-LOPEZ L. & MELIM-MENDES J.M. (2006) HOTRES: Renewable Energies in the Hotels. An extensive Technical Tool for the Hotel Industry *Renewable and Sustainable Energy Reviews* Volume 10, Issue 3, pp. 198-224.

KEMP R. & VOLPI M. (2008) The Diffusion of Clean Technologies: A Review with Suggestions for Future Diffusion Analysis *Journal of Cleaner Production* Volume 16S1, pp. 14-21.

KEMP R. & PEARSON P. (2007) *Final Report MEI Project about Measuring Eco-Innovation Project* OECD, pp. 1-120.

KESIDOU E. & DEMIREL P. (2012) On the Drivers of Eco-Innovations: Empirical evidence from the UK *Research Policy* Volume 41, pp. 862-870.

KINDSTRÖM D., KOWALKOWSKI C. & SANDBERG E. (2012) Enabling Service Innovation: A Dynamic Capabilities Approach *Journal of Business Research* Volume 66, Issue 8, pp. 1063-1073.

KLERKS L. & LEEUWIS C. (2008) Balancing Multiple Interests: Embedding Innovation Intermediation in the Agricultural Knowledge Infrastructure *Technovation* Vol. 28 pp. 364-378.

KOHLER M., FELDMANN N., HABRYN F., & SATZGER G. (2013) Service Innovation Analytics: Towards Assessment and Monitoring of Innovation Capabilities in Service Firms 46th *Hawaii International Conference on System Sciences*, 7-10th January, pp.1347-1356.

KVALE S. (1996) *An Introduction to Qualitative Research Interviewing* SAGE Publications, Inc., Thousand Oaks, London.

LANE P.J., KOKA B.R. & PATHAK S. (2006) The Reification of Absorptive Capacity: A Critical Review and Rejuvenation of the Construct *Academy of Management Review* Volume 31, No. 4, pp. 833–863.

LANE P.J. & LUBATKIN M. (1998) Relative Absorptive Capacity and Interorganizational Learning *Strategic Management Journal,* Volume 19, pp. 461–477.

LARSEN J. L. (2000) Supplier-User Interaction in Knowledge-Intensive Business Services: Types of Expertise and Modes of Organisation in MILES I. and BODEN M. (eds.) *Services and the Knowledge-Based Economy* Continuum Publishers London, pp. 146-154.

LATOUR B. (2005) *Reassembling the Social: An Introduction to Actor-Network-Theory* Oxford University Press, UK.

LEONARDO ENERGY (2008*) Power Quality and Utilization Guide - Hotels* (November), pp. 1-21, accessed 15th November 2012 at: http://www.leonardo-energy.org/hotels.

LEVITT B. & MARCH J.G. (1988) Organizational Learning *Annual Review of Sociology* Volume 14, pp. 319-340.

LOCKHART D. J. (1997) We Promise You a Warm Welcome: Tourism to Malta since the 1960s *GeoJournal* Volume 41, No.2, pp. 145-152.

LOORBACH D., VAN BAKEL J.C., WHITEMAN G. & ROTMANS J. (2010) Business Strategies for Transitions: Towards Sustainable Systems *Business Strategy and the Environment* Volume 19, pp 133-146.

LOORBACH D. & ROTMANS J. (2006) Managing Transitions for Sustainable Development in OLSHOORN X., & WIECZOREK A.J. (eds.) *Understanding Industrial Transformation: Views from Different Disciplines* Springer Publishers, The Netherlands, Chapter 10, pp. 187-206.

MALTA CLIMATE CHANGE COMMITTEE FOR ADAPTATION (2010) *National Climate Change Adaptation Strategy* Climate Change Committee for Adaptation, Malta Consultation Report (November), pp. 1-165.

MALTA ENTERPRISE (2011) *Energy Efficiency Measure for the Hospitality Sector Incentive Guidelines* published 5th May 2011, pp. 1-12.
http://www.maltaenterprise.com/sites/default/files/support_measures/energy_efficiency_-_hospitality_guidelines.pdf

MALTA ENTERPRISE (2010) *Interest Rate Subsidy Scheme for the Refurbishment of Hotels, Accommodation Facilities and Restaurants Accommodation Establishments & Restaurants Incentive Guidelines* (October) accessed 10th September 2012 at:
http://www.maltaenterprise.com/sites/default/files/support_measures/irss_hotels-guidelines-v1.pdf

MALTA MINISTRY FOR RESOURCES & RURAL AFFAIRS (2009) *A Proposal for an Energy Policy for Malta*, pp.1-62.

MALTA MINISTRY FOR TOURISM, CULTURE & ENVIRONMENT (2012) *Tourism Policy for the Maltese Islands 2012-2016,* Malta Government Press, pp. 1-124.

MALTA MINISTRY FOR TOURISM, CULTURE & ENVIRONMENT (2011) *Tourism Policy for the Maltese Islands 2007-2011*, Malta Government Press, pp. 1-82.

MALTA MINISTRY OF TOURISM (2000) *Carrying Capacity Assessment for Tourism in the Maltese Islands: Tourism Development Policies 2000-2010*, pp. 38.

MARKARD J., RAVEN R. & TRUFFER B. (2012) Sustainability Transitions: An Emerging Field of Research and its Prospects *Research Policy* Volume 41, pp. 955-967

MARTINEZ-ROS E. & ORFILA-SINTES F. (2009) Innovation Activity in the Hotel Industry *Technovation* Volume 29, Issue 9 (September), pp. 632–641.

MC EVILY S.K., EISENHARDT K.M. & PRESCOTT J.E. (2004) The Global Acquisition, Leverage and Protection of Technological Competencies *Strategic Management Journal* Volume 25 No.s 8-9 (August–September) Special Issue**,** pp. 713–722.

MEDLIK S. (1980) *The Business of Hotels* Heinemann Publishers, UK, Chapter 7, pp. 71-83.

METTES (2008) Environmental Technologies Regional Demand Profile for Malta: Focus on Energy Efficiency and Renewables *METTES Project – More Efficient Transnational Technology Transfer in the Environmental Sector Final Draft Report* (August), pp. 1-63.

MILES I., KASTRINOS N., FLANAGAN K., BILDERBEEK R., DEN HERTOG P., HUNTINK W. & BOUMAN M. (1995) *Knowledge Intensive Business Services: Users, Carriers, and Sources of Innovation* Report to DG13 SPRINT EIMS.

MILES M.B. & HUBERMAN M.A. (1984) *Qualitative Data Analysis: A Sourcebook of New Methods* Sage Publications USA.

MILES R.E., SNOW C.C., MEYER A.D. & COLEMAN H.J. (1978) Organizational Strategy, Structure and Process *The Academy of Management Review* Volume 3, No. 3 (July), pp. 546-562.

MILES I. (2012) KIBS and Knowledge Dynamics in Client-Supplier Interaction in DI MARIA E., GRANDINETTI R. & DI BERNARDO B., (eds.) *Exploring Knowledge Intensive Business Services: Knowledge Management Strategies* Palgrave Macmillan Basingstoke, UK, Chapter 1, pp. 20-51.

MILES I. (2008) Patterns of Innovation in Service Industries *IBM Systems Journal* Volume 47, No.1, pp. 115-128.

MILES I. (2005) Services and the Knowledge-Based Economy in TIDD J. & HULL F.N. (eds.) *Service Innovation: Organizational Responses to Technological Opportunities & Market Imperatives* Imperial College Press, UK, Chapter 4, pp 81-112.

MILES I. (2003) *Knowledge Intensive Services' Suppliers and Clients A Report prepared for the Ministry of Trade and Industry Finland*, Studies and Reports No. 15/2003, pp. 1-83.

MILES I. (1997) Environmental Services and European Regulation Paper presented at *Europeanisation and the Regulation of Risk, Science Policy Support Group European Context of UK Science User Conference* at the London School of Economics, London, 27th March.

MIOZZO M. & GRIMSHAW D. (2011) Capabilities of Large Services Outsourcing Firms: the "Outsourcing Plus Staff Transfer Model" in *EDS and IBM Industrial and Corporate Change* Volume 20, No. 3, pp. 909–940.

MOLINA-AZORÍN J.F., CLAVER-CORTÉS E., PEREIRA-MOLINER J. & TARÍ J.J. (2009) Environmental Practices and Firm Performance: An Empirical Analysis in the Spanish Hotel Industry *Journal of Cleaner Production* Volume 17, pp. 516–524.

MOSS T., MEDD W., GUY S., & MARVIN S. (2009) Organising Water: The Hidden Role of Intermediary Work *Water Alternatives* Volume 2, No. , pp. 16-33.

MOSS T. (2011) Intermediaries and the Governance of Urban Infrastructures in Transition in GUY, S., MARVIN, S., MEDD, W., & MOSS, T., (eds.) *Shaping Urban Infrastructures: Intermediaries and the Governance of Socio-technical Networks* London: Earthscan Ltd, Chapter 2, pp 17-35.

MULLER E. & DOLOREUX D. (2009) What We Should Know about Knowledge-Intensive Business Services *Technology in Society* Volume 31, pp. 64-72.

MULLER E. & ZENKER A. (2001) Business Services as Actors of Knowledge Transformation: the Role of KIBS in Regional and National Innovation Systems *Research Policy* 30, pp. 1501-1516.

NADKARNI S. & BARR P.S. (2008) Environmental Context, Managerial Cognition, and Strategic Action: An Integrated View *Strategic Management Journal* Volume 29, Issue 13 (December), pp. 1395–1427.

NELSON D.R., ADGER N. & BROWN K. (2007) Adaptation to Environmental Change: Contributions of a Resilience Framework *Annual Review of Environment & Resources* Volume 32, pp. 395–419.

NOOTEBOOM B. & WENT R. (2008) Innovation and Organization in NOOTEBOOM B. & STAM E. (eds.) *Microfoundations for Innovation Policy* Amsterdam University Press, Amsterdam, Chapter 8, pp. 219-248.

NOOTEBOOM B. (2000) Learning by Interaction: Absorptive Capacity, Cognitive Distance and Governance *Journal of Management and Governance* Volume 4, pp. 69-92.

NSO (2012) *Energy Consumption in Malta 2000-2011* National Statistics Office News Release No. 195 published 10th October 2012, pp. 1-5.

ODYSSEE-MURE (2012) *Energy Efficiency Policies in Industry: Lessons Learned from the Project* ADEME Editions, Paris Draft (September), pp. 1-51.

OECD/IEA (2012) *Progress Implementing the IEA 25 Energy Efficiency Policy Recommendations - 2011 Evaluation* International Energy Agency Insights Series, pp. 1-130.

OECD (2006) *Innovation and Knowledge Intensive Service Activities* pp. 1-182.

OECD (2002) *Proposed Standard Practice for Surveys on Research and Experimental Development (Frascati Manual)*, Paris, pp. 1-254.

OECD (1999) *The Environmental Goods and Services Industry: Manual for Data Collection and Analysis* Paris, pp. 1-64.

O'REILLY C.A. & TUSHMAN (2007) Ambidexterity as a Dynamic Capability: Resolving the Innovator's Dilemma *Stanford University Graduate School of Business Research Paper* No. 1963 (March), pp. 1-61.

ORFILA-SINTES F. & MATTSSON J. (2009) Innovation Behaviour in the Hotel Industry *Omega* Volume 37, pp. 380-394.

OTTENBACHER M. & GNOTH J. (2005) How to Develop Successful Hospitality Innovation *Cornell Hotel and Restaurant Administration Quarterly* Volume 46, No. 205, pp. 205-222.

PANAYIDES P.M. and SO M. (2005) Logistics Service Provider–Client Relationships *Transportation Research* Part E Volume 41, pp 179–200.

PAVITT K. (1984) Sectoral Patterns of Technical Change: Towards a Taxonomy and a Theory *Research Policy* Volume 13, pp. 342-373.

PINKSE J. & DOMMISSE M. (2009) Overcoming Barriers to Sustainability: An Explanation of Residential Builders' Reluctance to Adopt Clean Technologies *Business Strategy and the Environment* Volume 18, pp. 515-527.

PITTAWAY L., ROBERTSON M., MUNIR K., DENYER D. & NEELY A. (2004) Networking and Innovation: A Systematic Review of the Evidence *International Journal of Management Reviews* Volume 5/6, Issue 3&4, pp. 137–168.

POPPELBUS J., PLATTFAUT R., ORTBACH K. & MALSBENDER A. (2011) Service Innovation Capability: Proposing a New Framework *Proceedings of the Federated Conference on Computer Science and Information Systems* pp. 545–551.

POST J.E. & ALTMAN B.W. (1994) Managing the Environment Change Process: Barriers and Opportunities *Journal of Organizational Change Management* Volume 7, Issue. 4, pp. 64–81.

POTTERS L. (2009) R&D in Low-Tech Sectors *IPTS Working Paper on Corporate R&D and Innovation* No. 08/2009, pp. 1-18.

PPCD (2007) *Operational Programme I - Cohesion Policy 2007-2013 Investing in Competitiveness for a Better Quality of Life*, Planning & Priorities Coordination Department, Office of the Prime Minister (June), pp. 1-189.

RAMUS C. (2002) Encouraging Innovative Environmental Actions: What Companies and Managers Must Do *Journal of World Business* Volume 37, pp. 151-164.

RANDLES, S. & MANDER, S. (2011) Mobility, Markets and 'Hidden' Intermediation: Aviation and Frequent Flying in Guy, S., Marvin, S., Medd, W., & Moss, T., (eds.) *Shaping Urban Infrastructures: Intermediaries and the Governance of Socio-technical Networks* London: Earthscan Ltd., Chapter 8, pp 124-137.

RANDLES, S. & TETHER B. (2002) Services, Scale and Structures of Internationalization: Northwest England's Environmental Technology Firms in Miozzo M. & Miles I. (eds.) *Internationalization, Technology & Services* Edward Elgar UK, Chapter 10, pp. 227-254.

REID A. & MIEDZINSKI M. (2008) *Eco-Innovation: Final Report for Sectoral Innovation Watch Europe Innova Sectoral Innovation Watch Project* (May), Technopolis Group, pp. 1-96.

ROGERS E. M. (2003) *Diffusion of Innovations* Fifth Edition Free Press New York Chapter 9, pp. 365-401.

RENNINGS K. (2000) Redefining Innovation: Eco-innovation Research and the Contribution from Ecological Economics *Ecological Economics* Volume 32, pp. 319–332.

ROUSSEAU P. L. & WACHTEL P. (1998) Financial Intermediation and Economic Performance: Historical Evidence from Five Industrialized Countries *Journal of Money, Credit and Banking*, Volume 30, No. 4 (November), pp. 657-678.

RUBALCABA L., GALLEGO J., HIPP C. & GOTSCH M. (2010) *Organizational Innovation in Services Final Report* European Commission Directorate General Enterprise & Industry, Europe Innova Sectoral Innovation Task 4 Horizontal Report 2 (February) pp. 1-47.

SALTER A. & TETHER B.S. (2006) Innovation in Services Through the Looking Glass of Innovation Studies *Background Paper for Advanced Institute of Management (AIM) Research's Grand Challenge on Service Science* (April), pp. 1-38.

SAMBAMURTHY V., BHARADWAJ A. & GROVER V. (2003) Shaping Agility through Digital Options: Reconceptualizing the Role of Information Technology in Contemporary Firms *MIS Quarterly* Volume 27, No. 2 (June), pp. 237–263.

SANDBERG P. & SODERSTRØM M. (2003) Industrial Energy Efficiency: the Need for Investment Decision Support from a Manager Perspective *Energy Policy* Volume 31, pp. 1623-1634.

SAYER A. (1992) *Method in Social Science: A Realist Approach* Routledge London.

SCHEIN E.H. (1997) The Concept of "Client" from a Process Consultation Perspective: A Guide for Change Agents *Journal of Organizational Change Management,* Volume 10 No. 3, 1997, pp. 202-216.

SCHLEICH J. & GRUBER E. (2008) Beyond Case Studies: Barriers to Energy Efficiency in Commerce and Service Sectors *Energy Economics* Volume 30, pp. 449-464.

SHARMA S. and VREDENBURG H. (1998) Proactive Corporate Environmental Strategy and the Development of Competitively Valuable Organizational Capabilities *Strategic Management Journal* Volume 19, pp 729-753.

SHARMA S. (2000) Managerial Interpretations and Organizational Context as Predictors of Corporate Choice of Environmental Strategy *The Academy of Management Journal* Volume 43, No. 4 (August), pp. 681-697.

SIEBENHŰNER B. & ARNOLD M. (2007) Organizational Learning to Manage Sustainable Development *Business Strategy and the Environment* Volume 16, pp. 339–353.

SMIT B., & WANDEL J. (2006) Adaptation, Adaptive Capacity and Vulnerability *Global Environmental Change* Volume 16, pp. 282-292.

SMIT, B., BURTON I., KLEIN R. & WANDEL J. (2000) An Anatomy of Adaptation to Climate Change and Variability *Climatic Change* Volume 45, pp 223–251.

STRAMBACH S. (2008) Knowledge-Intensive Business Services (KIBS) as Drivers of Multi-level Knowledge Dynamics *International Journal of Services Technology & Management,* Volume 10 Nos. 2/3/4, pp. 152-171.

STURDY A. and WRIGHT C. (2011) The Active Client: The Boundary-Spanning Roles of Internal Consultants as Gatekeepers, Brokers and Partners of their External Counterparts *Management Learning*, (November) Volume 42, No. 5, pp. 485-503.

SUNDBO J. (2011) User-Employee Encounter Based Service Innovation and Blocking of Innovation Processes *ICE-Project Working Paper, Department of Communication, Business and Information Technologies*, Roskilde University Center for Communication, Media and Information Technologies, Aalborg University, pp. 1-23.

SUNDBO, J. (2010) The Toilsome Path of Service Innovation: the Effect of the Law of Low Human Multi-Task Capability, in GALLOUJ F. and DJELLAL F. (eds.) *The Handbook of Innovation and Services: A Multi-Disciplinary Perspective*, Edward Elgar UK, Chapter 12, pp. 279 – 300.

TEECE D. J., PISANO G. & SHUEN A. (1997) Dynamic Capabilities and Strategic Management *Strategic Management Journal* Volume 18, No. 7, pp. 509-533.

TEECE D. J. (2007) Explicating Dynamic Capabilities: The Nature and Microfoundations of (Sustainable) Enterprise Performance *Strategic Management Journal* Volume 28 pp. 1319-1350.

TETHER B. & HOWELLS J. (2007) Changing Understanding of Innovation in Services: From Technological Adoption to Complex Complementary Changes to Technologies, Skills and Organization in *Department of Trade & Industry Innovation in Services Occasional Paper* No. 9 (June) Chapter 2, pp. 21-60.

TETHER B.S. & TAJAR A. (2008) Beyond Industry–University Links: Sourcing Knowledge for Innovation from Consultants, Private Research Organizations and the Public Science-Base *Research Policy* Volume 37, Issues 6–7 (July), pp.1079–1095.

TIDD J. & HULL F.M. (2003) Managing Service Innovation: Variations of Best Practice in TIDD J. & HULL F.M. (eds.) *Service Innovation: Organizational Responses to Technological Opportunities and Market Imperatives* Imperial College Press, UK, Chapter 1, pp. 3-34.

TODOROVA G. & DURISIN B. (2007) Absorptive Capacity: Valuing a Reconceptualization *Academy of Management Review* Volume 32, No. 3, pp. 774–786.

TOIVONEN M. (2009) The Role of KIBS in the Technology Transfer Process *Entrepreneurship and Economic Development Research Institute (EEDRI) at the Academy of Management in Lodz Working Paper* No. 2, pp. 1-17

TORDOIR P.P. (1995) *The Professional Knowledge Economy: The Management and Integration of Professional Services in Business Organizations* Kluwer Academic Publishers, The Netherlands.

UNITED NATIONS ENVIRONMENT PROGRAMME (2011) *Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication*; available at: www.unep.org/greeneconomy

UNITED NATIONS WORLD TOURISM ORGANISATION (2012) *Tourism Highlights*, UNWTO, pp. 1-16.

UNITED NATIONS WORLD TOURISM ORGANISATION (2011) *Annual Report 2010 – A Year of Recovery*, UNWTO, pp. 1-82.

UNITED NATIONS WORLD TOURISM ORGANISATION (2009) *From Davos to Copenhagen and Beyond: Advancing Tourism's Response to Climate Change* UNWTO Background Paper, pp. 1-29.

UNITED STATES DEPARTMENT OF ENERGY (1995) Measuring Energy Efficiency in the United States Economy: A Beginning *Energy Consumption Series* (October), US Government Printing Office, pp. 1-105.

VAN DEN BOSCH F.A.J., VOLBERDA H.W. & DE BOER M. (1999) Coevolution of Firm Absorptive Capacity and Knowledge Environment: Organizational Forms and Combinative Capabilities *Organization Science* Volume 10, No. 5 (September–October), pp. 551–568.

VAN LENTE H., HEKKERT M., SMITS R. & VAN WAVEREN B. (2003) Roles of Systemic Intermediaries in Transition Processes *International Journal of Innovation Management* Volume 7, No. 3 (September), pp. 1-33.

VAN VLIET B. & SPAARGAREN G (2000) Lifestyles, Consumption and the Environment: The Ecological Modernization of Domestic Consumption *Environmental Politics* Volume 9, Issue 1, pp. 50-76.

VICTORINO L., VERMA R., PLASCHKA G. & DEV C. (2005) Service Innovation and Customer Choices in the Hospitality Industry *Managing Service Quality* Volume 15, No. 6, pp. 555-576.

VON HIPPEL E. (2009) Democratizing Innovation: The Evolving Phenomenon of User Innovation International *Journal of Innovation Science* Volume 1, No. 1 (March), pp. 29-40.

VON TUNZELMANN N. & ACHA V. (2005) Innovation in "Low-Tech" Industries in FAGERBERG J., MOWERY D.C., & NELSON R.R. (eds.) *The Oxford Handbook of Innovation* Chapter 15, Oxford University Press, pp. 407-432.

VOSS C. & ZOMERDIJK L. (2007) Innovation in Experiential Services – An Empirical View in *Department of Trade & Industry (DTI) Innovation in Services* (June) London: DTI, pp.97-134.

WANG C.L. & AHMED P.K. (2007) Dynamic Capabilities: A Review and Research Agenda *International Journal of Management Reviews* Volume 9, Issue 1, pp. 31-51.

WEBB I. (2002) Knowledge Management in the KIBS-Client Environment: A Case Study Approach in *PREST Discussion Paper Series* Paper 02-12, Manchester Business School, University of Manchester, pp. 1-49.

WEC (2008) *Energy Efficiency Policies around the World: Review and Evaluation* World Energy Council, London, UK, pp. 1-122.

WEIGELT C. & SARKAR M. (2012) Performance Implications of Outsourcing for Technological Innovations: Managing the Efficiency and Adaptability Trade-Off *Strategic Management Journal* Volume 33, pp. 189-216.

WINTER S.G. (2003) Understanding Dynamic Capabilities *Strategic Management Journal Volume* 24, pp. 991-995.

WORLD ECONOMIC FORUM (2011) *The Travel & Tourism Competitiveness Report 2011: Beyond the Downturn*, Switzerland, Chapter 1.1, pp.3-34.

YIN R. (2003) *Case Study Research Design and Methods* Applied Social Research Methods Series Volume 5 Sage Publications Third Edition.

YOUSIF C. (2012) Socio-Economic Analysis of Renewable Energy Systems (Focussing on Photovoltaics) *Enerscapes Seminar- PV systems in the Maltese Landscape* Friday 15th June 2012, Attard, Malta.

ZAHRA S. A. & GEORGE G. (2002) Absorptive Capacity: Review, Reconceptualization and Extension *Academy of Management Review* Volume 24, No. 2 (April) pp 185 – 203.

ZOLLO M. & WINTER S.G. (2002) Deliberate Learning and the Evolution of Dynamic Capabilities *Organization Science* Volume 13, No.3, 'Knowledge, Knowing and Organizations' (May-June), pp. 339-351.

Annex 1 – Coding Hotel Cases by Adaptation Mode, Category and Type of Informant

Adaptation Mode	Hotel Category	Hotel Code	Size (No. of Bedrooms)	No. of Full-time Employees	Interviewee Position	Interview Date	Duration
Reactive Adapters	A	1	90	14	T-Managing Director/Owner	08-Jun-10	42mins 14s
	A	2	900	-	T- General Manager	01-Sep-10	27mins 39s
	A	3	110-200	69	T- Managing Director	23-Sep-10	50mins 33s
					M- Maintenance Manager	03-Sep-10	1hr 5min 7s
	B	1	95	25	T- Director	27-Sep-10	20 mins
Active Adapters	B	4	303	150	M- Maintenance Manager	03-Sep-10	63mins 25s
	C	1	285	100	M- Room Division Manager	10-Jun-10	39mins 01s
	D	2	428	249	M- Chief Engineer	02-Sep-10	44mins 17s
	D	3	136	100	M- Chief Engineer	07-Jun-10	46mins 10 s
Proactive Adapters	B	2	279	-	M- Maintenance Manager	10-Jun-10	28mins 38s
					O- Operations Manager	02-Sep-10	email
	B	5	276	100	T-Managing Director	17-Aug-10	52mins
	B	6	120-450	400	T- Group Hospitality Director/Owner	25-May-10	55mins 42s
	D	1	5	2	T- Managing Director/ Sole Owner	13-May-10	56mins 45s
	E	1	451	350	M- Chief Engineer	20-May-10	1hr 02mins 26s
	E	2	342	250	M- Chief Engineer	18-Aug-10	1hr 13mins 12 s
					T- General Manager	18-Aug-10	17mins
					O- Human Resources Manager	19-Aug-10	email contact
	E	3	208-337	200	T- Director/Owner	17-Sep-10	41mins 54s
					M- Chief Engineer	24-Aug-10	1hr 33mins 28s
	E	4	276	120	M- Maintenance Manager	19-Aug-10	1hr 2mins
					O- Health & Safety Manager	02-Sep-10	1hr 2mins 26s
	E	5	410	330	M-1- Assistant Chief Engineer/Sustainability Coordinator	27-Aug-10	50mins 06s
					M-2 Chief Engineer	28-Jul-11	6mins 54s
-	B	3	112	18	T- General Manager	06-Aug-10	30mins 22s
	E	6	107	95	O- Human Resources Manager	30-Jul-10	27mins 53s
TOTAL		**19 cases**			**26 interviews**		**18hrs 39 mins**

Key to the Codes:

Adaptation Modes:

Reactive Adapters	Hotels possessing capabilities to implement *ad hoc* technology solutions and maintain operational efficiency
Active Adapters	Hotels possessing capabilities to modify maintenance practices to enhance energy efficiency
Proactive Adapters	Hotels possessing capabilities to implement new practices and organizational structures for environmental action
-	Insufficient information available to classify the hotel by its adaptation mode

Hotel Category:

A	Independent Economy; 3-star hotel
B	Independent Midscale; 4-star hotel
C	Multinational subsidiary; 4-star hotel
D	Independent upscale; 5-star hotel
E	Multinational subsidiary upscale/luxury; 5-star hotel

Type of Informant:

T	Top manager: general manager or director
M	Maintenance manager: technician or engineer
O	Other type of manager interviewed in the hotel (e.g. Health and Safety, Human Resources)

Note on Hotel Categories:

Generally hotels are categorized into distinct market segments according to the level of service offered, size, location, customer profile etc. Global chain scale classification schemes are available for internationally-accredited hotel chains and group properties that categorize hotels by chain scale (or market class) defined according to the ADR or average daily rate paid for rooms sold[62]. The market classes - from economy/budget, through midscale, upscale and upper upscale to luxury – reflect the amenities in the hotel and service level (from full to limited service).

For independent hotels, the classification varies widely across regions and countries, with countries often having a national classification system based on particular criteria[63]. In Malta, the Travel and Tourism Act grants hotels a classification certificate based on the standard and level of services offered [64] including the presence of various facilities such as a spa, fitness centre, massage and treatments, indoor and/or outdoor pools etc. It awards a star-level as an indicator of the market segment (from 2 to 5 stars). This gives an approximation of the market class categories.

[62] Smith Travel Research 2011 'STR Global Chain Scales' accessed July 2012 at:: http://www.strglobal.com/documents/2011_STRGlobal_Chain_Scales.pdf.

[63] European Consumer Centres' Network (2009) 'Classification of Hotel Establishments within the EU', accessed July 2012 at: http://ec.europa.eu/consumers/ecc/docs/hotel_establishment_classification_EU_en.pdf.

[64] Malta Travel & Tourism Services Act Chapter 409 of the Laws of Malta accessed July 2012 at: http://www.eccnetmalta.gov.mt/legislation.

Annex 2 - Environmental Profile of Hotel Cases

(Sources: The information in this table is sourced from the hotels' websites, information on environmental initiatives published in local newspapers; and hotel annual reports where available)

Hotel Code	Eco-certificate on hotel website and/or Hotel Lobby	Eco-certificate displayed on 3rd party websites*	Information on the Hotel Cases' Environmental Initiatives
A1	-	-	-
A2	√	-	Laundry re-use policy (Source: Interview data).
A3	√	-	The folder in the hotel rooms provides a plan of access to waste separation bins (Source: Interview data).
B1	-	-	-
B2	√	-	Eco-policy placed in the information book in each guestroom. The main objectives of the policy are to "improve the hotel's efficiency, reduce costs and also reduce the emissions achieved by reducing the use of fossil energy; reducing overall energy costs and overall waste (Source: Hotel Website accessed 12 July 2012).
B3	-	-	-
B4	√	-	-
C1	-	-	"We care about the Environment" programme with initiatives in the areas of energy, water, waste, and environmental awareness. Strategy to minimize the impact of business activity on the environment Awareness-raising; "small initiatives add to big results" approach e.g. improving efficiency of operations; reducing resource consumption in day-to-day operations. (Source: http://www.riu.com/en/Acerca_de_RIU/medio_ambiente/index.jsp accessed 12 July 2012).
D2	√		The hotel has a written environment policy included in the 'team member manual' that is distributed to all employees. This tackles energy and water conservation, waste reduction and minimization of pollution. The policy is displayed on staff canteen notice boards. (Source "Go Green Initiatives at Excelsior", accessed 12 July 2012 at: www.visitmalta.com).
D3	√	-	-
B5	√	√	Laundry re-use policy; waste separation programme (Source: Interview data).
B6	√	-	"The Environment as a Commitment to a Global Issue". "Eco-friendliness" section on hotel website provides information on environmental and social initiatives and practices implemented and community level initiatives (from waste separation to the correct use of cleaning products, water and energy conservation measures. (Source: Hotel websites accessed 12th July 2012).
D1	-	-	The restoration works undertaken in the Palazzo were covered in the local media - newspaper and national television. The media reported on environmental initiatives in the Palazzo and on the concept of converting the old Palazzo into an up-market boutique hotel. The hotel website is continuously updated on the progress of restoration works including the adjudication of government subsidy funds for such investments. (Sources hotel website; The Times of Malta 24th June 2010, The Malta Independent online 2009, accessed 12 July 2012).

*: Web search on hotels.com; bookings.com and expedia.com in July 2012.

Hotel Code	Eco-certificate on hotel website and/or Hotel Lobby	Eco-certificate displayed on 3rd party websites*	Information on the Hotel Cases' Environmental Initiatives
E1	√	-	"To create green hotels that guests love". Encourage development of environmental technologies: reduce energy in owned and managed estates by between 6% and 10% over three years (2010-2012) via the use of Green Engage: Encourage development in the community (IHG training Academy) Environment Strategy: Creating value from environmental performance. 'Green Engage' online sustainability reporting tool to measure and monitor energy and water consumption. Engagement of stakeholders: 'Innovation-hotel' interactive web-interface showcasing initiatives for sustainable design. (Sources: Green Engage Programme: http://www.ihgplc.com/index.asp?pageid=742; and 'Innovation Hotel Initiative: http://www.ihgplc.com/innovation/ accessed 15 July 2012).
E2	√	√	Environment Strategy: Conserving natural resources, minimizing waste and pollution. Innovation core to competitive edge: Introduced Element, the world's first major hotel brand carrying U.S. Leadership in Energy and Environmental Design (LEED) certification. Environmental Assessment Tools: online Sustainability Resource Center including an Environmental Initiative Assessment Survey and Initiative Tracking Tool. (Source: Starwood 2009 Annual Report accessed 15 July 2012 at: http://development.starwoodhotels.com/writable/resources/2009_starwood_annual_report.pdf)
E3	√	√	"Yes I can: Always Care" motto. Risk-reduction approach through environment, safety and security programmes; Performance-based targets for environment. *Rezidor Responsible Business Programme* - Top down and bottom up approaches to ensure engagement at all levels. (Source: Rezidor Responsible Business Programme Report 2010 http://www.carlson.com/cdc-cms/pdf/Hotels%20Presentations/rezidor-responsibility-report.pdf accessed 15 July 2012).
E4	√	-	Goal to "to score highly in environment sustainability in the hospitality sector." Source: Hotel website accessed 15 July 2012.
E5	√	√	To become an industry leader in sustainability whilst delivering great guest experiences. Sustainability as a brand standard; Focus on high impact areas that offer huge potential long-term benefits, including sustainable design and construction, renewable energy; Environment Strategy: Action and Innovation: Lightstay® sustainability performance assessment indicator Sustainable actions are integrated into how "we deliver hotel performance around the globe and a better experience for our guests." (Source: http://www.hiltonworldwide.com/corporate-responsibility/ accessed 15 July 2012).
E6	√	√	Sustainability intrinsic to tourism product and creating guest experience. Decentralized strategy and not determined by corporate Headquarters. Environment Strategy: Contributing to the eco-vision of the island; Creating an eco-image for the island of Gozo by promoting sustainable practices in the hotel; Innovation and lead-technologies: the first Kempinski in Europe to treat tap water and upgrade it to drinking water quality using EcoProx technology. (Sources: hotel website; Times of Malta 13th March 2011 accessed 15 July 2012 at: http://www.timesofmalta.com/articles/view/20110313/environment/gozo-hotel-stops-using-chlorinated-tap-water.354434)

Annex 3: Coding the Engineering Consulting Firms

(Sources: Interview Data with Engineering Consulting Firms, April-September 2010; desk-based research July-September 2011)

Typology	Description (Source: empirical data)	Code	Interviewee Position	Date Interview	Duration
α	*Traditional Building Services Engineering Firms involved in designing and managing building services in hotel properties and assisting in implementing the preventive maintenance programme.*	1	Senior Partner/Director	06-Aug-10	23mins 49s
		2	Senior Partner	22-Apr-10	43mins 02s
		3	Sole Owner	18-May-10	41mins 25 s
β	*Innovative Building Services Engineering Firms incorporate energy management and other environmental services as one of their core functions alongside building services design. These are innovation-oriented firms, researching new environmental technologies and solutions.*	1	Partner/Lead Sustainability Consultant	05-May-10	56mins 35s
		2	Senior Partner	16-Sep-10	57mins 51s
		3	General Manager	06-May-10	25mins 23s
δ	*Energy Services Consulting Firms provide energy management and energy efficient solutions as their core service. Their mission is to improve the competitiveness of their clients through increasing efficiency of operations.*	1	Sole Owner	22-Apr-10	55mins 59 s
		2	Director	09-Apr-10	82mins 19s
		3	Director	16-Apr-10	90mins 45s
		4	Sole Owner	08-Apr-10	43mins 51s
		5	Business Development Director	04-May-10	93mins 42s
		6	Sole Owner	06-May-10	47mins 03s
		7	Environment Design & Building Energy Consultant	01-Oct-10	40mins
		8	Associate	09-Apr-10	38mins 45s
	TOTAL:	**14**			**12hrs 20mins**

Annex 4 - List of Interviews with Actors in the External Environment

Organization	Date Interview	Duration
Climate Change Board	17-Oct-09	45mins 11s
Institute of Sustainable Energy, University of Malta	28-Oct-09	82mins 16s
Malta Resources Authority	04-Nov-09	40mins 22s
Consultant to government on water, climate change	13-Nov-09	62mins 39s
Malta Tourism Authority	25-Nov-09	60mins 33s
Ministry for Resources & Rural Affairs	01-Dec-09	52mins 16s
Tourism & Sustainable Development Unit	21-Dec-09	51mins 57s
Malta Enterprise	05-Mar-10	54mins 08s
Malta Intelligent Energy Management Agency (MIEMA)	05-Apr-10	49mins 02s
Malta Intelligent Energy Management Agency (MIEMA)	05-Apr-10	30mins 01s
Tourism & Sustainable Development Unit	19-Apr-10	51mins 37s
Institute of Sustainable Energy, University of Malta	13-Sep-10	58mins 24s
Faculty of Engineering, University of Malta	13-Sep-10	30mins 14s
Malta Hotels & Restaurants Association (MHRA)	16-Sep-10	34mins 43s
Faculty of the Built Environment, University of Malta	11-Nov-09	60mins 01s
Renewable Energy Association of Suppliers in Malta	11-May-10	30mins01s
TOTAL:		**13hrs 13mins**

Annex 5 – Hotel Interview Protocol

Introduction

My research is looking at trends in energy consumption in the hotel sector in Malta and the implementation of energy efficient technologies and measures. I would like to discuss your views on energy consumption, whether this is important and how it is changing in Malta and the measures your hotel has adopted to deal with energy efficiency.

HOTEL PROFILE

In which year did this hotel start operating in Malta?

Is this the only hotel that you run in Malta? Is it part of a group or chain of hotels?

Can you describe who owns the hotel and who takes care of the hotel management? [Prompt: family-run, shareholder-based].

Can you tell me how many **employees** work within the hotel (full and part time)?

Can you tell me how many bedrooms and bedcovers there are?

What type of guests does your hotel attract?

- business/conference,
- holiday-making,
- special-events visitors (e.g. sports)
- Foreign vs local visitors?

FACTORS INFLUENCING HOTEL OPERATIONS (Topics 1 & 2)
The (brackets) refer to the topics characterizing the capabilities in Annexes 10 and 11.

Which are the three most important factors or issues affecting your hotel and its operations currently?

Can you say the top three? Has this changed in recent years?

Prompt Examples	
• Quality control • Price competitiveness • Availability of human resources/skills;	• Seasonality • Does the hotel remain open all year round? • Does the seasonality of tourist arrivals affect your hotel operations? If yes, in what ways? • For example, do you offer special rates in winter season when tourist arrivals are supposed to be low?

[**If energy not mentioned amongst the top three**] Would you say that energy is comparable in importance to the issues you mentioned above?

ENVIRONMENTAL PROFILE OF THE HOTEL (Topics 9 & 13)

For hotels carrying an eco-certification:

I noticed from my own research that your hotel is marketed as a 1) green hotel; and/or 2) it carries the eco-certificate of the Malta Tourism Authority (MTA). What does this mean for the hotel and why is it important?

What were the reasons and motivations that drove the hotel to obtain the MTA eco-certification?

Was it a relatively easy process or cumbersome to obtain? Is it worthwhile?

Who did you get support from?

[Only then prompt:]

What sort of support did you get from the Malta Tourism Authority in the process of implementing the eco-certification?

Do you plan to go further and obtain another international certification or labels?

For hotels without any eco-certification:

Are you aware that the Malta Tourism Authority has an eco-certification scheme for hotels?

Have you considered applying for this eco-certificate? If yes, what are the difficulties encountered?

If not, why don't you think this is relevant for your hotel?

For hotels with and without an eco-certification:

Is the hotel management implementing any environmental policies (measures) with:
1) staff and
2) hotel guests such as policies to be careful about the use of the laundry or any oterh?

Are these policies part of an environment policy, if you have one?

DEMAND FOR ENVIRONMENTAL & ENERGY EFFICIENCY MEASURES: (Topic 5)

Do you ever receive specific requests from your guests on environment issues in general and energy in particular?

Do tour operators make specific requests for environment measures?

ENVIRONMENTAL TARGETS/ENVIRONMENTAL STANDARDS: (Topic 12)

Does the hotel have particular environmental standards that it abides by e.g. vis-à-vis minimizing waste, being more energy efficient, use of eco-friendly materials, or implementing environment policy?

If yes, how do you incorporate these standards into hotel operations?

[**In the case of multinational subsidiaries:**] Does the corporate group have particular environmental standards that it requires subsidiaries to abide by? Does the corporate send its engineers to transfer knowledge on how to implement these standards?

If not, does your hotel in Malta interact in any way with Head office to obtain advice on environmental or energy matters?]

MOTIVES TO ADOPT ENERGY EFFICIENT/RENEWABLE ENERGY MEASURES: (Topic 7)

Can you briefly describe which technologies or practices related to energy efficiency or clean energy production you have adopted?

What were the principal reasons and motivations for which you adopted these energy measures/technologies?

[*Prompt*]

- Cost-saving?
- Business strategy?
- Complying with regulations (specify which…) or anticipated regulations?
- Consumers demanding greener services?
- Any other?

Where these investments subsidized by the ERDF Energy Grant Scheme/Sustainable Tourism Development Projects Scheme? What is your experience with applying for the funding schemes (e.g. with compiling the proposal)?

Did you make additional investments apart from those supported by government's subsidy scheme?

Why were these measures not introduced before? Energy was not so much of an issue before this? Would you have made these investments without subsidy?

Did the hotel take energy efficiency into account in the planning, design and construction of the hotel?

DECISION-MAKING ON INVESTMENTS IN ENVIRONMENT/ENERGY EFFICIENT INITIATIVES: (Topic 10, 17, 19, 20)

Can you tell me who took the initiative to introduce energy efficient/renewable energy technologies and practices in your hotel?

[*Prompt*: Was it the management or the maintenance department that decided this should be a prerogative?

How did you present the project to the top-level management of the hotel (Board of Directors/Owners/Corporate group) to go ahead with the project and obtain financing (if this was necessary)? How was this received?

Did you form a specific team/committee to discuss these issues on a regular basis?

Did the team involve top management and maintenance/technical person?

Did you management receive or request a proposal from suppliers?

Did the head office send its engineers to talk to your technical people on what solutions are implementable locally?

BARRIERS TO ADOPTION: (Topic 8)

What were the main barriers that you came across when introducing energy efficient technologies?

Open-ended; ***then,***

How important were:

- Lack of information about alternatives;
- Lack of technical knowledge or support to evaluate;
- High costs;
- Uncertainty about costs and benefits;

How did you overcome difficulties?

Do you feel you needed more technical advice or financial support? If yes, who do you think should provide this?

CHOICE WHEN ADOPTING ENERGY EFFICIENT SOLUTIONS: (Topic 11)

Can you describe the decision-making process that led to the choice of a particular solution over others available and what was the decision based on?

Did the hotel's maintenance manager work with suppliers and/or an engineering consulting firm to discuss on the best options and then presented the proposal to the top management?

What was the involvement of the top management in the process?

Can you explain how you went about choosing the consultants/supplier that specialize in providing particular technologies or environmental solutions?

Did you feel you could trust them or needed to monitor carefully?

Would you consider investing in renewables? Have you thought about whether renewable energy installations (PV or wind) could prove to be a valuable option for your firm?

INVESTMENTS & BUDGETING: (Topic 14, 17, 19)

Today, how important are investments in energy efficient technologies/projects compared to other investment projects (such as refurbishments, purchasing new machinery, machinery repair, responding to customer demand etc.)?

Do you put aside a 'reserve' budget in your capital expenditure budget for energy efficient measures every year?

How big or small is this budget for investments in energy efficient technologies/projects compared to that for other investments?

Who comes up with ideas to implement new projects for energy efficiency or other (renewable installations) on a yearly basis? Are these issues discussed in the management meetings?

Do you incorporate energy efficiency as a criterion when deciding to install or purchase new machines or design new buildings; or when doing refurbishment works do you consider at management level, the inclusion of energy efficient systems?

ORGANIZATION OF MAINTENANCE DUTIES: (Characteristics and Organisation of Maintenance Tasks)

I would like to ask you about your day-to-day duties as chief engineer/technical/maintenance manager.

Firstly, for how many years have you worked in hotels?

Do you have a team of people working with you? How many?

Could you give me an idea of what your typical duties consist of?

What new activities took up most of your time this past year? E.g. did you implement any new system or where you involved in a particular project? Was it different from previous years?

ENERGY-RELATED TASKS & RESPONSIBILITIES*:* (Topic 6, 15, 16, 18, 23)

Do you monitor energy consumption regularly?

How much of your time do you spend on energy issues and energy management? Has this changed over the past ten years?

How did you first get to know about energy efficiency or get interested in energy efficiency?

How did you learn about energy efficient technologies? For example, do you attend relevant seminars?

What sort of training was required to implement these systems? Or were you already familiar with these technologies and systems?

ADOPTION OF ORGANIZATIONAL MEASURES: (Topic 21, 22)

Can you describe the process of how you go about implementing these policies or measures?

- Do you offer training for staff?
- Do you leave messages/notices in guest rooms?
- Other?

INTERACTION WITH CONSULTING ENGINEERING FIRM: (Topics 24, 25, 26)

Did you use the services of an engineering consulting firm for the preventive maintenance programme/ renovation projects in the past ten years? How did you make contact?

What type of services does the engineering consulting firm provide? How often does the engineer from the firm visit the hotel and who does he/she interact with (hotel manager/maintenance department or both)?

Does the engineering consulting firm give advice on energy management or do you request this specifically?

INFORMATION FLOWS AND NETWORKS: (Topic 3)

Do you share information/ideas on energy efficient and/or renewable energy technologies with other firms? If yes, in which forum (e.g. chamber of engineers, MHRA etc)?

I want to ask if the following entities supported you when implementing environmental/energy measures - e.g. by providing information on available technologies?

- Government agencies/departments (e.g. Malta Enterprise, innovation agency);
- University;
- Associations such as MEEREA, MHRA?
- Chambers such as chamber of commerce and enterprise, chamber of engineers, others?
- Suppliers?

What type of support did they provide?

If you don't have any links with these organizations, can you tell me why?

GOVERNMENT POLICIES AND INTERVENTIONS: (Topic 4)

Do you think the government is doing enough to promote energy efficiency and renewable energies in Malta, for example in terms of regulations and policy support?

Do you think the subsidy schemes are an effective way to encourage private sector to take up these solutions?

What sort of support do you think is lacking if any?

ADDITIONAL DOCUMENTS:

Do you have any material e.g. an annual report or corporate social responsibility profile that you could provide me with?

Can you give me the contact details of an engineering consulting firm that you work with or have worked with over the past year?

Annex 6 – Engineering Consulting Firms Interview Protocol

Introduction to the Research

My research is looking at trends in energy consumption in the hotel sector in Malta and the implementation of energy efficient technologies and measures. I would like to discuss your views on energy consumption and specifically how energy consumption patterns are changing in Maltese hotels and how these are organizing for energy efficiency.

CHARACTERIZATION OF ENGINEERING CONSULTING FIRMS:

Can you give me a brief history of your firm: when it was set up, how many full-time employees it has? Who are your main clients?

What type of services, do you offer? What type of services do you offer to hotels?

Do you work on contract on a project-by-project basis or do you also have longer term contracts with clients that you service on a regular basis (e.g. for preventive maintenance)?

ENERGY-RELATED SERVICES SUPPLIED TO CLIENTS:

Would you say that energy services have grown in importance in the past ten years? If yes, what do you attribute this to?

What type of services do you offer on energy matters?

- Do you identify and define problems with the hotel-client in relation to energy consumption in the hotel/establishment or the energy performance of the building?
- Do you also develop solutions by providing technical knowledge and technical capabilities to the client (e.g. environmental management strategy, monitoring systems design, process plant design, eco-design)?
- Do you implement (technical) solutions i.e. do you provide the client with the technology and install and maintain it yourselves?

SERVICES RELATED TO ENERGY AUDITING:

Malta Enterprise launched a scheme offering "free" services of energy assessors to enterprises including hotels that wish to undertake an energy audit; also there is a subsidy scheme for renewable energy installations.

Was your firm on the list of certified engineering firms that undertook audits on behalf of Malta Enterprise?

Do you think hotels are aware of these services offered by government?

Do you advise clients on how to apply for these schemes, who to contact, where to obtain information from?

CAPABILITIES TO IMPLEMENT ENERGY EFFICIENCY MEASURES:

How did you first get to know about energy efficiency or get interested in energy efficiency?
[*Prompt* examples:
- Specific training;
- attend international seminars;
- attend training abroad;
- international network;
- Or where they systems you were already familiar with?]

How do you identify local industry's energy concerns?
[*Prompt* examples:
- Discussions with professional or trade associations such as chamber of commerce, chamber of engineers; government committees on needs of hotel sector;
- Interaction with higher education institutions;
- Monitoring changes in national policy;
- EU standards and regulations;
- Client presents particular problems]

What would you say motivates industry and specifically hotels to implement energy efficiency and renewable energy systems?

How do you define what the specific problems of your client firm are vis-à-vis energy consumption?

[*prompt*:
- Do you carry out an energy audit or
- Does the client come up to you with specific issues he perceives are a problem in his establishment?

Can you describe briefly the approach you adopt when undertaking an energy audit:

Once the energy audit is carried out, do you advise the client on what they need to implement in terms of measures or technologies to reduce energy consumption or be more energy efficient and do you give them contacts of suppliers/manufacturers?

To your knowledge, have the client firms implemented any of the recommendations from the audit such as energy saving measures or renewable energy installations?

From your analysis of the energy audits, what would you say are the main barriers or obstacles for hotels to introduce energy efficient measures or renewable energy technologies (RETs)?

Do you think there is enough information on the performance and reliability of RETs and on payback periods? What is the role of suppliers in providing this information?

RELATION WITH CLIENT-FIRM:

I would like to understand the relation you establish with your hotel clients. Can you tell me how you make first contact with the hotel?
[*prompt*,
- through personal contacts;
- referrals;
- advertise your services (e.g. in the Yellow pages);
- other?]

What type of relation do you develop with your client?
[*Prompt*,
- Does the client present the problem issue and you attempt to solve it by coming up with a number of NEW solutions?
- Do you identify the problem with the client e.g. inefficiencies in energy consumption in operations and attempt to develop solutions?
- Other

Do you deal mainly with the top management or with technical people in the hotel? Do you keep regular links with your clients (hotels) – e.g. for maintenance of systems or on-going consultancy or are you engaged on a fixed term contractual basis?

How do you go about discussing technical solutions with a client which does not have a technical background?

Hotels often have an in-house technical person (maintenance manager or a technician). Can you describe the relationship that you establish with this maintenance person?

- Do you work with the maintenance person in the hotel to discuss on the best options for energy saving or renewables and then you present a proposal to the hotel management?

- Who takes the decisions on which technology/ies to opt for? Do you decide these with the maintenance department and present a proposal to the top management or is this done differently?

What is your role in taking decisions to invest in energy efficient and renewable energy measures?
[*Prompt*,
- you provide a technical opinion on technology choice;
- you suggest to the client which systems can actually be implemented;
- other?]

What is your relation with suppliers of renewable energy installations and energy saving products?
[*Prompt*,

- Do you involve specific suppliers you prefer working with or do you leave it up to the client to tender out the work to the suppliers of energy saving/RE equipment and services?]

In your view to what extent is the concept of reducing energy consumption being incorporated in the planning, design and construction of a new building or of a hotel extension project? Specifically,

- How open is the client to introducing energy efficient and renewable energy measures in the design and operation of a building?
- To what extent are energy efficiency and/or renewable energy measures taken into account in the procurement of services, for e.g. in the tendering procedures in construction phase or in tendering for building services?

INFORMATION FLOWS & NETWORKS

Do you share information/ideas on energy efficiency and renewable energy technologies with other engineering consulting firms? If yes, in which forum?

Do you have contacts with organizations such as?

- MEEREA (Malta Energy Efficiency & Renewable Energy Agency);
- MHRA (Malta Hotels &Restaurants Association);
- University;
- Renewable Energy Association of Malta (Importers);

If not, why not?

FACTORS THAT MAY BE INFLUENCING THE ADOPTION OF ENERGY EFFICIENCY IN MALTA:

Do you think the government is doing enough to promote energy efficiency and renewable energies in Malta?

Do you think the subsidy schemes are effective way to encourage private sector to take up these solutions?

What sort of support do you think is lacking if any?

ADDITIONAL CONTACTS:

Do you know of any other energy consulting firm that I could contact that maintains business relations with hotels?

Annex 7 - Interview Protocol with a Wider Pool of Actors in the External Environment

[*Note on the Interview Guide: Some additional questions were included to address specific themes with particular interviewees (e.g. the Tourism Policy for Malta was discussed with the director of the Tourism Sustainable Development Unit; the topic of 'research projects and skills building' was addressed in the interviews with knowledge institutions (Institute for Sustainable Energy and University of Malta); and the interview with the Malta Tourism Authority had a greater focus on the national eco-certification scheme for hotels. Also some topics arose spontaneously during the interview.***]**

INTERVIEWEE BACKGROUND INFORMATION:

- Can you first provide me with a brief background on yourself?

THE ENERGY SYSTEM IN MALTA: CURRENT TRENDS AND EVOLUTIONS:

- What do you think are the main energy-related issues in Malta in general at the moment? How have these changed compared to the past five years and how might they evolve in the future?

- The energy system in Malta is currently isolated. How do you see the system changing with the putting in place of the interconnector with Europe, in terms of electricity market becoming more open for competition?

- The system seems to be very much a supply-driven and state-driven system where the government is investing in infrastructures (new oil-driven power plant). What do you think is the role of end-users in bringing about change in the way of more efficient energy practices?

- What role do you think that renewable energy could play in Malta now and in the future?

TOURISM SECTOR, ENVIRONMENTAL RESPONSIVENESS & INNOVATION:

I am focusing on the tourism sector and hotels in my study because of the sector's high impact on the economy of small states.

- How important do you think issues of environmental awareness and responsiveness are to the tourism sector in Malta? How important will they be in, say, five years' time?

- What are the actors in tourism sector doing to raise their environmental profile?
  [*Prompt*,
  What new things are they doing, if any?
  Are there new ways of working being implemented?
  What do you think are the main motives for these greener initiatives?
  How much of an impact do you think they will have? Will they be enough?

- How important are issues related to energy consumption in hotels? How are hotels organizing to become more energy efficient if at all?

- Are there any new partnerships emerging between local communities, tourism sector, and utility companies in driving environmental initiatives in tourism?

ADDITIONAL CONTACTS:

- Can you suggest organizations/individuals you think would be relevant for me to contact for my study?
- Can you give me their contact details?
- Are there any important publications, websites, or similar that could be relevant for my study?

Annex 8: Matrix Characterizing the Types of Engineering Consulting Firms

(Sources: Unless otherwise specified, the data are sourced from the Interviews with the Engineering Consulting Firms, April-September 2010. Other data are sourced from desk-based research of websites, July-September 2011)

		Typology of Engineering Consulting Firms (based on web-site analysis and interview data)		
		Energy Services Consulting Firms with Energy Management as Core Business Service	**Innovative Building Services Engineering Firms with Energy management as one of the Service 'Pillars'**	**Traditional Building Services Engineering Firms**
Categories and Codes		**δ 1-8**	**β 1-3**	**α 1-3**
Characterization of Engineering Consulting Firms	*Size:*	**'Young' emerging firms:** est.1990 onwards; Self-employed/sole owners; Typically 1-5 employees.	**Well-established firms:** est.1980 onwards; micro-enterprises, 'larger' firms (15-30 employees).	**Well-established with wide client-base:** est. 1980 onwards; micro-enterprises of mixed size (from sole owners to additional employees)
	Mission/Vision of the firm: (web-site analysis)	**Energy features prominently:** Provision of energy saving and energy management solutions; increasing efficiency and savings in client-firm; enhancing competitiveness in client.	**Innovation-oriented:** Provision of innovative engineering technologies and solutions.	**Traditional building services design:** Offering leading edge building services consultancy.
	Portfolio of Services: Core service(s) and energy/environment-related services: (web-site and interview data)	**Energy management and energy-efficient solutions:** energy audits; feasibility studies; energy performance certification;	**Building services consultants:** energy auditing; designing building management systems; feasibility tests.	**Building services engineering**; energy auditing; design and implementation of building management systems.
	Perception on the growing importance of energy-related services, nationally and in the hotel sector:	**High Importance:** increased demand from industry for energy efficient solutions due to higher tariffs and (EU) regulations.	**Growing Importance:** Importance of incorporating energy efficiency in existing facilities has grown.	**Raised Awareness:** Clients are taking more initiative to introduce energy efficiency in day-to-day operations due to spike in energy prices.
	Interest in energy services:	Energy efficiency as a niche (not many companies specialize in this field e.g. energy performance certification); energy efficiency perceived as becoming an important issue in the future.	Demand from the market (clients).	Keeping abreast with energy efficient technologies through experience gained on the job; market demand.
	Approach to identifying local industry's energy concerns:	**Client-centred approach:** Direct feedback from clients; reaching out to potential clients	**Client-centred approach:** Directly from client; reaching out to potential clients (e.g. those who are preparing	**Client-centred approach:** Directly from clients.

		and undertaking feasibility trials; through contact with the Malta Hotels & restaurants Association (MHRA); through international partners/contacts.	a tender document), also to raise awareness of energy efficient solutions at tender stage.	
Characterization of Service Relation	*Types of Hotel-Clients:*	**Upscale and upper upscale hotels, with long-term plan:** Mainly 4 and 5 star hotels; Few smaller 3 star hotels; 3star less willing to invest, "close minded" (have other more strategic business concerns).	**Upscale and upper upscale hotels, with long-term plan:** Mainly large upper scale hotels although 3 star hotels starting to think about energy efficiency.	**No particular type of client-firm:** A spectrum of 3, 4 and 5 star hotels.
	Business relation with client-firm (definite versus long-term):	**Definite-term** (project-basis).	**Mixed:** Project-basis and long-term contractual agreements (preventive maintenance).	**Mixed:** Project-basis and long-term contractual agreements (preventive maintenance).
Type of energy-related service supplied to client-firm	*Energy efficient solutions offered as part of preventive maintenance (e.g. replacing inefficient equipment):*	Typically not so.	Mainly through preventive maintenance meetings. In project-based work, the firm and the client negotiate the introduction of energy management solutions in refurbishment and/or new construction development.	During routine meetings with top management, problems are brought to the table; the hotel brings forth concerns over energy bills and the KIBS advises on solutions and on choice of energy efficient technologies.
	Energy efficient solutions offered as "Stand-alone"/individual service e.g. energy auditing; managing for reducing energy consumption:	Customized solutions are prepared and presented to clients - specified to the client's need.	Project-based assignments: discussion and negotiation with client on the feasibility of introducing energy efficient/renewable energy measures in refurbishment projects or new construction development.	**None**. Energy efficient measures introduced as part of preventive maintenance and routine operations.
	Support in applying for subsidies to implement energy efficient systems:	**Technical and managerial support:** Make clients aware of subsidies; support clients in compiling applications, drawing up technical specifications for energy technologies etc.	**Technical and managerial support:** Make clients aware of subsidies; support clients in compiling applications, drawing up technical specifications for energy technologies etc.	**Technical and managerial support:** Make clients aware of subsidies; support clients in compiling applications, drawing up technical specifications for energy technologies etc.
Interactions	*Initial contact with the client-firm:*	**Marketing/Direct Contact:** Through contacts made in previous employment;	**Principally work with existing client-base/through referrals** in need of updating equipment; direct	**Principally work with existing client-base/through referrals**: experiencing problem

		reaching out to potential clients directly; marketing services and products to the client.	contact with potential clients e.g. in pre-tender phase; marketing.	with equipment. Referrals.
	Type of interaction with hotel-client when implementing energy measures:	**Intense, high interaction, short-lived.** An energy audit/survey identifies problems; collection of data on energy consumption; the firm prepares a proposal on approaches to reduce consumption (pre-sales); client-centred approach where products/solutions are customized to clients' needs.	**Mixed: frequent, regular and intense but short-lived:** Pre-tender/marketing phase; energy audit and preparation of proposal; implementation of solutions; routine preventive maintenance meetings.	**Frequent, regular, routine:** Routine preventive maintenance meetings with general manager and financial controller (typically fortnightly); introduced to new systems by suppliers, review technical specifications of energy technologies;
	Relation established between KIBS and director/owner or manager of hotel:	**Top-down**: discuss energy efficient solutions with top management and demonstrate energy savings; **Creating awareness about energy efficient services/products:** present systems/solutions to top management; **Technical advisor role:** provide advice on which solutions are best in terms of savings and feasibility.	**Top-down** Involve the directors in discussions on feasible options (e.g. through visioning workshops, α1); **Technical advisor role:** provide technical guidance on which solutions to be make investments; **Negotiation role:** negotiation process on what is possible and feasible to implement.	**Top-down:** interact with general manager and/or directors of the client-firm. **Technical advisor role:** advise the client on technical specifications of technologies; customer may come up with his own ideas;
	Relation established between the KIBS and hotel maintenance department:	Hotel maintenance manager often lacks time and/or skills to think about energy efficiency or the knowledge about technology solutions (especially in smaller hotels); Resistance to accept responsibility for potential failures that could be attributed to novel technologies; reluctance to implement energy efficient systems.	The hotel's maintenance manager is focussed on routine tasks and has no time to think about energy efficiency; others have sufficient knowledge but unaware of the bigger picture; In-house technicians may lack enthusiasm for new systems because this means more monitoring and additional maintenance (extra duty work).	Hotel maintenance manager is involved in execution of project. Typically in-house technicians lack expertise or time;
Sources of Knowledge	*Sourcing information on energy efficient and renewable energy technologies:*	Experience in previous employment; participation in research and demonstration projects with international	Suppliers; knowledge embodied in employees; other professionals (engineers/architects) when implementing new building projects; Making investments in new energy-related	Suppliers; Scanning new technologies on internet or from brochures received from suppliers. On-the-job experience.

		partners (δ1 and δ4); links with the institute for Sustainable Energy (δ7).	technologies (e.g. β2)	
	Participation in profession-led networks and specialized 'energy' networks:	**High participation in energy-related networks:** Participation in MEEREA seminars (Malta Energy Efficiency & Renewable Energy Association); delivering presentations on energy management.	**Profession-led networks:** Membership of Chamber of Engineers; participation in energy-related seminars; at personal level, firm delivers talks/training/seminars.	**Profession-led networks:** Membership of Chamber of Engineers. No specific links or contacts with energy-oriented associations.
	Staff training:	Accreditation to provide certification services on energy performance of buildings; training on ISO9000 and ISO14000; training on new energy efficient solutions.	Accreditation to provide certification services on energy performance of buildings;	None specified.
Approach when implementing energy-efficient solutions in the client-firm		**Prioritize responses according to the client's needs:** Prioritize energy efficiency over alternative energy technologies when the main problem of high consumption is outdated inefficient equipment; Education/Awareness raising on usage of energy and water probably provides the largest savings. **One size does not fit all:** Not any technology provides an adequate solution; characteristics of hotel property must be accounted for; Systemic view; joint solutions; Proposing feasible solutions over those which are technically and practically improbable (e.g. changing the HVAC system)	**One size does not fit all:** The nature of the solutions adopted is in line with the characteristics and infrastructure present in the client-firm. **Insufficient technical backup**: Renewable energy systems being marketed by suppliers with limited expertise; the market is acquiring a 'bad name' because of disappointments that clients are experiencing in terms of not getting promised pay-backs.	**Small actions, big savings:** Many energy efficient measures are low cost and do not involve expensive technology; in many cases they entail behavioural measures. **Fast to market Technology:** Technology changes fast; information and knowledge on emerging technologies are useful only once the technologies are present in the local market. **One size does not fit all:** The characteristics of the building, e.g. whether it is occupied and in use or a new building influence the type and extent of solutions that can be implemented. Replacement technology is a more attractive investment compared to opting for completely new systems (e.g. HVAC).
Factors influencing diffusion of energy	*Factors in the Hotel Client-Firm perceived by the KIBS to*	**You cannot manage what you don't measure:** lack of accurate	**You cannot manage what you don't measure:** lack of regular monitoring of energy	**Bringing down barriers of mis-guided information**: A misconception of

efficient solutions	*influence energy efficiency adoption (the cost-barrier was mentioned in all cases investigated):*	(sub-metered) monitoring of energy consumption in the hotel-client; difficult to determine savings from energy efficient measures; **Constrained by standards:** energy efficiency at odds with aesthetic environment in the property (e.g. white energy efficient and warm lighting). **Trusted relations with engineers** hampering innovative technologies and systems. Energy efficient investments struggle against more urgent priorities **Green Image at all costs:** Some hotel-clients invest in alternative energy system because of their corporate social responsibility/to build a green image or to benefit from a subsidy.	consumption makes managing energy consumption problematic. Misconceptions on what efficient heating and cooling are; e.g. energy efficient lighting altering the ambience of the property (β2). **Long-term vision:** the corporate culture affects the type of investments that are prioritized by the client firm e.g. Firms are buying in to renewables in order to build a green image thus they have a double advantage of reducing cost of electricity consumption and marketing.	what is 'good' practice vis-a-vis energy conservation; this stalls the adoption of certain technologies. **Constrained by standards:** In a hotel environment, standards of lighting and ambience, interior design may come at odds with energy efficient measures such as lighting.
	The Perceived Influence of Policy Measures on Energy Efficiency adoption in Hotel-Client:	**Energy Grant scheme** positive in stimulating investments but tend to promote one type of technology (renewables) whilst overlooking the importance of energy efficiency. The grants do not cover replacement of existing equipment as an eligible cost. They Market for alternative energy sources lacks necessary incentives. There is an interest in combined heat and power however taxes on fuel may pose a barrier to entry (δ6).	**Energy Grant Scheme:** appears to be favouring introduction of alternative energy systems whilst fewer incentives are provided for energy conservation and efficiency. **Legislation**: Although regulations are in place (the Energy Performance for Buildings Directive) these are not being enforced. Interpretation of legislation is an issue: division of labour amongst architects who oversee the construction and engineers who take care of building services; how effectively can this division of labour lead to implementation of regulations.	**Energy Grant Scheme:** to an extent, the energy subsidy scheme changed the market by stimulating investments that otherwise would have been slow to catch up (latency in the market with regard to energy efficiency). There are a number of energy audits being undertaken through the scheme but there is a lack of follow up. So the benefits from these audits are being lost.

Annex 9 - List of Local Seminars attended, Target Audience and Scope of the Seminar

Seminar Title	Target Audience	Scope of Seminar
'Renewable Energy Plan for Malta: Roadmap Towards 2020', 12th February 2010, Victoria Hotel, Sliema, Malta organized by Malta's Energy Efficiency & Renewable Energy Association (MEEREA).	Government bodies, policy-makers, industry, enterprise, energy producers and distributors, engineers, architects, academics, building sector.	The aim of the seminar was to compile proposals to be presented to the government in connection with the compilation of Malta's Renewable Energy Action Plan.
'Intelligent Energy Europe National Information Seminar for Stakeholders', 21st April 2010, organized by CIP-IEE and MEUSAC, Enterprise Centre, San Gwann.	Public bodies, education entities, business support organizations, consumer representation bodies.	A showcase of projects funded under the EU's Intelligent Energy Europe Programme that promotes energy efficiency and the use of renewable energy sources.
AMITEX 'The Travel & Leisure Fair', 24th April 2010, Malta Fairs & Convention Centre, Ta' Qali.	General public.	A national travel and leisure exhibition bringing together tour operators and travel agencies showcasing their travel packages and destinations.
'Change in Travel & Tourism: National Response to Global Trends' organized by the Tourism Studies Association, University of Malta on 28th April 2010 at Radisson Blu St. Julian's.	Stakeholders in the Maltese tourism industry; Education institutions.	A discussion on trends in tourism and how these are affecting Malta as a destination.
'Stakeholder Information Meeting: Feed-In Tariff Information Session' organized by the Malta Resources Authority, 4th October 2010 at Project House, Floriana.	Suppliers and distributors of renewable energy equipment; industry; general public.	Discussion on the feed-in Tariff Scheme for electricity produced through Photovoltaic systems Legal Notice 422 of 2010 Regulations.
Malta EU Steering & Action Committee (MEUSAC) Seminar on 'The Roadmap towards a Resource Efficient Europe', organized by MEUSAC on 28th July 2010 at The Palace Hotel, Sliema.	Industry associations; decision-makers; public bodies; consumer associations.	An overview of Europe's 2020 Strategy with emphasis on a resource efficient economy. Working groups addressing "industry and the green economy"; "resource efficient transport system"; "biodiversity and climate change" and "the role of the public sector in the quest for efficiency".

Annex 10 - A Capabilities Framework for the Adoption of Environmental & Energy Efficient Measures in Hotels – Bridging Theoretical Perspectives and the Empirical Investigation

Capability	Characterizing the Capability	TOPICS Addressed in Empirical Investigation and Themes emerging from Interview Data	Respondents from the Hotel Cases (see Annex 1 for Hotel Codes)
SENSING Scanning as a search process for emerging signals (Choo, 1999; Teece, 2007); Scanning for market-related knowledge in services (den Hertog *et al*., 2010); Scanning for emerging technologies (Choo, 1999); Ability to recognize different types of signals arising within and outside the firm (Arnell and Delaney, 2006; Bhave, 1994)	Sensing signals in the External Environment	**1. SIGNALS ABOUT DEVELOPMENTS IN TOURISM & HOTEL SECTOR**	
		(a) Long-standing challenges (competitiveness, seasonality; occupancy) *'**Seasonality is always an issue** though we are targeting off-peak travelers too.' (D1T)*	A1T; A2T; A3T; A3M; B1T; B2M; B6T; C1M; D1T; D2M; D3M; E1M; E2T; E2M; E3T; E4M; E5M; E6O
		(b) New emerging challenges in tourism (e.g. low cost airlines; environmental responsiveness in tourism) *'We used to receive most bookings from tour operators contracted in Malta. We still work with tour operators in Malta but **the trend changed in the past two years** where now we receive most bookings on line through internet (online bookings). This is the most significant **change** in recent years.' (A1T)*	A1T; A3T; B6T; B5T; D1T; E1M; E3T
		2. SIGNALS IN THE EXTERNAL ENVIRONMENT ABOUT ENVIRONMENTAL AWARENESS AND ENERGY	
		(a) High electricity tariffs *'If I had to think about where energy **stands** vis-à-vis hotel operation, then what I can say about energy is that all we can do is to continue to control and maintain or reduce energy consumption and increase our efficiency. The **increases** in **tariffs have translated in a 150% increase in electricity cost** and this is a massive increase for us. We are a high energy consumer.' (E1M)*	All respondents
		(b) Market-related signals prompting adoption of environment measures (demand from tour operators, 'green' tourists) *'**Some tour operators ask specifically for environmental label**; before bringing over the guests, some of the big tour operators when carrying out their audit/assessment are **asking about** environment measures implemented in hotels; thus the tour operator will **gain information on whether the hotel is eco-certified and what environment measures it implements**.'. (E2T)* *'I would say that this comes in to attract a particular type of guest, mainly from Scandinavian countries. So **eco-certificates serve to widen your market**. So certain tourists/markets tend to prefer eco-friendly hotels. Some of the tour operators we work with ask for eco-measures too.' (E3M)*	E1M; E2T; E2M; E4M; E4O (tour operators); A3T; B6T; B5T; B2M; E1M; E2T; E3T; E3M (niche tourists)

		(c) Regulatory/policy-driven measures (mainly headquarter policy for MN subsidiaries; waste separation regulation) *'**Because of environmental regulations** the refrigerant that our A/C chillers use called R22, is going to be phased out soon and will not be produced any more until 2015 because of its effect on the ozone layer. Other than invest in conversion equipment that would operate the chiller on a gas equivalent, it makes more sense **to get rid** of the A/C and **invest in new ones** that are more energy efficient. 60% of energy in summer goes for A/C, it more than doubles in summer compared to winter.' (E2M)*	C1M; E2T; E2M; E3T; E3M; E4M; E4O; E5M; E6O.
		3. SIGNALS ABOUT EMERGING ENVIRONMENTAL TECHNOLOGIES	
		(a) Sourcing suppliers for information on novel technologies *'When we were thinking of applying for a grant to install solar water heaters* [SWH]*, one of the **suppliers came over** to the hotel to survey the site and he produced an estimate on the savings we would accrue from installing SWH system. We specified the roof area we had available and asked about the savings. (C1M)*	A1T; A3T; A3M;; B1T; B2M; B3T; B5T; B6T; C1M; D1T; D2M; D3M; E1M; E2M; E3M; E4M; E5M
		(b) Business networks used for information exchange on environmental technologies (i.e. forum of hotel engineers and maintenance managers within MHRA) *'We **meet regularly with the engineers and technicians** of other five star hotels within **MHRA**. We exchange experiences of systems we have installed, what problems we came across, which suppliers we used. So there is **networking amongst hotels**. During these meetings we often have talks delivered either by suppliers themselves; or for example we had academics coming over from the institute for sustainable energy.' (D2M)*	B6T; B2M; B4M; D1T; D2M; E1M; E2M; E3M; E4M; E5M
		(c) Social networks (informal exchange) tapped for information on environmental technologies *'We **share information amongst hotel engineers but on an informal** basis. When I need information on particular systems I can **easily** call up an engineer and likewise I have often been of help to other hotels so it works both ways really.' (B5T)*	A2T; A3M; B2M; B4M; B5T; B6T; D2M; D3M E1M; E2M; E3M; E5M
		4. SENSING FUNDING OPPORTUNITIES TO ADOPT ENERGY EFFICIENT MEASURES	
		Maintenance Department Involved in applying for/monitoring grant scheme for energy efficiency (EE)/renewable energy RE) *'**We** **[the maintenance]** **applied for a grant** to install a room management system and inverters on our pumps. Under a separate scheme, we also applied for a grant to improve our website. We are still waiting to see what the outcome of our proposal will be. Our HR department took care of compiling the application; they made contact with the relevant authorities to obtain more information on the grant scheme. We came in when it came to making contacts with suppliers, obtaining quotations.' (D2M)*	B2M; B5T; D2M; E1M; E3M; E5M

Capability	Characterizing the Capability	TOPICS Addressed in Empirical Investigation and Themes emerging from Interview Data	Respondents from the Hotel Cases (see Annex 1 for Hotel Codes)
SENSING	Signals about energy consumption arising from within the Firm (Internal signals)	**5. SIGNALS FROM THE FRONT-OFFICE: CLIENT RESPONSIVENESS TO & ADOPTION OF HOTEL ENVIRONMENTAL POLICIES**	
		(a) Positive take-up of laundry reuse policy *'We implemented a laundry policy in the guestrooms, a **good percentage responded to this**. We **monitor this** because we outsource our laundry cleaning (we don't do it ourselves) so we know exactly how much laundry we have.' (B6T)*	A3M; B5T; B6T
		(b) Guest appreciation of environmental measures implemented by hotel *'**Mostly there are guests that ask what we do on the island, from the environmental aspect**. It depends on what type of clients you get. I've had guests, **some** are **very interested**, and some couldn't care less what you do. But lately I would say there's been a **trend**, people are **being more aware**. I mean I think globally, the whole concept of environmental issues is more in the news; generally people are becoming more aware of it.' (D3M)*	B4M; B5T; D3M; E2M; E3M
		(c) Guests do not comply with environment measures *'We do print out an environment policy which we leave in the rooms to encourage re-use of laundry. We find that our guests, mainly students, **do not follow many of the points in the policy**. We have a particular problem with waste separation for example.' (A2T)*	A2T
		6. SIGNALS ABOUT ENERGY EFFICIENCY ARISING FROM 'ON THE JOB' MONITORING ACTIVITY	
		(a) Energy data used to keep operational costs low *'**Every month we look at figures on energy consumption and compare this to previous months' consumption to ensure we are keeping to our targets**. This gives an idea of total energy consumption per room night per month; therefore this is a measure of how effective we are being in reducing consumption. Of course the more room nights I have means that I am going to be more efficient - because the fixed cost of maintaining the public areas is spread over more rooms. We have a **fixed** budget we can **spend** on energy per room - this is fixed when the budget is laid down at the year's start.' (E1M)*	All respondents
		(b) Energy data used to signal opportunities for enhanced operational efficiency (energy management) *'Essentially my job entails **regular monitoring** of all the equipment especially in the plant room; **where you have a piece of equipment that is not performing as it should**, at its maximum efficiency, that is where you are likely to find losses in energy consumption….I spent the first two months at this hotel going round and **inspecting** the equipment **to see what needed to be done**; one of my **targets** is to reduce cost by reducing consumption..' (B4M)*	B4M; B5T; C1M; D1T; D2M; D3M; E1M; E2M; E3M; E4M; E5M; E6O.
		(c) Energy data used to justify investment in energy efficient projects *'Since we have been in the business for over thirty years now, we have our own* [energy] *records. We have a fuel meter in every boiler so that I know how much energy I am consuming down to every individual boiler. This gives me the **background** to work and **base investments**; I am not working on fictitious figures but on actual figures.' (B5T)*	B2M; B4M; B5T; B6T; D1T; E2M; E3M; E4M; E5M

		(d) Environment included as indicator of firm performance *'In 2006, Hilton International launched the "We care Programme" that had amongst its aims the reduction of energy consumption and also reduction of water consumption and waste generation. When launched there was a **goal** to reduce consumption by **5%** over the previous year. The initiative originated from the Europe-Africa Regional office and Hilton Malta embraced the challenge wholeheartedly. **We managed** to **save 15.1% energy compared to the previous year**, making Hilton Malta the overall winner of the programme in the Mediterranean Region.' (E5M)*	B6T; E2T; E3M; E4M; E5M; E6O

Capability	Characterizing the Capability	TOPICS Addressed in Empirical Investigation and Themes emerging from Interview Data	Respondents from the Hotel Cases (see Annex 1 for Hotel Codes)
TRANSLATING SIGNALS INTO DECISIONS FOR ACTION Interpreting impact of change on the firm (Berkhout *et al*., 2006; Hall, 2009) Ability to make strategic choices and commit resources (Helfat and Peteraf, 2003)	Recognizing Value from Environmental Action	**7. INTERPRETING VALUE OF ENVIRONMENTAL MEASURES**	
		(a) Environment as a cost-factor *only* '*With the power factor correction we make more **efficient** use of electricity; there are fewer losses therefore our consumption is reduced and we **pay less** to the national utility. It is about **cost-saving** really.' (A1T)*	A1T; A2T; B1T; B4M; C1M; D2M; D3M
		(b) Environmental awareness linked to strategy/long-term vision *'We are now discussing the national environment policy for example with government and other stakeholders. **Tourism and environment are inseparable** - **you cannot be in tourism and not be involved in environment issues**. People look at tourism as being the culprit of environmental degradation – a lot of environmental **improvements** and investments [were made' precisely because of tourism. For example, why is Malta spending so much money on the rehabilitation of the Heritage sites? In large part this is **to preserve the tourism product and sustain demand for Malta as a destination**.' (A3T)*	A3T; B3T; B6T; D1T; E1M; E3T; E4O; E5M; E6O
		(c) Environmental action providing enhanced marketing exposure *'For the countryside resort Kempinski Hotel San Lawrenz, an environmentally friendly approach to tourism comes naturally. Sustainable tourism is not just about reducing energy and water, and adopting a waste management system, but also offering our visitors the authenticity, culture and heritage that characterize the Maltese islands. **We have been concentrating on the marketing of the island's ecological aspects**, such as offering country walks, painting holidays, agro-tourism or experiences at local farms to our guests. The Eco-certification will help us to **market** the hotel and Gozo better.' (E6O)*	B5T; B2M; E2T; E6O
		8. PERCEIVED IMPACTS OF ENVIRONMENTAL MEASURES ON HOTEL PERFORMANCE & OPERATIONS	
		(a) Environment Technologies represent high capital investment *'Also there is the **capital investment** involved. Last year was relatively a bad year financially. I don't think I could go to the Financial Director and say to him I want to **spend €200,000 on room management systems. The investment competes with other refurbishment projects**. I mean I'm going through it at the moment. We're looking at spending €12 million in this* [new] *building. I mean we haven't yet gone into the stage on technologies in the sense renewable energies or anything like that. It hasn't been mentioned yet and it's at the bottom of the list unfortunately.' (D3M)*	A1T; A2T; A3T; A3M; B4M; D2M; D3M; E1M

		(b) Uncertainty vis-à-vis savings, performance of new technologies *'**There was a bit of conflict as to whether these systems would perform up to the standard** of the more **traditional systems** because the others are **tried and tested**. And this was a new system. But yes we trusted. We heard what the engineer was telling us from these particular companies and we went ahead.' (B3T)*	A1T; B3T; E3M
		(c) Impact on guest comfort, service delivery, service standard *'In a five star hotel you have to be careful to maintain a **service standard**. We cannot say ok to reduce consumption, we will switch off the lights. So we opt for a suitable alternative, i.e. energy efficient lighting; it is like a **compromise**. In every measure we implement we must ensure not to take anything away from the comfort of the guest. So if a guest left all lights on in his room, then he expects when he returns in the room to find the same type of lighting.' (E4M)*	A3T, B4M, C1M, D2M, E2M, E3M, E4M, E5M
		(d) Concern over compatibility of novel technologies with existing systems in hotel (e.g. piping, roof space) *'There are various issues to consider. For example when looking at alternative energy systems**, roof space is often a limiting factor**. For example our hotel's roof is taken up by the pool area.' (B2M)*	B2M, D1T
		9. MOTIVES FOR ADOPTING NATIONAL TOURISM AUTHORITY ECO-CERTIFICATION LABEL	
		(a) Reduced consumption of resources and therefore operational costs *'In terms of costings, **the eco-certificate is useful because it helps us save on certain costs** and reduce consumption. So it is acting as an **incentive** in this sense; since we must comply with certain criteria we must necessarily implement certain savings.' (B4M)*	A2T, B4M, E2M
		(b) Enhanced marketing exposure (on national Tourism Authority's website and other published material) **'***If the MTA* [National Tourism Authority] *gives more **prominence to properties that are eco-certified**, hoteliers are encouraged to be eco-certified; whilst if they are not privileged in any way, there is no incentive apart from cost-saving". **This would help hoteliers to appreciate short-term benefits of eco-certification**. The MTA could give prominence to eco-certified hotels by featuring these on their webpage, or when there are fairs, give prominence to eco-certified properties. The MTA have only started doing this.' (B6T)*	A3T, B2M, B4M, B5T, B6T, D2M, D3M
		(c) competitive edge (attracting particular niche tourists) *'The motivation for adopting this eco-certificate stems from the belief that this gives **an edge** over other hotels in the market over competitors when it comes to **selling the product**. The prime objective is to determine how a given measure allows a hotel to sell more rooms.'(B6T)* *'It* [the eco-certification] *was about showing that the hotel is aware of the environment so it's basically attracting a certain clientele.' (D3M)*	B6T, D3M, E3T
		(d) push-factors (tour operators, guests) *'The hotel has had the eco-certification for around 5-6 years now. This was adopted before I started working here. Every two years we have to renew this. One of the issues here is that many of the clients the hotel **attracts** are German who are particularly advanced in terms of being eco-friendly so they are **willing** to see this.' (B4M)* *'Som**e tour operators ask specifically** for environmental labels; before bringing over the guests, some of the big tour operators when carrying out their **audi**t/assessment are **asking about** environment measures implemented in hotels. Some guests are now looking out for eco-hotels - there seems to be a demand in tourism for such labels.' (E2M)*	B4M, E1M, E2T, E2M; E4M
		(e) Headquarter policy (for MN subsidiaries only)	E3M, E5M, E6O

		*'It is part of our **corporate social responsibility** and recognizes its environmental responsibility. It is one of the many awards that Hilton Malta has achieved over the years.' (E5M)*	
		(f) Interested in obtaining eco-certificate as marketing tool *'We are **thinking** of applying for the eco-certification but there are a few difficulties. It **helps as a marketing label/tool**.' (B1T)*	B1T, B3T, B2T, C1M, E4O
		(g) Not a priority *'We are aware and heard about the initiative through the media. We **never thought about obtaining the eco-certificate**. Here at the hotel we never really considered implementing this. I don't really know what it entails so I cannot really express an opinion on this.' (A1T)*	A1T, D1T

Capability	Characterizing the Capability	TOPICS Addressed in Empirical Investigation and Themes emerging from Interview Data	Respondents from the Hotel Cases (see Annex 1 for Hotel Codes)
TRANSLATING SIGNALS INTO DECISIONS FOR ACTION	Decision-making within the firm	**10. DECISION-MAKING RE: IMPLEMENTATION OF ENVIRONMENT & ENERGY-RELATED PROJECT**	
		(a) Top-down: top management drives energy efficiency measures and/or is directly involved in their implementation *'*[Environment projects are] *discussed in **our board meetings with the Directors, CEO** and the Director of operations held once a month.* [When asked how the hotel became aware about the availability of energy subsidy schemes, the interviewee said:] *"**The chief executive officer takes these things in hand** as we are more focused on day to day operations at the hotel. **He would have attended meetings** and actually brings to our attention the fact the government is offering subsidies so then we have to take action. Ultimately the proposed investment must pass through the CEO and get the go-ahead from the Directors.' (C1M)* *'Yes, it was one of the **owners** more **than the engineer who was adamant** to **introduce these measures** and pushed the engineer to implement it….He* [the owner] *had been looking at some PV systems in his school and you know, we are all very aware about price of oil, cost of utilities, green, so we don't live in a shell. So we know that when you try and do something today you should be looking at implementing these types of systems.' (B3T)*	A1T, A2T, A3T, A3M, B1T, B6T, B3T, B5T, C1M, D1T, E3T, E6O
		(b) Bottom-Up: maintenance dept. prepares ideas/proposals for energy efficiency measures and presents to owners *'**I** **[the maintenance manager]** **take initiative to see which energy technologies can be implemented in refurbishment** and re-decoration projects. These suggestions must be approved by the board of Directors.' (E3M)* *I **[the maintenance manager]** **took the initiative** to obtain information from suppliers on what systems are available; I triggered this.' (E4M)* *'We* [maintenance department] ***come up with the*** **[energy]** ***proposals*** *and present them to the owner.(D2M)* *I* [health and safety officer] ***personally take a lot of initiatives on environment matters;*** *although sustainability is a requirement of the Starwood group I do go out of my way. My initiatives generally are well received by the general manager.' (E4O)*	B2M, B4M, D2M, D3M, E1M, E2M, E3M, E4M, E4O; E5M-1; E5M-2.

		11. DECISION-MAKING PROCESS ON THE CHOICE OF ENVIRONMENT/ENERGY TECHNOLOGIES	
		(a) New equipment vetted for its energy efficiency and payback on operational lifetime *'Durability, **quality and lifespan of materials and energy technologies** are amongst the top criteria used when planning investments.' (D1T)* *'We do look at **the energy efficient profile of new equipment**; so for example the new chillers that were installed in 2005 when the hotel was refurbished were installed as energy efficient. So it is a criterion we look out for.' (D2M)*	A1T, B6T, B5T, B4M, B2T,D2M, D1T, E1M, D3M, E2M, E3M, E4M, E5M
		(b) Assess cost of adoption of technology and savings incurred *'We look out for energy efficient equipment when purchasing new equipment. **Price makes an important difference when purchasing equipment**, but in the long run consumption of electricity is also an important factor as such equipment is likely to be used for at least 5-6 years so consumption is important.' (A1T)*	A1T, A2T, B6T, B4M, B2T, C1M, D2M, E1M, D3M, E2M, E4M, E4O, E5M
		(c) assess best available technological solution causing minimal 'disruption' (e.g. space availability, use of existing piping for installation of new systems) *'We are thinking of renewables now. There are **two main options** which seem to be the current trend locally at least: there are the photovoltaics and solar water heaters. …..For a given roof surface area we would require 52 PV panels of 1.5m each and the for the solar water heaters **we would need 65 panels to cover a given roof surface area. Since in the hotel we have a high demand for electricity** i.e. we have high consumption essentially, then the photovoltaic system **is not going to cover significant amount of our consumption for the given roof-area we have available**. And it is not possible to store that amount of electricity not consumed at a particular time because this would require the use of batteries etc. so we are more inclined to install solar water heaters (SWH).' (E4M)* *'A few years later, we introduced out of necessity seawater in the flushing. Now it is **taboo because now sewage/waste water must be recycled** and apparently the salt in seawater has a negative effect on the bacteria involved in sewage digestion. So now we are reusing bath water for our flushing **and this was possible because we have the entire infrastructure in place and with a minimum expense we could do this**.' (B5T)*	A2T, A3M, B6T, B3T, B2M, B5T, D1T, E3T, E3M, E4M, E4O, E5M
		(d) Compliance to regulations, hotel standards *'Locally we have very **strict** **Legionella** **rules**, probably the strictest in the world together with Australia and UK. This means that at any time throughout the building your hot water must be at a minimum of 55 degrees Celsius. This is a **major challenge for solar heating** so the engineer and rightly so was a bit skeptical at the beginning as to whether we could achieve this. This is why the engineer was a bit skeptical – it is not that he wants to waste fuel but as an engineer it is his **duty to ensure that regulations and requirements are met by his designs**. So we had a fair number of discussions and meetings before we decided that this alternative energy is a way forward' (B3T)*	B3T, B5T, C1M, D2M, E4O

Capability	Characterizing the Capability	TOPICS Addressed in Empirical Investigation and Themes emerging from Interview Data	Respondents from the Hotel Cases (see Annex 1 for Hotel Codes)
TRANSLATING SIGNALS INTO DECISIONS FOR ACTION	Resource commitment	**12. SETTING ENVIRONMENTAL TARGETS IN HOTEL**	
		(a) Targets aimed at cost-saving (e.g. reducing energy consumption by %) *'The **performance** of each department is also being **benchmarked** against environmental performance (30%)' (B6T)*	A1T, B6T, B2M, B4M, E1M, D3M, E4M, E4O, E5M
		(b) Targets to comply with regulation (e.g. waste) *'There are no specific targets for environment. **Our targets are based on compliance with regulation** for example **waste management** and separation which we are currently implementing.' (B4M)*	B4M
		(c) Targets to comply with eco-certification criteria *'The targets are those **imposed by the eco-certification**.' (A2T)* *'We have the **eco-certification criteria** to go by at the moment. We obviously try and reduce our impact when it comes to waste.(A3M)*	A2T, A3T, A3M, D2M,
		(d) No specific targets for environment/energy *'Our targets are to reduce on consumption **but there are no fixed figures we work by**.* [When asked if waste was separated before regulations came into force, the interviewee responded:] *No, not so much but we have been separating waste for over one year now so a bit before the legislation came into force' (D2M)*	B3T, B5T, BIM, B2T, C1M, D1T
		(e) Complying with corporate policy (targets not imposed typically but recommended) *'We **are not like other chains/brands where the corporate imposes company standards** on its subsidiaries. In terms of the corporate IHG, we **work on best practices** and try and see how to obtain better results; we can **take more of our time to implement these best practices**. The targets we set are mainly related to cost of operation. I mean we are continuously striving to reduce consumption to maintain profit levels. Therefore my job is to ensure we remain within the budget allocated in terms of energy consumption otherwise this affects the profits' (E1M)*	E1M, E2M, E3T, E4M, E5M
		13. ADOPTION OF THE ECO-CERTIFICATE AND/OR ENVIRONMENTAL PROGRAMME (Refer also to Annex 2: Environmental Profile of Hotel Cases	
		(a) Implementing voluntary environmental programmes (incl. an eco-certificate)	A2T, A3T, A3M, B6T, B5T, B4M, D2M, E1M, D3M, E2M, E3T, E3M, E4M, E4O, E5M, E6O
		(b) Advertising eco-certificate on own and 3rd party websites	A2T, A3T, B6T, B5T, B1M, D2M, E2T, E3T, E5M, E6O
		14. IMPORTANCE OF ENERGY INVESTMENTS COMPARED TO OTHER INVESTMENT PROJECTS (SUCH AS RENOVATIONS)	

		(a) Budget for environmental measures accounted for in annual budgeting exercise *'**Energy investment projects are given priority** on a regular basis. The firm has two budgets: the **operational budget including energy** and there is the capital budget. These are computed in August and presented in November. The capital budget **includes investments needed in energy**. [For example], we are planning the installation of a reverse osmosis plant at Sunny Coast holiday complex.' (B6T)*	B5T, B6T, D2M, D1T, E1M, E3T, E5M
		(b) Environment measures implemented *ad hoc* (with no specific budget allocation) *'There isn't anything* [reserve budget] *in particular. Obviously we have a depreciation fund which is normal but that's it. We will always look at opportunities for investments in energy technologies and systems but on an ad hoc basis' (B3T)*	A1T, A2T, A3M, B3T, B1M, B4M, B2T, C1M, D3M, E4M

Capability	Characterizing the Capability	TOPICS Addressed in Empirical Investigation and Themes emerging from Interview Data	Respondents from the Hotel Cases (see Annex 1 for Hotel Codes)
CAPABILITIES TO IMPLEMENT ENVIRONMENTAL ACTION Adapting routines by implementing known alternative practices (Berkhout, 2012) Sustaining multiple tasks in the firm (del Brio *et al*., 2007; Sundbo, 2011) Organizational resources needed to operationalize environmental capacity (Florida	**Making Adjustments in Routine Tasks**	**TASKS & RESPONSIBILITIES RELATED TO ADOPTION OF ENERGY EFFICIENCY**	
		15. MONITORING ENERGY CONSUMPTION IN HOTEL	
		(a) Energy data used to keep costs down *'We **monitor energy consumption on a daily basis**; especially in certain hot spots so we monitor energy consumption of the laundry, the reverse osmosis plant; there are sub-meters in certain areas in the hotel. The maintenance team does this regularly monitoring. Such close monitoring is important because it alerts you to any equipment which isn't working as it should. Of course **monitoring consumption is an indicator of how much every department is costing you** to run." (B2M)*	All
		(b) Energy data exploited in order to Enhance Operational Efficiency *'As maintenance team we monitor energy on a regular basis through taking regular readings. We **use these data** to try and **find ways of how to reduce consumption**; so if we find that consumption in particular operation is high; we try and see **how we can reduce this** whilst ensuring that the guest is not affected to any large extent. Naturally reduced consumption means reduced operational cost.' (D2M)*	B5T, C1M, D2M, B4M, D1T, E1M, D3M, E2M, E3M,E4O, E5M, E6O
		(c) Energy data exploited to justify investment in energy efficient measures *'We have always had **very good feedback from the Directors** regarding **investments in energy saving.** For example, we are currently refurbishing the indoor pool because it was old; the ceiling is a skylight with special glass to keep the water warm - we have a Maltese supplier who gets this glass from abroad. This glass is more expensive than standard Perspex (€21k compared to €1k of Perspex). And the solar water heaters we plan to install on the roof are going to heat the pool and contribute to central heating of the hotel. In fact **we exceeded the budget when we decided to install glass skylight** instead of Perspex. But when we went up to the directors and **showed them savings on heating sources** and presented the payback period, we got to go-ahead. The directors give us a free hand and they are quite flexible - this is one thing that I feel comfortable with.' (B4M)*	B4M, B5T, B6T, D1T, E2M, E3M, E4O, E5M

and Atlas, 2001) Producing the service with a new combination of characteristics (den Hertog, 2010b; Gallouj, 2000) Taking initiative beyond job description (Florida and Atlas, 2001; Sundbo, 2011)		**(d) 'Environment' and 'energy consumption' included as indicator of firm performance** *'Investments in energy technology are high on the agenda; since the hotel industry is very competitive, it is essential to ensure that the operation is as efficient as possible before embarking on any other investment. Thus it is important to ensure efficiency of operation i.e. a good percentage of profit to be able to re-invest in the business. Energy is a "make it or break it" for a business today. Energy saving measures enable the hotel to be more profitable because they reduce the fixed operational costs (e.g. cost to run the chillers of the A/C, lighting public areas, operate kitchen) and give more profits per guest night. The performance of each department is also being* ***benchmarked against environmental performance*** *– this is 30%' (B6T)*	B6T, E2M, E3M, E4M, E5M, E6O
		16. TIME DEDICATED TO MONITORING ENERGY CONSUMPTION	
		(a) Specific time allocated to researching energy-related technologies/projects *'****5% of time*** *is spent collecting and analyzing energy consumption data. However it probably is* ***more than this*** *-* ***up to 20%*** *if you consider that I* ***go around the hotel property checking*** *that air-conditioning is operating only where needed and that the kitchen cookers/ovens are being used efficiently. I also* ***spend some time researching on energy technologies*** *and talking to suppliers. The increase in cost of electricity bills, have made us look at alternative ways to reduce consumption.' (E3M)*	E2M, E3M, E5M
		(b) Energy issues part of day-to-day duties and monitoring *'Well it* [energy monitoring] *is* ***part and parcel*** *of what the day to day monitoring is about.' (E1M)*	A3M, B6T, B5T, B1T, C1M, D2M, D1T, D3M, E1M, E4M

Capability	Characterizing the Capability	TOPICS Addressed in Empirical Investigation and Themes emerging from Interview Data	Respondents from the Hotel Cases (see Annex 1 for Hotel Codes)
CAPABILITIES TO IMPLEMENT ENVIRONMENTAL ACTION	**Problem-Solving and Evaluation**	**17. EVALUATING TECHNOLOGY OPTIONS**	
		(a) ***Ad hoc*** **problem-solving approach (replacing inefficient/high consumption equipment' one-off investments in energy efficient technologies)** *'These* [energy investments] *are* ***ad hoc****. It depends on a number of factors. The subsidy schemes are a good* ***incentive*** *to invest.' (A2T)* *'We implement* [energy efficient projects] ***according to need'*** *(A1T)* *'The* [energy efficient] *subsidy schemes help. However the government needs to offer more assistance; I think the government should offer subsidies for* ***replacement technology*** *for example, our* ***A/C system is now getting on in years*** *and there are systems that are more efficient. I had raised this point myself with the Ministry for Gozo during a seminar we had organized at my hotel last year.' (B1T)*	A1T, A2T, A3M, B1T,
		(b) Assessing technology options that 'fit' with existing operations based on building services design and architecture *'As an engineer, I do* ***my assessment based on how easy or difficult to implement*** *a particular system or technology. For example, it was easy for us to replace our lighting with energy efficient equivalents but*	B6T, B3T, B5T, B4M, C1M, D2M, D1T, E1M, D3M, E2M, E3M, E4M, E5M

		imagine implementing insulation in the building - it would be a complex operation; whilst on the other hand it is easier to purchase 10,000 square meters of reflective screen and cover all the glazing - this is easy. There are no structural alterations which would increase the cost and disturb the operation as well.' (E1M) *'We monitor energy consumption* ***on a daily basis****; we taking daily readings per operation; we have sub-meters in the hotel. We convert the daily readings into a monthly average. Every month we look at figures on energy consumption and* ***compare this to previous months' consumption*** *to ensure we are keeping to our targets This gives an idea of total energy consumption per room night per month; therefore this is a* ***measure of how effective we are being in reducing consumption****. We have what I call 'hands-on'* ***control of daily consumption****; daily we* ***observe if there are variations****, if we are going over budget and therefore if we need more control when we go over budget. We already know that because of the increase in tariffs from a monthly expenditure of €40k we are going to go up to €80k in the month of May. I have* ***committed myself to see how to reduce on this expenditure****. I cannot say then ok let us switch off the lights in the hotel or the A/C;* ***but I have to see how to control this****. To date we are doing a 19% energy saving according to the figures. Despite the massive electricity increase, yet we have managed energy saving.' (E1M)* *'*[During the hotel construction], *the architect originally did not want to build a double brick wall to keep costs low whilst the engineer who looks at the long term and doesn't only look at capital cost said it is better to do a double brick wall and introduce insulation; the engineer is interested in the running cost of the property whilst the architect is more concerned about the capital investment and he looks more at structural elements of a building. Thus extra costings were introduced - €500k were needed to implement the engineer's design. We* ***decided to go for the thicker wall with insulation*** *because we* ***were convinced that there were long term savings*** *on air-conditioning for example.' (B6T)* *'We take daily recordings of energy i.e. electricity, fuel, gas and water consumption. The up-keep of these systems is being* ***recorded on spreadsheets*** *- I have introduced this and* ***we monitor the functioning/operation of every system on a daily basis****. This allows us to* ***build a history of every equipment/piece of machinery****; thus this helps* ***do better follow-up on performance*** *and also* ***efficiency****. Also* ***it is not sufficient to say we have a BMS*** [building management system] *that regulates consumption. When it is cool outside and there are northwesterly winds, I switch one chiller one and not two chillers. At the moment I am using the monthly-committee meetings to brief the staff on how we can be more careful with consumption because of rising costs, also I raise awareness on safety with using equipment and ask them to alert me to any malfunctioning equipment/systems -* ***I am doing this with banqueting, kitchen and housekeeping****.' (E4M)* *It* ***doesn't make sense for us to keep equipment which is functioning inefficiently****. I would* ***replace*** *a pump which is still working but consuming too much precisely because of its inefficiency. For example I am looking at the air-conditioning system now. Our A/C system was installed in 1974 so it is 35yrs old. I managed to make it more efficient by simply replacing the thermostat from an old analogue one to a digital*	

		*thermostat; I saved quite a lot on electricity. Typically however when **replacing old equipment** we try and look out for technology that is energy saving. **We installed new A/C in 16 suites** with VRF/VRV technology.' (B5T)* *'We installed power factor correction on the refrigeration systems and the main air-conditioning plant. We **already had power factor correction** before we installed this but the power factor correction we had already was being done centrally on the main meter. Now since there is a large distance between the power factor corrector (attached to the meter) and the actual A/c plant and refrigerator **there was still wastage so that is why we then installed power factor correction individually on the energy-consuming equipment**. Another example: when we installed the card-switch systems in the bedrooms, they proved to be effective to save on electricity. People were quite happy in the summer months to take the card out and go out. However **a bigger problem arose in winter months** as the rooms tend to get cold **so we had to get a "light manager" to go round the rooms** and place the keycards in the rooms before the guests arrived so as to turn the heating on and heat up the room from beforehand.' (B5T)* *'Investigating renewables is an option; e.g. Photovoltaics were discussed at length with the engineering consultant firm. I was involved in these discussions and prepared various reports. We would like to install PVs and we have asked for an energy grant to install these. However, again it doesn't make economic sense so far when you consider the payback is 15years…. And apart from this, there are technical problems. In this property there is a **small area that is suitable for PVs** and thus the **amount of electricity that these will generate compared to the amount the hotel consumes is a drop in the ocean**, just a small percentage." (E3M)* *'It is more difficult to implement certain measures and change technologies in existing properties. Pulling out A/C and fitting in new A/C is a huge cost. And often **it's not just about replacing the equipment** but you often have to **change the type of piping in** each room. You might not be able to do it physically because of the **structure** of the building.' (E3T)*	
		18. MANAGING THE THERMAL ENVIRONMENT IN THE HOTEL	
		(a) Client 'manages' thermal environment *'Any card system could be used and abused even a cardboard. In fact even the intelligent keycard is not 100% effective since **many families visiting the hotel ask for a second keycard** because they claim the family is not always together. In truth most times the second keycard **is left in the room in the switch so as to leave the A/C on and they find the room cool.** So to avoid this, we removed the switch and installed proximity sensors that detect presence of individual in room or in the absence of movement the A/C Switches off.' (E3M)*	A1T, A2T, A3M, B5T, B1T, B4M, B2M, C1M, D2M, D3M
		(b) Hotel manages thermal environment of guest room *'It is going to be a major change to reduce dependency on energy. This will mainly fall on the expectations of the guests. The guests will become more tolerant on ambient conditions. Whilst in the past guests were provided with a cool environment in the hotel, I think more and more guests will not demand and expect*	B6T, D1T, E1M, E2M, E3M, E4M, E5M, E6O

		that and as time goes by the ambient condition will rise. In other words, whereas the ambient temperature in the hotel lobby today is at 24 degrees Celsius in the future it will rise to 26 degrees and this will reduce on energy consumption. Whereas in a five star hotel you would ***normally expect to have air-conditioning in the rooms on all the time*** *in the summer; in* ***the future this will change*** *because both of the cost and also because of the environment.' (E1M)* *'In the construction of the hotel extension in 2005, the engineering consultants worked closely with the designers and architect to introduce environment measures already in the construction phase. For example the A/C system in the hotel is centralized whilst in the newer part of the hotel the A/C consists of split units. The latter* ***allows us to have more control over the temperature in the rooms*** *whilst with a centralized system the temperature must be kept at the same thermal level, you don't have much choice.' (E5M)*	
		19. IMPACT OF ADOPTING ENVIRONMENT/ENERGY TECHNOLOGIES	
		(a) Information/Knowledge vis-à-vis savings, performance of new technologies *'We also investigated geothermal energy and talked to the Institute for Energy Technology. We did our own investigation and then bounced our ideas with these experts. The* ***wind option seems to be most viable in terms of payback*** *which is about 4-5years, you need a small footprint (surface area) but the* ***two main problems is lack of sufficient data on wind and weather conditions*** *in the site we have earmarked. Our director gave us the go-ahead to start collecting such wind data.' (E3M)*	A1T, B3T, E3M
		(b) Impact on guest comfort, service delivery (e.g. switching off of A/C system when door opens, lighting, impact on ambience) *'We implemented systems such as energy efficient systems* ***that do not have any significant impact on the guest****; I would say that the guest does not even realize about certain measures. We ensure that the measures we introduce* ***do not compromise the quality*** *of the service offered.' (E5M)* *'The hotel collaborated with a researcher engineer who built a prototype system, whereby treated water from sewage treatment plant is purified to potable water standards. In the system currently present at the hotel the sewage treatment plant does not produce potable water but the water is stored in cisterns and used for flushing toilets and for irrigation. The researcher wanted to take this a step further and the treated water upgraded to potable water. [*When asked if the hotel was interested in implementing this system on a commercial basis, the engineer claimed*]: "Our main concern was that* ***the guests would not perceive positively*** *the fact that the water used for washing or in the pool originated from waste water". (E3M)*	A3M, B4M, C1M, D2M, E2M, E3M, E4M, E5M
		(c) Feasibility of environment technologies in terms of compatibility with existing systems in hotel (e.g. piping, A/C system; roof space) *'The* [hotel] *is supplied with 50 Amperes in three phases from the energy provider; this is the maximum energy supply that limits what can be implemented from an appliances perspective. Therefore this meant that the engineering consultant had to design a "switching schedule" that will not keep all systems "on" at the same time; thus for example when the sauna is switched on then the under floor heating goes off - this is in fact possible thanks to the energy management system which switches on and off automatically. As a result of this* ***unexpected outcome****,* ***more investments were channeled towards insulation (wall, floor****) therefore so much heating will not be required.' (D1T)*	B2M, D1T

Capability	Characterizing the Capability	TOPICS Addressed in Empirical Investigation and Themes emerging from Interview Data	Respondents from the Hotel Cases (see Annex 1 for Hotel Codes)
CAPABILITIES TO IMPLEMENT ENVIRONMENTAL ACTION	**Taking Initiative beyond Day-to-Day Tasks**	**20. INITIATING IDEAS/PROPOSALS FOR ENVIRONMENT/ENERGY PROJECTS**	
		(a) Maintenance takes initiative to implement energy efficiency measures *'I* [the maintenance manager] *am often **the person who comes up with ideas** of what can be implemented in terms of energy conservation because I regularly monitor the equipment and the property. The engineering consultant also pushes or encourages the hotel general manager to, for example, apply for subsidy schemes.' (B4M)* *The **chief engineer** and the engineering consultant **put together a proposal for a new project**. Naturally these must be approved by the general manager and the owner. The general manager has a very positive attitude towards such investments; he strives to be at the top of initiatives taken by Hilton including in the environment. Then the project is presented to the Hilton head office and we must get approval from the head office for any initiative.' (E5M)*	B2M, B4M, B5, D1, D2M, D3M, E1M, E2M, E3M, E4M, E4O, E5M-1; E5M-2
		(b) Top management initiates and drives energy efficiency and/or is directly involved in their implementation *'The guidance* [for environmental projects] *comes from **top management**. Technical details come from the operations manager. The maintenance team then executes; we **are more hands-on** and seeing what needs to be implemented.' (A3M)* *The **owners are very much involved in new projects**; for example they take care to **formulate the tender specifications** for the new A/C system together with the financial controller. I am then informed of which projects are going to be implemented and which I have to follow up.' (A2T)*	A1T, A2T, A3T, A3M, B6T, B3T, B5T, B1T, C1M, D1T, E3T, E6O
		21. INITIATIVES TAKEN TO INVOLVE THE GUEST IN ENVIRONMENT MEASURES IMPLEMENTED BY THE HOTEL	
		(a) "Informed" guest (supplying guests with printed information on hotel's environment initiatives e.g. in guestroom, notice-boards on waste efforts) *'We do print out an **environment policy** which we **leave in the rooms** to encourage re-use of laundry. We find that our guests, mainly students do not follow many of the points in the policy.' (A2T)*	A2T, A3M, B1T
		(b) "Participating" guest (environment policies to encourage guest involvement in environment measures e.g. laundry re-use, linen reuse) *'We try and get the **guests to participate** in our eco-measures for example we have a **laundry re-use policy** which is a voluntary programme that guests may wish to follow. But then it is up to the guest to follow or otherwise. Those guests that leave the bookmark on their bed comply with the re-use policy".(D2M)* *'We implement the Green Involvement programme with guests; more than on energy consumption it focuses on reuse of laundry, replacement of bedding etc. We do not explicitly tell guests to save on electricity. We try and display throughout the hotel and staff our cautiousness on energy consumption in a*	B6T, B3T, B5T, B1T, B4M, B2M, D2M, D1T, E1M, E2M, E3M, E4M, E4O, E5M, E6O

		subtle manner.' (E1M)	
		22. ENVIRONMENTAL MEASURES INVOLVING HOTEL STAFF	
		(a) Awareness-raising on reducing energy (and water) consumption *'Apart from that I must say that in our daily briefings with the staff we always insist on awareness and responsibility. During winter we do a lot of energy saving schemes i.e. each department must come up with ideas on how to save energy. For example, we communicate with reservations and front office so that we close particular floors when these are vacant; rooms in these particular floors are not allocated. The departmental managers discuss with the staff what types of measures can be implemented and obviously the head of departments discuss this in our weekly meetings and we issue a memo on particular measures making sure to continuously remind staff about such measures.' (C1M)* *'I try and do **awareness-raising with the staff**. So for example if you need to defrost you don't need to put it under hot water but can use a defroster. Simple things really but this awareness-raising is important as there is no one manual with instructions addressing these issues.' (E3M)*	All respondents
		(b) Training on environment issues '*We use the "Eco-learning web based distance learning tool to train our team members on Hilton's environment goals. I also rely on my background experience on my knowledge on systems (e.g. A/C systems, pumps); this helps me make an assessment on how we can improve on what we have currently in terms of consumption*.' (E5M) *'A series of lectures on **Responsible Business** (part of Rezidor Responsible Business Programme) was organized last year for all employees. We also **organized responsible business week** with activities and tours of the hotel facilities (e.g. the sewage treatment plant) for employees and guests and lectures on local products etc.' (E3M)*	A3T, B6T, B5T, B4M, D2M, D1T, E1M, E2M, E3M, E4M, E5M
		(c) Implementing eco/green committee *'A system of **eco-wardens has been established** where **staff members look out for practices** which are not environmentally sound (e.g. bulbs which have not been replaced by energy saving ones). 'Every month an audit is carried out within each department based on a number of criteria, one of which is energy. 30% of weighting of performance of each department is allocated for environment (not energy only). **Eco-wardens are voluntarily-appointed members of staff** who form part of an eco-committee that meets every month (both hotels meet together). During the meeting held with the Director, **opinions are shared, give suggestions and discuss points** that every department has accumulated. The information is shared in the annual staff party and those departments that excel in environmental performance are rewarded whilst those that haven't done so well are "**penalized**" in the sense that they are made aware they could do better. The engineer "balances" out ideas, and sees what can be implemented. The aim of bringing all department representatives together is because each department tackles the environment issue from his department's **own point of view**. Many of the ideas are common sense such as using energy saving bulbs and don't need technical input.' (B6T)*	B6T, C1M, D2M, E1M, E2M, E3M, E4M, E4O, E5M

		(d) Maintenance Department leads green initiatives in the hotel (e.g. waste separation, staff training) *'*[The hotel] *has a Green Team that coordinates environment initiatives implemented within the hotel and also outside the hotel (such as clean-up activities). The team members are from different departments within the hotel. I take it in hand to train the team members on environmental aspects.* ***We organize workshops for the staff****; every department has its own best practice in terms of environment initiatives since certain practices that may apply in an office do not apply to the kitchen for example****. I give out a set of instructions*** *of what can be achieved in the various areas. Every department has a green leader that takes it in hand to monitor whether the initiatives are being attained****. I liaise with the green leaders of every department*** *on this aspect so we ensure every department is doing its share in terms of reducing consumption and other environment practices.' (E5M)* *'We have a green committee where departmental managers meet to brainstorm on what initiatives we can implement for the environment and also to raise awareness with the staff particularly. For the waste separation scheme****, I also organize training for the staff****. We also meet on a weekly basis - we have what we call an HOD meeting (heads of department) where we raise issues relating to hotel operations.' (E4M)*	B5T, D1T, E2M, E4O, E5M
		(e) Maintenance part of Green Committee/Eco-team *'The hotel set up* ***a green committee with team members from every department*** *- this was set up as part of the* [national tourism authority] *eco-certification exercise. We basically discuss ideas to safeguard the environment whilst saving cost; so the aim is two-fold: we look at the environment and the economics.' (D2M)*	A3M, C1M, D2M, E1M, D3M, E3M, E4O
		No green initiatives	A1T, B4M
		23. ROLE OF MAINTENANCE DEPARTMENT IN ADOPTION OF ENVIRONMENT/ENERGY MEASURES	
		(a) Maintenance involved in execution/ implementation phase of environmental measures *'Many ideas come from the operations side; for example the idea of putting up a notice-board with the hotel's environmental initiatives and achievements. The guidance comes from top management. Technical details come from the operations manager. The maintenance team then* ***executes****; we are more* ***hands-on and seeing what needs to be implemented****.' (A3M)*	A1T, A2T, A3M, B3T, B1T, B2M
		(b) Maintenance searches for feasible options; acts as project proponent; active role in choice of technologies; trials/experiments on novel systems; adoption of technology *'For the new hotel extension, I already started doing****, putting a document together on what's involved*** *in the M&E* [mechanical and electrical] *side of things. I* ***am discussing this document together with the engineering consultant.*** *In the document we would put our recommendations to look deeper into renewable energy, environmental aspects….. I* ***won't just take what I'm told****;* ***I investigate and research*** *on what people are saying.'(D3M)* *'My knowledge on energy efficient technologies comes with* ***experience****, with monitoring equipment and checking on its performance and* ***with trial and error****. You try one technology e.g. power factor correction,*	B6T, B5T, B4M, C1M, D2M, D1T, E1M, D3M, E2T, E3M, E4M, E4O, E5M

		see how much saving *you get from it, by looking at the data of energy consumption and* ***then learn from there to do something different and new****. What I can say is that every technology/system creates an issue in itself then you have to* ***go back and revisit****. For example, when we had installed half-flush system in the toilets to save water we found then we had a problem with the sewage becoming too concentrated and blocking the drains so we had to see to that. There are ups and downs for everything. Also everything needs its own maintenance and upkeep. Also we had an issue with keycards; if there is a power surge the keycards need to be reset. Without knowing therefore these things* ***create extra work*** *but in the long run it pays for itself.' (B5T)* *'When the* [hotel] *was being designed****, I took interest and involved myself in the designs*** *of the building services. I asked the Director to be involved in the design of the project and was consulted on the tender documents and the specifications. I went through all of that.' (E3M)* *'As chief of maintenance,* ***I come up with my own ideas*** *of how we can improve energy consumption; I got the idea of introducing room management systems but for now we are doing this in a few rooms as a trial.* ***I carry out research*** *on internet. I often am the* ***one to raise awareness on new systems to the general manager*** *and financial controller. I was* ***responsible for writing the environment procedures and environment policy*** *at [another hotel] where I worked previously so I gained experience through the job itself.' (E2M)*	

Capability	Characterizing the Capability	TOPICS Addressed in Empirical Investigation and Themes emerging from Interview Data	Respondents from the Hotel Cases (see Annex 1 for Hotel Codes)
ABSORPTIVE CAPACITY Relation between service-provider and client as a locus for absorptive capacity (Miles, 2012) Exploiting value from relations with external actors (Jimenez *et al*., 2010) Exchange of knowledge amongst partners (Dyer and Singh, 1998)	**Interaction Pattern between KIBS and Hotel-Client**	**24. PROFESSIONAL RELATION WITH ENGINEERING CONS. FIRMS**	
		(a) Hotel maintenance meets regularly with consulting engineering firm to discuss hotel preventive maintenance programme (KIBS acts as 'company engineer') *'The engineer visits the hotel on a monthly basis' (A1T)* *'The company engineer **visits** the hotel **regularly**, once every two weeks. He will have the **programme or schedule of the maintenance** that needs to be done on the equipment; this maintenance covers all types of equipment from the lift to the chiller of the A/C system, for which we regularly service the motors so as to ensure that these are working efficiently. The **engineer draws out this schedule** of maintenance and I follow together with my team the programme of maintenance that needs to be undertaken' (A3M)* *'The company engineer visits the hotel regularly; we discuss new projects with him in our board meetings with the operations manager and directors.' (C1M)*	A1T, A3M, B1T, B4M, B2T, C1M
		(b) Meetings of maintenance with Engineering Consulting Firm based on specific projects (renovations, hotel extensions) *'**High frequency** **[interaction]** **during design and construction phase**. As mentioned. We had several discussions on the solar water heating system with the shareholders; I was also present.' (B3T)* *'**Meetings were held regularly** between the engineering consultants, the architect and the Director **during the design and implementation** of the hotel.' (E3M)* *'We are **in contact with the engineering consultants to discuss new projects** for example new projects; currently in the pipeline these are mainly about installing renewable energy sources. So we are working with* [β1] *on this. So there is frequent contact with the engineering consultants. Once we have discussed on the technical aspects of the project, a proposal is presented to the general manager and then to the owners and finally to the Head office.' (E5M)*	B6T, B3T, B5T, D1T, E1M, D3M, E2M, E3M, E4M, E5M
		25. SCOPE OF INTERACTION WITH ENGINEERING CONS. FIRM	
		(a) KIBS- maintenance interaction: hotel maintenance discusses with engineering consultant on new energy technologies, feasible projects and a proposal is presented to owner	B6T, B5T, B4M, C1M, D1T, D3M, E1M,E3M, E5M
		(b) KIBS-owner interaction: KIBS interacts with the hotel owner (the maintenance manager mainly involved in project execution)	A1T, A3T, B1T,B3T, B5T, B2T, D1T, E2T, E3T, E4M

		26. SERVICES CONTRACTED TO ENGINEERING CONSULTING FIRM	
		(a) KIBS as a source of awareness on energy issues (e.g. identifying hot spots of consumption, providing advice on methods of enhancing energy performance) *'Engineering consultants* [α2] *carried out an* ***energy audit*** *of the hotel which* ***highlighted we had wastages*** *or* ***inefficiencies*** *in gas consumption and therefore this prompted me to submit an application for solar water heaters. The audit also highlighted inefficiency of the A/C system that we have installed in the original hotel property; in the extension we installed the more efficient VRF technology'. (B1T)*	A1T, B1T, B5T
		(b) KIBS provides advice on emerging technologies, on choice of technology systems to base investments (e.g. replacing/buying new systems) *'We sought advice when implementing energy measures. When deciding to implement power factor correction, the* ***engineer gave us advice on which was the best system to implement****. His advice on technical specifications was important as the technology was new and we weren't sure what sort of savings the technology would bring. Most of the information is technical.' (A1T)* *'Not on a regular basis. Only when there is a* ***need to consult on specific issues****, such as that of the* Legionella *legislation when we did use a consultant.' (B5T)* *'When it comes to* ***looking out for particular products or technologies*** *then* ***the*** **[consulting engineer]** ***plays an important role*** *because he knows the market very well, much better than I do, because he has contacts with suppliers or has implemented similar systems elsewhere. For example when it came to replacing the boiler,* ***we had about one hundred options*** *available in front of us (in terms of quotes); the* ***consultant provides technical advice*** *on how many litres of water are required and at what temperature per day so we ensure that what ultimately is purchased fits the technical specifications drawn out by the consultant. So the consultant draws out the technical specifications of the equipment to be purchased based on his knowledge of our hotel - in terms of the design of the hotel, the plumbing system and the pumps we have available specifying what is needed for example in terms of pipe work, where the pipe work is going to be passed etc.' (A3M)*	A1T, A3M, B1M, B4M, B2T, C1M, B5T D3M, E1M
		(c) Co-production of new environmental solutions and designs *'We refer to specialized engineers and other consultancy agencies* ***when we require expertise on specific topics or projects****. For example they carry out* ***research on new technologies and undertake feasibility studie****s to determine whether particular systems are compatible with our property. For example we sought expert advice from an engineering consultant when we embarked on our reverse osmosis plant project - we asked for advice on what type of plant to install and how to operate this. More recently, we have been in contact with the consultants on the potential of installing combined heat and power. So* ***we worked with*** **[β1]** ***to determine the types of technologies available on the market, how they operate, what difference they could make for the hotel*** *etc. We submitted a proposal to obtain a subsidy from ME for this project - we are waiting to know the outcome of the application now.' (E5M)*	B3T, D1T, E2M, E3T, E3M, E4M, E5M

Notes on the Capabilities Framework in Annex 10:

The entries in the third column of the tables are organized as follows:

TOPIC (capital letters bold script)	Each topic, which refers to a particular set of questions in the interview protocol, resulted in a number of themes being identified;
Theme (bold script)	The themes listed for each topic are the result of a grouping of a larger number of themes that emerged from the raw interview data. The collapsed themes are presented here for practical reasons (listing all the themes per topic would have produced too large a matrix);
Quote from the interview transcripts (*italicized*)	For each theme, an exemplary quotation is provided from the raw interview transcripts. Within each quotation, terms or words are highlighted in bold script that were used to code (categorize) the data and identify the themes to which these quotes 'belonged'.

The entries listed per theme refer to the hotel respondents; the codes used for hotel respondents are based on the categorization of the hotel cases presented in Annex 1. A distinction is made between respondents who are in top management (T) and those in maintenance management (M).

The number of respondents per topic may be less than the total number of interviewees (26); the reasons could be 1) because the topic and/or theme did not arise during the interview with particular hotel cases and 2) because of a lack of response to a particular question. Also, for a number of topics, the same hotel case provided multiple responses and therefore is listed in more than one theme per topic.

The percentage distribution of quotations from the interview data is illustrated below:

Hotel Category		**Number of Hotels per Category**	**Number of Quotes used in the Capabilities Framework**	**% Quotes per Hotel Category**	**% Quotes per Category/Hotel**
A	Independent Economy; 3-star hotel	3	23	13.44	4.48
B	Independent Midscale; 4-star hotel	6	52	30.41	5.07
C	Multinational subsidiary; 4-star hotel	1	6	3.51	3.51
D	Independent upscale; 5-star hotel	3	20	11.70	3.90
E	Multinational subsidiary upscale/luxury; 5-star hotel	6	70	40.94	6.82
Total		**19**	**171**	**100**	

Annex 11 - Matrix Clustering the Hotel Capabilities and Identification of the Hotel Adaptation Modes

Note: Each topic is numbered; and the themes are represented as letters as in Annex 10. The hotels are clustered (using colour coding) into three adaptation modes of **Reactive, Active and Proactive Hotels** according to their combination of capabilities.

CAPABILITY	CHARACTERIZING THE CAPABILITY AS A SERIES OF TOPICS				HOTEL CODES AND THEMES CHARACTERIZING EACH CAPABILITY													
	TOPIC	A1	A2	A3	B1	B4	C1	D2	D3	B2	B5	B6	D1	E1	E2	E3	E4	E5
SENSING																		
Signals in the External Environment	1.DEVELOPMENTS IN TOURISM & HOTEL SECTOR	1a,b	1a	1a,b	1a	1a	1a	1a	1a	1a	1b	1a,b	1a,b	1a,b	1a	1a,b	1a	1a
	2.SIGNALS IN THE EXTERNAL ENVIRONMENT ABOUT ENVIRONMENTAL AWARENES	2a	2a	2a,b	2a	2a	2a,c	2a	2a	2a, b	2a,b	2a,b	2a	2a,b	2a,b,c	2a,b,c	2a,b,c	2a,b,c
	3.EMERGING ENVIRONMENTAL TECHNOLOGIES	3a	3c	3a,c	3a	3b,c	3a	3a,b,c	3a,c	3a,b,c	3a,c	3a,c	3,a,b	3a,b,c	3a,b,c	3a,b,c	3a,b,c	3a,c
	4.FUNDING OPPORTUNITIES TO ADOPT ENERGY EFFICIENT MEASURES	-	-	-	-	-	-	4a	-	4a	4a	-	-	4a	-	4a	-	4a
	5.FRONT-OFFICE: CLIENT RESPONSIVENESS TO & ADOPTION OF ENV. POLICIES	-	5c	5a	-	5b	-	-	5b	-	5a,b	5a	-	-	5b	5b	-	-
Signals about Energy Consumption within Hotel	6.SIGNALS ABOUT ENERGY EFFICIENCY ARISING FROM 'ON THE JOB' MONITORIN	6a,	6a	6a	6a	6a,b,c	6a,b	6a,b	6a,b	6a,c	6a,b,c	6a,c,d	a,b,c	6a,a,b	6a,b,c,d	6a,b,c,d	6a,b,c,d	6a,b,c,d
TRANSLATING SIGNALS INTO DECISIONS FOR ACTION																		
Value of Environmental Response Behaviour	7.VALUE OF ADOPTING ENVIRONMENTAL MEASURES	7a	7a	7b	7a	7a	7a	7a	7a	7c	7c	7b	7b	7b	7c	7b	7b	7b
	8.PERCEIVED IMPACTS OF ENVIRONMENTAL MEASURES ON HOTEL OPERATIONS	8a,b	8a	8a,c	-	8,c	8c	8a,c	8a	8d	-	-	8d	8a	8c	8b,c	8c	8c
	9.MOTIVES FOR ADOPTING ECO-CERTIFICATION	9g	9a	9b	9f	9a,b,d	9f	9b	9b,c	9b,f	9b	9b,c	9g	9d	9a,d	9c,e	9d,f	9d
Decision-Making to Adopt	10.DECISION-MAKING:TOP-DOWN & BOTTOM-UP PROCESSES	10a	10a	10a	10a	10b	10a	10b	10b	10b	10a	10a	10a	10b	10b	10a,b	10b	10b
	11.CHOICE OF ENV/ENERGY TECHNOLOGIES	11b	11b,c	11c	11b	11a,b	11b,d	11a,b,d	11a,b, d	11a,c	11a,c,d	11b,c	11a,c	11aa,b	11a,b	11a,c	11a,b,c,d	11a,b,c
Resource Commitment	12.SETTING ENVIRONMENTAL TARGETS	12a	12c	12c	12d	12a,b	12d	12c	12a	12a,d	12d	12a	12d	12a,e	12e	12e	12a,e	12a,e
	13. ADOPTION ECO-CERTIFICATE	-	13a,b	13a,b	13b	13a	13a	13a,b	13a	13a	13a,b	13a,b	-	13a	13a,b	13a,b	13a	13a,b
	14.BUDGET FOR ENERGY EFFICIENT MEASURES	14b	14b	14b	14b	14b	14b	14a	14b	14b	14a	14a	14a	1414a	-	14a	14b	14a
IMPLEMENTING ACTION																		
Making Adjustments in Routine Maintenance Tasks	15. MONITORING ENERGY CONSUMPTION IN HOTEL	15a	15a	15a	15a	15a,b,c	15a,b	15a,b	15a,b	15a	15a,b,c	15a,c,d	15a,b,c	15a,b	15a,b,c,d	15a,b,c,d	15a,b,c,d	15a,b,c,d
	16.TIME DEDICATED TO MONITORING ENERGY CONSUMPTION	-	-	16b	16b	-	16b	16b	16b	-	16b	16b	16b	16b	16a	16a	16b	16a
Problem-Solving & Evaluation	17. EVALUATING TECHNOLOGY OPTIONS	17a	17a	17a	17a	17b	17b	17b	17b	-	17b	17b	17b	17b	17b	17b	17b	17b
	18. MANAGING THERMAL ENVIRONMENT IN HOTEL	18a	18a	18a	18a	18a	18a	18a	18a	18a	18a	18b	18b	1818b	18b	18b	18b	18b
	19. IMPACT OF ADOPTING ENVIRONMENT/ENERGY TECHNOLOGIES	19a	-	19b	-	19b	19b	19b	-	19c	-	-	19c	-	19b	19b	19b	19b
Taking Initiative Beyond Day-to-Day Tasks	20.INITIATING IDEAS/PROPOSAL FOR ENV/ENERGY PROJECTS	20b	20b	20b	20b	20a	20b	20a	20a	20a	20a,b	20b	20a,b	20a	20a	20a,b	20a	20a
	21.ENVIRONMENT INITIATIVES INVOLVING GUESTS	-	21b	21a,b	21a	21b	-	21b	-	-	21b	21b	21b	21b	21b	21b	21b	21b
	22. ENVIRONMENTAL MEASURES INVOLVING HOTEL STAFF	22a,f	22a	22a,b,e	22a	22a,b	22a,c,e	22a,b,c,e	22a,e	22a	22a,b,d	22a,b,c	22a,b,d	22a,b,c,e	22a,b,c,d	22a,b,c,e	22a,c,d,e	22a,b,c,d
	23.ROLE OF MAINTENANCE IN ADOPTION OF ENV/ENERGY MEASURES	23a	23a	23a	23a	24b	23b	23b	23b	23a	23b	23b	23b	23b	23b	23b	23b	23b
ABSORPTIVE CAPACITY																		
Patterns of KIBS-Hotel Interaction	24. PROFESSIONAL RELATION WITH ENGINEERING CONS. FIRMS	24a	-	24a	24a	24a	24a	-	24b	24a	24b	24b	24b	24b	24b	24b	24b	24b
	25. SCOPE OF INTERACTION WITH ENGINEERING CONS. FIRMS	25b	-	25b	25b	25a	25a	-	25a	25b	25b	25a	25a	25a	25b	25a	25b	25a
	26. SERVICES RELATING TO ENV/ENERGY EFFICIENCY MEASURES	26a,b	-	26b	26a	26b	26b	-	26b	26b	26a	26b	26c	26b	26c	26c	26c	26c
		REACTIVE HOTELS				ACTIVE HOTELS				PROACTIVE HOTELS								

Annex 12 Characteristics and Organization of Maintenance Tasks in Hotels

Characteristics and Organization of Maintenance Tasks	**Respondents from the Hotel Cases (see Annex 1 for Hotel Codes)**
Maintenance Department organized as a team	A2T, B6T, B5T, B4T, C1M, D2M, E1M, D3M, E2M, E3M, E4M, E5M
Maintenance Department consisting of One Technician	A1T, A3M, B3T, B2M, D1T
Maintenance Manager's Experience Working in Hotels:	
0-10 years	A3M, B4M, C1M, D1T, E4M
> 10 years:	B5T, D2M, E1M, D3M, E2M, E3M, E5M
Training of Maintenance Managers:	
Specific Training Background (electrical/maintenance/white goods): *'I **trained** as a refrigeration technician. Originally I worked in construction industry, and worked with a company servicing air-conditioning. I have been working with hotels for 10 years. When I saw that in a particular hotel I couldn't advance any further, I moved on. I kept on studying; I obtained a license A and B from Enemalta and kept studying on Refrigeration - I followed a part time course at MCAST. Since business is doing very well in this hotel, there is always some new project going on. Apart from giving my job security it also is a boost for me in my work. When I was at the Hotel* [Code E] *I felt that the director was less ready to invest perhaps because he was very careful to maximize his investments; but then the job for me became too much of a routine, of doing the same thing.' (B4M)* *'My **specific trade** is as a refrigeration and air-conditioning engineer. I would say I am the oldest "hotel" engineer on the island today. I have been 27 years as chief engineer in hotels and have been exposed to many changes and I continue developing on the hotel. Therefore because I have so much experience I have come across so many different situations in hotels.' (E1M)*	A3M, D2M, B4M, E1M, D3M, E2M, E3M, E4M, E5M
No specific Training in Hospitality Maintenance or related: *' I was a financial banker by profession, and decided to set up a B&B after coming to Malta on holiday ' (D1T)* *'I was a police officer by profession. Due to early retirement I moved to the hospitality industry first as a security officer. I took interest in health and safety and took up a part time course of two and a half years after which I graduated in health and safety' (E4O)*	D1T, B5T, B2M, E4O
Day-to-Day Duties of Maintenance Department:	
Monitoring Equipment and Preventive Maintenance *'I spend quite a lot of my time **monitoring the equipment** and doing maintenance. I also cover health and safety in terms of fire safety, lifts and their pumps etc. Naturally I also do **refurbishments** and take care of overseeing new projects in the hotel.' (A3M)* *'We have a technician who **goes round the property** and takes care of the plant rooms and the equipment - he also does **maintenance** of the equipment' (B1T).*	A1T, A3M, B3T, B1T, B2M, C1M
Characteristics and Organization of Maintenance Tasks	**Respondents**

	from the Hotel Cases
Managing Staff and Decision-Making, Preventive Maintenance *'We start with a management meeting with the heads of department. I **distribute the work** to my team of technicians, painters and gardeners, pool attendants etc. We take care of the treatment of the water. I check my emails; we monitor the equipment. Essential **the work is different every day** because something always crops up in the rooms, or on the premises. Mostly the job is about **taking decisions and solving problems.'** (E2M)* *'**Apart from maintenance** there is always some development and upgrading of hotel rooms or shifting of office space taking place. Then there is a percentage of time spent **analyzing data** collected by my team or collected by the BMS* [Building Management System] *e.g. daily one of our technicians takes readings of equipment such as temperature of hot water, the running hours of generator, fuel level of bolier, and data from our sub-meters. There are cesspits under the hotel that are part of the sewage recycling system of the hotel; we have sewage pumps that I make sure we operate daily to ensure correct functionality.' (E3M)* *'When I came to work into a hotel, I experienced a large exposure to different engineering and management styles. Why: because when you are a hotel engineer you don't only talk about air conditioning or refrigeration; you are talking about water production and control, you get into heating, building management, carpets, curtains, refurbishment, you have to handle gardens etc. So the exposure to different situations is much larger. Now when you start **linking everything together** you come out with your building, you must know how to **control your building**.' (E1M)*	A2T, B6T, B5T, B4M, D2M, D1T, E1M, D3M, E2M, E3M, E4M, E5M
Sources of information and Knowledge on Environment/Energy technologies:	
Utilizing contacts with suppliers to source info on environment/energy technologies *'Suppliers are also providing other services. In our hotel, we had a supplier come over to do an energy audit. The supplier brought over his own consultant engineer to do the audit; then we installed power factor correction on the machinery and motors as a result because the supplier showed us that we would be saving at least 7% from electricity bills.' (E2M)* *'We have trusted suppliers we work with because they know our property well so they know what our needs are; however for the tendering of the solar water heaters we did approach different suppliers to obtain three quotations' (C1M).*	A3T, A3M, B6T, B3T, B5T, B2M, C1M, D2M, D1T, E1M, D3M, E2M, E3M, E4M, E5M
Business networks used for information exchange on environmental technologies (i.e. forum of hotel engineers within MHRA) *' I am asked repeatedly to deliver presentations to other hotel managers within the national hotel association* [MHRA] *and national tourism authority on energy and environmental measures' (B6T)* *'All maintenance **managers and engineers meet regularly**, **once a month within MHRA** where a lot of issues are discussed including new legislation and issues such as energy and others. Energy has become a topic which is discussed more often.' (B4M)*	B6T, B1T, B4M, D1T, E1M, E2M, E3M, E4M, E5M
Social networks (informal exchange) *'I met the engineer of* [Hotel E3] *at one of the seminars and we spoke of a number of things amongst which I mentioned my intention to install more energy efficient A/C in the new suites of an extension we were doing; and he gave me information and his experience with VRV/VRF technology they had installed at* [Hotel E3]. *Likewise the engineer of* [another hotel] *had **called me to ask me for information** on the keycard switches; he had to convince his director so I gave him some help with energy consumption figures which he used to make a case with his director. We **also helped** the* [Hotel B2] *with some information on reverse osmosis plants. We also know some of the hotel managers personally so we feel quite comfortable to approach them.' (B5T)* *There **is sharing of information** on these issues I would say, unlike for example what you see in sales department. For example I am about to go to* [Hotel C1] *with one of my technicians to **assist** with a problem that cropped up over there. We work together. Fifteen days ago I was at* [Hotel E2] *- they had a **problem** with the chiller and since my specialization is as a refrigeration technician. Similarly I had a problem with the steamer and the engineer at* [Hotel E3] *came over because they have a similar steamer.' (B4M)*	A2T, A3T, B6T, B5T, B1T, B4M, D2M, E1M, D3M, E2M, E3M, E5M